GUIDING THE WAY WITH MARINE DEBRIS 101: AN ONLINE COURSE FOR ECOTOUR GUIDES

by

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1. Introduction

This study addresses the ever-increasing presence of anthropogenic debris in marine ecosystems, which has substantial environmental effects, as well as social and economic impacts. Marine debris, specifically plastic pollution, is now so widespread, and its negative impacts so substantial, that it has been proposed by some scientists as a planetary boundary threat, meaning it could be harmful enough to challenge the very survival of humanity (Arp et al., 2021; Persson et al., 2022; Villarrubia-Gómez et al., 2018). Marine debris is a direct result of anthropogenic activities and choices, therefore, every person on Earth has the potential to contribute to this growing problem. From everyday choices made in supermarkets to decisions made while visiting a coast, marine debris originates from the actions of humanity. Fortunately, this also means that the solutions to marine debris can and must come from humanity.

There have been rising concerns over marine debris as its growing presence becomes impossible to ignore, but there is still a lack of knowledge among non-experts about what it actually is and how significant its impacts are. Proposed solutions by scientists and policymakers are limited in their effectiveness as people lack an understanding of why such solutions are needed. Further lacking is an understanding of each individual's role in addressing marine debris. If large communities around the globe believe that they are powerless in changing things, then indeed no change will occur.

The education of the general public is an oftentimes overlooked component in addressing marine debris, yet it is arguably the most important factor in creating change. Eco-friendly alternatives to plastic are pointless if the public does not know why they should choose them. Campaigns to remove trash from the ocean and beaches focus on cleaning up marine debris sinks but do not address the debris sources, i.e., people. The problem of marine debris is a behavioral one. To stop the flow of debris that is entering the marine environment it is imperative that the source is acknowledged and educated.

To address the lack of knowledge of marine debris among non-experts and to help promote sustainability, I created an online course titled "Marine Debris 101". I created this course created using WordPress™ software, and it was offered through the University of Georgia Marine Extension and Sea Grant in the Spring of 2023 as a free educational program. Marine Debris 101 was offered to coastal ecotour companies working along the coast of Georgia in the United States, with the assumption that by educating ecotour guides on marine debris issues and best practices, they can then disseminate this knowledge to their clients and, subsequently, help to educate the public.

1.1. Marine debris and plastic pollution

Anthropogenic activities have long affected the marine ecosystem and the health of its inhabitants. As human civilizations advance and new inventions arise, the potential for human impacts on the ocean also increases. One area of environmental concern that is rapidly increasing with no signs of slowing down is the production of plastic and, consequently, the escalating

pollution of the marine environment by plastic debris (Andrady, 2015; Beaumont et al., 2019; Eriksen et al., 2023).

Marine debris is defined as any human-manufactured or processed persistent solid material that enters the marine environment directly or indirectly, intentionally or unintentionally (NOAA). There are many possible routes for debris to enter the ocean, such as from maritime activities or atmospheric deposition (Willis et al., 2017). However, around 80% of marine debris is attributed to land-based sources alone, either from beach and coastal litter, industrial dumping and discharges, or from trash entering waterways upstream and transported out to sea (UN Environment Program, 2021; Landrigan et al., 2019).

Although marine debris does include materials such as aluminum and glass, plastic is the most common type as it represents 80% of litter in aquatic ecosystems on average (Chassignet et al., 2021). In recent years, some of the most commonly found types of plastic litter in marine environments are cigarette butts, plastic bags, single-use bottles, food wrappers, and other food containers (International Coastal Cleanup, 2021). Derelict fishing gear also accounts for roughly 10% of this ocean plastic estimate, as modern fishing gear such as nets, ropes, and traps are largely made of synthetic material (Scheld et al., 2016).

The abundance of plastic in the marine environment can be directly attributed to its increasing production and growing prevalence throughout the world. As a durable and low-cost material, plastic began to be commercially mass-produced in the 1950s, at a global rate of 2 million metric tons (Mt) per year (Ryan, 2015; Geyer, 2020). Now, in the 2020s, the rate of global primary plastic production is between 350-400 Mt per year (Geyer et al., 2017; PlasticsEurope, 2022). It is estimated that more than 8000 Mt of primary plastics have been produced globally to date, and that over half of this quantity has been generated in the last 2 decades alone (Geyer et al, 2017). Furthermore, of the up to 400 Mt of plastic produced each year, about half of this is discarded after only one use (Mathalon & Hill, 2014).

The durability of plastic is another contributor to its ubiquitousness in the ocean. Just over 1% of new plastic produced annually is biodegradable, a process which is mostly negligible in the marine environment due to limited oxygen supply hindering biological decomposition (Geyer et al., 2017; Andrady, 2015). Fragmentation of plastic marine debris still occurs, however, often as a result of physical forces like wave action and photochemical processes from UV exposure (Roy et al., 2011). These smaller plastic fragments, termed ‘microplastics’, are defined as pieces that are smaller than 5 millimeters in diameter (Barnes et al., 2009). Microplastics can also enter the ocean as pellets or nurdles manufactured for creating new plastic products or to be added to other products such as face washes and toothpaste (UN Environment Program, 2021). The worldwide transport of nurdles in shipping containers put them at risk of losses during storms and other accidents, with a global estimate of 230,000 tons of nurdles lost at sea every year (Sherrington, 2016).

Microplastics and derelict fishing gear make up the majority of debris in open oceans (Lebreton et al., 2018). The Great Pacific Garbage Patch, for instance, has an estimated 1.8 trillion pieces of marine debris floating in it, 94% of which are microplastics. By mass, however,

discarded nets, lines, and ropes make up 46% of this garbage patch, oftentimes floating just beneath the surface (Lebreton et al., 2018). This derelict fishing gear poses a significant threat to marine organisms, primarily through entanglement, which can lead to starvation and sometimes lethal injuries from lacerations (Bilkovic et al., 2016). A comprehensive study conducted in 2020 found that over 350 marine species have been found entangled in debris (Kühn & van Franeker, 2020). Specifically, one-third of all seabird species and nearly 40% of all marine mammal species have been found entangled. Another significant threat is the possible ingestion of marine debris, which can puncture the internal tissues of marine organisms and lead to starvation from blockage in the digestive tract. As of 2020, over 700 marine species have been found to ingest plastic debris, including 40% of all seabird species and more than half of all marine mammal species (Kühn & van Franeker, 2020). Marine debris (especially derelict fishing gear) can also disrupt critical habitats such as coral reefs, salt marshes, and mangroves through physical damage or smothering (Lamb et al., 2018).

The economic impacts of marine debris can include reduced coastal tourism, impacted fisheries, job loss, and negative recreational experiences. The United States alone spends an average of $11.5 billion per year on litter cleanup, and globally an estimated $500 billion to $2.5 trillion is lost each year because of plastic pollution (Beaumont et al., 2019).

Plastics are known to contain an array of chemicals from manufacturing, some of which have the potential to impact human health. The toxicity of a plastic product can vary depending on chemical additives such as solvents, plasticizers, flame retardants, and colorants. A 2019 study identified 906 potential chemicals associated with the manufacturing of plastic packaging, 63 of which are classified as hazardous to human health, 7 are bioaccumulative and toxic, and 15 are known endocrine disrupters (Groh et al., 2019). Once plastic products are discarded and enter the aquatic environment, these chemical additives have the potential to leach out into the water or can enter the food web as marine organisms ingest microplastics. Human consumption of seafood inevitably means ingestion of microplastics, with estimates that the average seafood consumer can ingest between 1,800 to 11,000 particles of microplastics per year from shellfish alone (Van Cauwenberghe & Janssen, 2014). There is a direct link between plastic production and the amount of marine debris in the oceans (Borrelle et al., 2020; Jambeck et al., 2015), and studies have shown that plastic negatively impacts the natural environment while also introducing unknown, potentially harmful, substances.

The first published findings of plastic marine debris came in 1972, approximately two decades after its mass production began, when researchers reported sightings of plastic particles in the Sargasso Sea (Carpenter & Smith, 1972). Now, after more than 70 years of mass production, plastic particles can be found nearly everywhere—in seafood (Rochman et al., 2015), Antarctic sea ice (Kelly et al., 2020), the Mariana Trench (Peng et al., 2018), on top of Mount Everest (Napper et al., 2020), and even in the human bloodstream (Leslie et al., 2022). It is difficult to quantify the exact number of plastic debris currently in the ocean, but a recent study from 2023 estimates that there are currently 170 trillion plastic particles afloat in the surface layer of the ocean (Eriksen et al., 2023), and other studies estimated the volume of plastic debris

in the ocean as being between 75 and 199 million metric tons (Jang et al., 2015; Law, 2017; Lebreton et al., 2019; Borrelle et al. 2020; Lau et al. 2020). These estimates are only expected to increase as years pass and more litter enters the ocean, and unless people start acting now and changing their behaviors, the effects of plastic pollution on the environment and on humanity will be devastating.

1.2. Marine debris knowledge and perceptions among the general public

Understanding public perceptions and general knowledge about marine debris is crucial to developing strategies that mitigate the problem. Marine debris is the direct result of anthropogenic activities (Jambeck et al., 2015), but the knowledge levels and understanding of this issue by the general public can vary across communities. Identifying knowledge gaps and common misconceptions from the public provides valuable information to relevant stakeholders (i.e., scientists and policymakers) to address the issues raised by marine debris, and informs educators of curricula areas that may need improvement.

Given the ubiquitous nature of marine debris, comprehensive studies of global human perception and knowledge on the matter are limited. There have been numerous local studies on this subject, however, which give crucial insight into marine debris perception, and oftentimes show similar results. Studies on marine debris, especially coastal littering, have shown a wide array of public perceptions and knowledge of the issue, with an apparent rise in citizen science and outreach activities in recent years (Heidbreder et al., 2019; Napper & Thompson, 2020). Also increasing are public concerns and worries surrounding plastic pollution. In a 2020 survey of over 27,000 European citizens from differing countries, 89% were worried about the environmental impacts of plastic products, a 3% increase from 2017 (European Commission, 2020). Additionally, the growing amount of waste was tied with air pollution as the second most important environmental issue by participants in this survey, behind the top-ranked issue of climate change (European Commission, 2020).

This increase in problem awareness and community involvement can be attributed to the rise in use and disposal of plastic materials in daily life. As plastic production increases so does the disposal and accumulation rate, making the presence and negative impacts of plastic in marine environments difficult to ignore. In 2018, 95% of respondents across 16 European countries reported seeing litter while visiting a coastal area and agreed with survey statements that the quantity of marine litter is increasing, it is a present threat rather than a future concern, and that it is a problem for all, not just coastal communities (Hartley et al., 2018). Interestingly, when asked about marine litter responsibility, motivation, and competency, participants of this study rated themselves as responsible and motivated, but less competent, while they rated the wider general public as competent and responsible, but less motivated. This is a common perception that arises in studies on marine debris, as people commonly recognize the human responsibility in reducing marine litter yet tend to shift this responsibility onto other players such as tourists, the general public, or industries (Hartley et al., 2018; van Oosterhout et al., 2022).

It is clear from the findings of these studies and countless others that the majority of people globally are at least somewhat aware of the presence of man-made debris in marine ecosystems, and that concerns over marine debris have been rising over recent years. However, studies into the marine debris knowledge levels of the general public have shown a wide array of results, illustrating the information gaps and misconceptions that are present in some communities. A Sri Lanka study found that 89.6% of the nearly 100 citizens surveyed believed that plastic pollution is increasing in quantity, yet 6.3% of respondents believed that plastic pollution is decreasing, and another 4.2% believed it was impossible to predict a trend (Arulnayagam, 2020). Regarding marine debris sources, Hartley et al. (2018) found that the majority of participants across 16 European countries thought that most debris enters the ocean through direct releases into the sea. This is a contrast to scientific literature that attributes up to 80% of marine debris as originating from indirect land-based sources (Chassignet et al., 2021). In a 2023 study of 220 Italian beachgoers, interviewees believed on average that plastic represented 44% of litter on their current beach; however, from prior beach cleanup surveys the authors found that plastic comprised 70-90% of litter items found, depending on the exact beach (Corbau et al., 2023). Additionally, respondents of this study estimated plastic bottles as having the same degradation time as aluminum cans at around 10-100 years. This underestimation of degradation rates is similar in other studies, such as a survey of 350 oceanic Portuguese island residents where less than half of the respondents correctly identified plastic bottles as taking 400-500 years to degrade (Bettencourt et al., 2023).

Knowledge of the presence of marine debris may be rising, but a critical understanding of the true impacts and implications of its presence is still seemingly lacking in large portions of the world. Educating people about this issue is a necessity if any major change is expected to occur. People must first understand that something is a problem, and understand *why* it is a problem, for solutions to be enacted and followed. In the case of marine debris, every person has a role to play in the reduction of its presence, but there is perhaps one sector that has a larger influence than some of the others: tourism.

1.3. Impacts of the tourism industry on marine debris

A common public perception of marine debris is that tourists are the most significant contributors to beach litter. Beachgoers interviewed in Italy ranked tourism as the main source of coastal litter (Corbau et al., 2023), similar to a study from Colombia where more than 70% of respondents stated that beach visitors, rather than residents, were responsible for creating litter (Garcés-Ordóñez et al., 2020). There have been studies that indeed support these claims, or at least show some correlation between beach litter and tourism. In the same Colombia beach study by Garcés-Ordóñez et al. (2020), there was an increase in beach litter during the high tourist season when compared to the low tourist season. In a study from Chile, the beaches of two popular tourist regions had significantly higher accumulations of litter than those less frequented by tourists, despite having similar numbers of Chilean residents between these regions (Kiessling et al., 2017). At publicly accessible islands within the southern Great Barrier Reef system, a

popular tourist destination as well as a fragile marine ecosystem, the greatest source of litter was found to be tourist-related activities (Wilson & Verlis, 2017).

Despite these correlations between tourism and beach debris in some studies, tourism itself cannot be labeled as the primary cause of marine debris on a global scale. Although the Italian beachgoers in the Corbau et al. (2023) study mainly identified tourism as the primary source of beach litter, the researchers argue that the low frequency of specific touristic items makes this doubtful. Instead, the main source of beach litter identified in this study was labeled simply as "public litter", meaning that the debris originated from the activities and choices of the general public as a whole. This idea is supported by the Kiessling et al. (2017) Chilean study, where the most littered coastal region has almost 10 times more tourist visits per year than the least littered region, but also has almost 100 times more permanent residents.

Marine debris is not caused by the tourism industry itself, rather, it is linked to human behavior, both of tourists and of residents. More than 40% of the world's population is known to live within 100 kilometers of a coastline, almost half of all people on Earth (United Nations, 2017). Marine debris stems from anthropogenic activities, so locations with large human presences, such as many coastal cities, are bound to have an increased abundance of debris in the environment. Popular coastal cities with large tourism rates simply have the added environmental stressor of more people and more potential for littering rates. However, numerous studies have found that it is oftentimes more than simply having a larger number of visitors that influences rates of coastal litter. It is possible that human behavior is altered when temporarily visiting a region versus permanently residing there. Studies have strongly suggested that tourists visiting popular coastal sites can feel less responsible for maintaining the cleanliness of the area as they lack a sense of emotional connection to the local environment (Adam, 2021; Heidbreder et al., 2019). Furthermore, it is possible that tourists are more likely to litter while visiting an environment that is already dirty from the actions of residents or other tourists (Panwanitdumrong & Chen, 2021).

The Georgia coast is no stranger to the effects of tourism. In 2021, the city of Savannah had 15.2 million visitors for the year (Savannah Area Chamber of Commerce, 2021). Unlike some other popular coastal cities though, Savannah does not only receive high tourist volumes in the summer. Year-round events such as the St. Patrick's Day parade, music festivals, and popular ghost walking tours all lead to a coastal city that experiences a constant flow of visitors, making Savannah and the nearby ocean a potential sink for large amounts of discarded trash (Shi, 2021).

Approximately 90 miles south of Savannah is Jekyll Island, a 7-mile-long barrier island on the coast of Georgia that received around 3.5 million visitors in 2022 (Miller & Burbach, 2020; Jekyll Island Authority, 2022). In 2007, the Georgia Sea Turtle Center was established on Jekyll Island, and in that same year, the center created a marine debris collection project (Miller & Burbach, 2020). Using the marine debris tracker app (Jambeck & Johnsen, 2015) the GA Sea Turtle Center has been able to log every piece of debris collected on Jekyll Island over the years, and using this publicly available data it can be seen that almost 45,000 pieces of debris were collected by the center from January 2021 to January 2023. Of these nearly 45,000 items, plastic

and Styrofoam materials made up the majority at 51.4%, and the most commonly found items overall were cigarette butts (n = 10,756), plastic fragments (n = 7,315), plastic food wrappers (n = 2,871), and plastic bottles or caps (n = 2,796).

Cigarette butts are one of the most common litter items found during beach cleanups worldwide (ICC Report 2021, 2020, 2019) and despite their immense popularity, many consumers are unaware of their environmental impacts once discarded. Cigarette butts contain filters that help to reduce the amount of toxic chemicals entering the smoker's lungs; however, this filter is often made of cellulose acetate, a plastic material that accumulates the toxins from the cigarette smoke and then persists in the environment for long periods of time once discarded (Granados et al., 2019; Healton et al., 2011). One study from 2020 investigated the cigarette butt disposal behavior of beachgoers at Jekyll Island, to understand who incorrectly discarded their cigarette butts and why. Of the 227 beachgoers interviewed, over half were reported to dispose of their cigarette butts incorrectly, either by tossing them directly into the ocean or discarding into the beach sand (Miller & Burbach, 2020). 88% of all the interviewees were visitors to the island, classified as not permanently residing in the Brunswick or Jekyll Island area. The researchers found that one of the main reasons for their littering behavior could be attributed to a lack of knowledge, of both the components that make up a cigarette butt and of the environmental impacts once discarded (Miller & Burbach, 2020).

A lack of awareness of environmental consequences is the main driver of marine debris; essentially, an individual will not change their personal behavior and habits if they do not understand the consequences of their actions. Bringing awareness not only to the impacts of marine debris but also to the role that each individual plays in this issue has the potential to dramatically alter the course of plastic pollution and marine debris that has been projected thus far. However, it can be difficult, if not impossible, to economically and efficiently educate large masses of people about marine debris on any substantial scale. Therefore, enlisting the help of those who directly interact with tourists, such as eco-tour guides, could be a solution that addresses the crisis of marine debris at the individual level by altering personal norms to be more pro-environmental.

1.4. Ecotour Guides: the role of nature education in Tourism

Ecotourism is a subset of tourism with a definition that can have multiple interpretations but essentially involves any form of nature-based tourism where the visitor practices sustainability and conservation of the environment. Many researchers have asserted that for an activity to be considered ecotourism there are key tenets that must be included, among which are the criteria that it is nature-based, promotes environmental awareness, and has an educational component to it (Donohoe & Needham, 2006; Wardle et al., 2021). The negative environmental impacts associated with tourism, such as beach littering, can often be attributed to a lack of understanding of the ecosystem, both on a local and global scale. Including environmental education in tourist activities helps to solve this. In a review of published studies on ecotourism outcomes, 78% of the 21 reviewed outcomes were positive, with the most common outcomes

being increased environmental awareness of the tourists and altered behaviors or lifestyles of local participants (Wardle et al., 2021).

Coastal Georgia offers visitors many opportunities to engage in ecotourism through guided water-based activities (e.g., boat trips, kayaking, and recreational fishing) or land-based activities (e.g., nature walks, and island expeditions). It is difficult to quantify the exact number of people participating in ecotourism in coastal Georgia due to the ambiguity of its definition, but survey reports can offer some insight. In 2019, a small-scale survey report assessed the interests, attitudes, and knowledge of the Georgia coast based on responses from 254 Georgia coast residents, 133 Georgia mainland residents, and 54 out-of-state visitors. In total, 46% of the respondents stated they had participated in a guided nature field trip (such as a barrier island exploration) and 25% participated in a guided kayaking, boating, or fishing trip in the past year (Allers, 2019). The survey also assessed the respondent's concerns about beach litter and microplastic pollution along Georgia's coast. Approximately 79% and 74% of all respondents were "very concerned" with litter and trash on the coast, and with microplastic pollution, respectively (Allers, 2019). Although this survey only represents a small fraction of coastal Georgia residents and visitors, it can serve as a basis for better understanding the local perceptions of marine debris and the role of ecotourism in this popular destination on a larger scale. If the majority of people are concerned about marine debris to some extent, and if almost half of people are engaging in some form of ecotourism, then it is conceivable that ecotourism in Georgia (and in other locations) could play a key role in alleviating marine debris.

The success of ecotourism in promoting sustainability and conservation stems from altering the tourist's environmental attitude. Environmental attitude is defined as a person's beliefs and values about nature, essentially the degree to which a person favors or disfavors an environmental issue (Milfont & Duckitt, 2010). Studies have shown that participation in ecotourism activities that educate the individual on an environmental issue, as well as ecosystem functioning in general, leads to an increase in support for conservation efforts and alterations of behavioral intentions (Aswita, 2018; Larm et al., 2018; Lee & Jan, 2015; Mokhtari et al., 2019; Powell & Ham, 2008). Environmental education can even alter the purchase decisions of consumers while visiting a region. A recent study found that tourists' attitudes and intentions to buy eco-friendly products increased with increasing knowledge about the product and the environment, while simply increasing the availability of the eco-friendly product did not affect consumer intentions (Gautam, 2020).

Additionally, the design and execution of the nature-based activity plays a significant role in the long-term outcomes of the participant's behavior. Short-term shifts in positive environmental attitudes and habits can typically be seen in individuals directly following participation in an ecotourist activity; however, long-term behavioral changes can differ depending on variables such as personal environmental experiences, motivation to learn, and the structure of and engagement in the learning activity itself (Ballantyne et al., 2011). Ecotourism experiences that are more engaging in structure (Larm et al., 2018) and that encourage reflection

and discussion (Ballantyne et al., 2011) were found to have longer-lasting impacts on the environmental attitude of participants.

The structure of an ecotourism activity is entirely dependent upon the creator's own environmental attitudes and knowledge levels of the issue being presented. Ecotourism guides are educators and role models who lead the ecotour, typically educating the participants on local environmental issues while promoting sustainable actions. For a guide to accurately educate visitors on issues, such as marine debris, it is imperative that they themselves are knowledgeable on the subject and are familiar with best practices to mitigate further harm. When considering what aspects make an ecotourism experience enjoyable, participants often state that the expertise of the guide is a key component (Randall & Rollins, 2009; Walker & Moscardo, 2014), which aligns with numerous studies highlighting the importance of guide training and the role of guides in facilitating positive experiences (Periera, 2005; Weiler & Walker, 2014). Providing marine debris education and training for ecotour guides in coastal Georgia ensures that they are knowledgeable on the topic, aware of best practices to teach, and that marine debris education is consistent and available to visitors across ecotour companies.

1.5. The University of Georgia Marine Extension and Georgia Sea Grant

Located on Skidaway Island along the Georgia coast is the University of Georgia Marine Extension and Georgia Sea Grant, a program jointly managed by the University of Georgia (UGA) and the National Oceanic Atmospheric Administration's (NOAA) National Sea Grant College Program. Broadly, the goals of UGA Marine Extension and GA Sea Grant are focused on utilizing research and communication to promote stewardship and education of the Georgia coast for visitors and residents. By promoting responsible use of coastal resources and educating on social responsibility, UGA Marine Extension and GA Sea Grant seeks to provide practical solutions to real coastal problems. One such way this is achieved is through the Coastal Awareness and Responsible Ecotourism (CARE) certification program.

The CARE certification program was first launched in 2021 and was developed by joint efforts from the UGA Marine Extension and GA Sea Grant and Manomet, Inc., a non-profit organization that uses science education to promote shorebird conservation. CARE is a virtual training program designed for water-based ecotourist guides along the Georgia coast that focuses on recreational disturbances of coastal habitats, especially shorebirds, and provides tools to implement best practices to reduce potential harm. Essentially, the CARE certification program provides ecotour guides with education on the ecosystem of coastal Georgia and how to protect it, so that the guides can then pass this education along to their clients. Over the course of 4 weeks, ecotour guides complete a 16-hour long course that includes work-at-your-own pace learning content created by UGA marine educators mixed with live Zoom meetings and a final in-person field-based component. Upon completing the program, guides receive a CARE certificate that can be uploaded onto their company websites to show potential ecotourist clients that they are certified environmentally responsible guides. In order to remain CARE certified

guides must be recertified every 2 years and are required to maintain their certification through continuing environmental education programs.

Marine Debris 101 is an online course that I created in the Fall of 2022 and that was piloted in Spring 2023 on the CARE certification platform as an option for ecotour guides to complete for credit towards their recertification requirements. By completing this course, ecotour guides along coastal Georgia can have a similar standard for what to teach their clients about marine debris and for what actions every person should be taking to help address the problem. The goal of this course was to increase the marine debris knowledge levels of the ecotour guides.

2. Methods

2.1. Content

Marine Debris 101	
Topic Name	**Key Concepts**
Marine Debris: The Big Picture	• Plastic abundance • Microplastics • Debris sources • Great Pacific garbage patch
Impacts	• Economic impacts • Social impacts • Ecological impacts
Research on Marine Debris and Microplastics	• Research throughout the decades • Sources of error • Local marine debris • National research
Education and Outreach	• Marine debris education at UGA Marine Extension and Georgia Sea Grant • Stewardship • Marine debris tracker app • Refuse, Reduce, Reuse, Recycle
Additional Resources	—

Table 1. Key concepts addressed in each of the five topics presented in the course. Key concepts are the main points addressed in each topic in line with the overall course objectives, except for "Additional Resources" which did not have any key concepts.

Marine Debris 101 was designed to educate ecotour guides on the connection between marine debris and human activities, so that they may become knowledgeable guides able to educate their clients on this issue and potential solutions. It contained 5 topics, as outlined in Table 1, as well as 2 quizzes and a survey, and took an estimated 2 hours to complete. I wrote the course content using peer-reviewed sources and information from NOAA's "Marine Debris Program" through their Office of Response and Restoration. At the end of each topic within the

course, the references were listed in APA 7th edition format for the user's convenience if further information was desired.

The first topic within Marine Debris 101 was titled “Marine Debris: The Big Picture” and contained key concepts of addressing plastic abundance, microplastics, marine debris sources, and the Great Pacific garbage patch. As an introduction to marine debris, I embedded a 19-minute-long YouTube video into the beginning of the first topic, created by the UGA Marine Extension and GA Sea Grant in Spring 2022 and titled, “Plastics… From Athens to the Atlantic”. This video features scientists, marine educators, and members of the general public, traveling between Athens and the Georgia coast to highlight the consequences of upstream plastic waste on the marine ecosystem. Using the H5P plugin, I created an interactive module on decomposition rates of marine debris items, where users could click and drag item labels to different decomposition rates and test their knowledge (Fig. 1). Users had unlimited chances to complete this interactive content and received a pop-up notification stating whether their answers were correct. From my point of view as the developer, it was possible to see how many attempts a user had, and the number of answers they got correct, but it was not possible to see which exact questions they correctly or incorrectly answered. Another interactive piece I created within this topic was an illustrated depiction of the Great Pacific garbage patch which contained “hot spot” buttons for the user to click on to receive more information (Fig. 2).

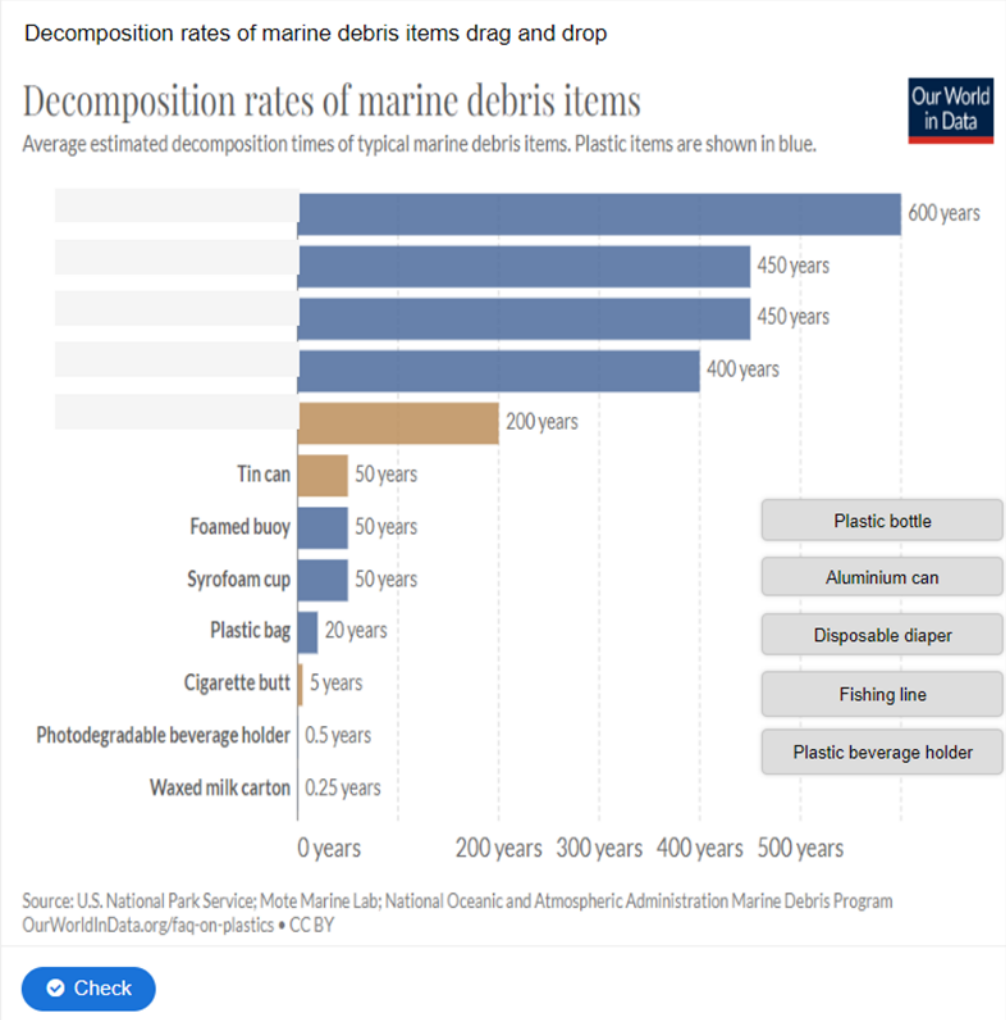


Figure 1. Picture of the interactive module on decomposition rates of marine debris items within the course topic “Marine Debris: The Big Picture”. Users could click and drag item labels (lower right corner) to different decomposition rates (upper left corner) and test their knowledge.

Figure 2. Picture of the interactive piece of the Great Pacific garbage patch within the course topic "Marine Debris: The Big Picture". This piece contained hot spot buttons (the purple plus signs) that the user could click on to receive more information.

The second topic within this course was "Impacts" and had key concepts of economic, social, and ecological impacts. Among other information in the economic section, I used a case study of a coastal city within the United States to show the cost reductions and economic benefits associated with reducing coastal litter along local beaches. In the social impacts section, I highlighted potentially harmful chemicals associated with plastic pollution, as well as the ubiquitousness of nano- and microplastics and their routes to the human body. I further divided the ecological impacts section into subsections of e*ntanglement*, *ingestion,* and *disruption of habitat.* Within these subsections, I gave definitions and statistics of the ecological impacts of marine debris on marine wildlife, incorporating graphics and figures to further illustrate key points (Fig. 3).

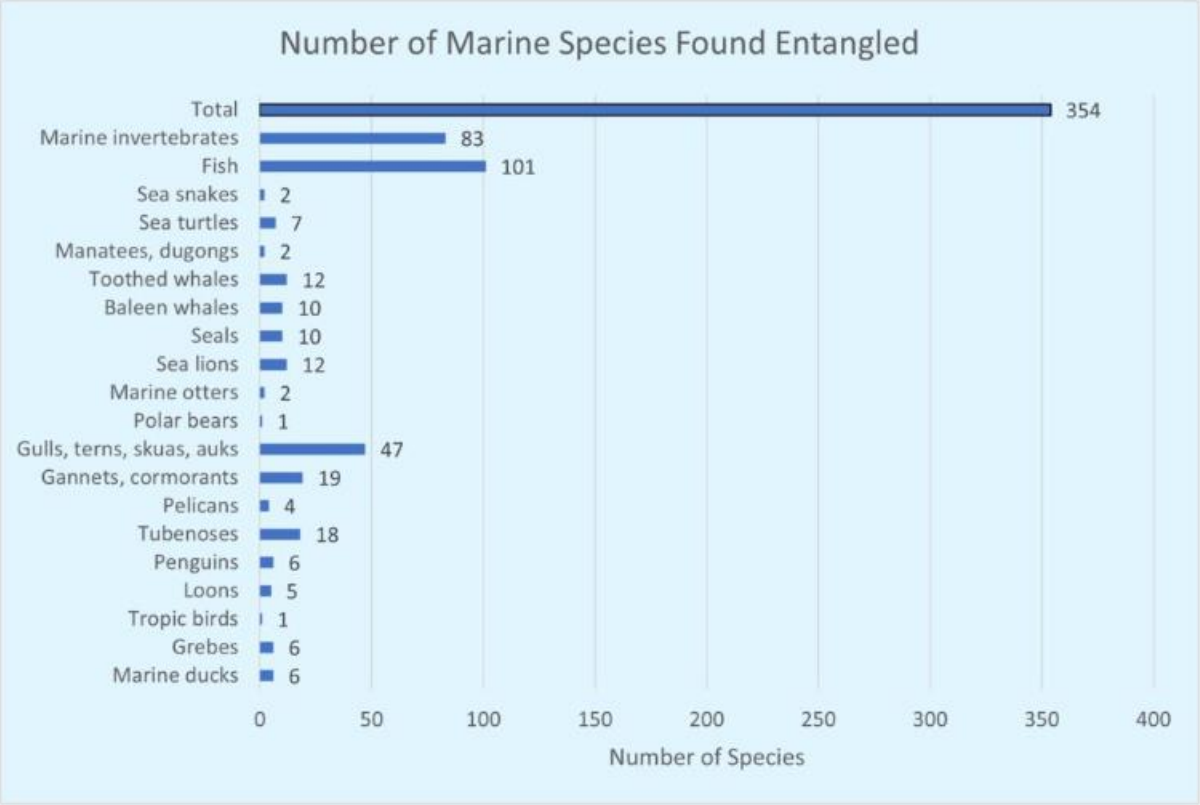
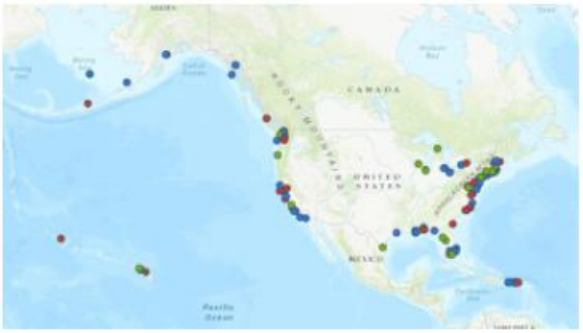


Figure 3. A bar graph showing the number of marine species that have been found entangled in marine debris as of 2020, which was included in the course topic "Impacts". The data in the graph comes from Kühn & van Franeker, 2020.

In the third topic, "Research on Marine Debris and Microplastics", I created an interactive timeline that illustrated major milestones in marine debris research and discoveries (Fig. 4). Other key concepts that I covered in this topic included possible sources of error and challenges in microplastic identification, as well as brief overviews of marine debris research in coastal Georgia and research occurring on the national level (Fig. 5).

Figure 4. Picture of the interactive timeline that illustrated major marine debris research and discovery milestones, included within the course topic "Research on Marine Debris and Microplastics".



A map showing current marine debris research, prevention, and removal efforts supported by the NOAA Marine Debris Program, with map legend to the right (Image courtesy of NOAA).

Figure 5. Picture of a map showing different types of marine debris research occurring at the national level within the United States (courtesy of NOAA), included in the course topic "Research on Marine Debris and Microplastics". The map legend and link to the interactive map are shown on the right.

The fourth topic was titled "Education and Outreach" and I began with an overview of marine debris education occurring at the UGA Marine Extension and GA Sea Grant. I then delved into the practice of environmental stewardship, where I provided definitions and examples of ways to participate in beach clean-ups (and other environmental events) locally. One of the key components that was outlined in this topic was to provide information on the Marine Debris Tracker App, an app designed by a UGA researcher to track how much and what kind of litter is collected in the environment (Jambeck & Johnson, 2015). To provide the participants with more information on this app, I embedded a YouTube video that included instructions on how to use the app, and I created a QR code that allowed the user to download the app for themselves (Fig. 6). I then explored the actions of refusing, reducing, reusing, and recycling in order for the participants to understand the pros and cons of each decision, and I wrote an information box that highlighted the "Problem with Plastic Recycling" (Fig. 7). Finally, I gave tips, possible lifestyle changes, and stewardship actions for the participants to consider in their day-to-day lives.

Video courtesy of *Marine Debris Tracker*.

Marine debris tracker app QR Code.

Figure 6. Picture of the marine debris tracker app instructional YouTube video and QR code to download the app, included in the course topic "Education and Outreach".

Figure 7. Picture of the "Problem with Plastic Recycling" information text box included in the course topic "Education and Outreach".

The fifth and final topic within this course was in fact not a true topic, but rather a page dedicated to providing the participants with "Additional Resources". Specifically, I provided links to outside sources, such as papers, videos, and blogs, that included more information on marine debris or ways to help in the community.

2.2. Evaluation

My overall course learning goals for the participants are given below. Upon completion of Marine Debris 101, participants should be able to:

1. Identify sources of marine debris and recognize plastic as the most common type of marine debris.
2. Describe the economic, social, and ecological impacts of marine debris, and give specific examples of the ecological impacts of plastic debris in marine environments.
3. Understand how the UGA Marine Extension and Georgia Sea Grant educates the public on marine debris.
4. Recognize the role that people play in generating marine debris and evaluate best practices in addressing this issue.
5. Integrate the information learned from the course into their ecotour educational content.

To test the participant's knowledge levels on marine debris prior to completing the course, I created a check-in knowledge assessment (or "pre-" course quiz), which consisted of 7 multiple choice and true-false questions (Table 2); however, only questions #3-6 had right/wrong answers, whereas #1-2, and #7, were opinion-based questions. I used these same questions at the end of the course ("post-" course quiz) to assess the participant's knowledge gains from the course content. Participants were notified at the end of the quiz if they incorrectly answered a question and were allowed to retake both the pre- and post-course quizzes an unlimited number of times. Because some of the questions were opinion-based, I only used the answers to right/wrong questions (#3-6) in calculating the participant's final quiz scores. I chose the quiz questions based on the learning goal criteria and the key concepts for each of the topics.

In addition to these in-course assessments measuring knowledge gains, I created a course evaluation survey that was offered to participants post-completion and assessed their experience completing the course, such as their satisfaction with the course length and content. I specifically asked the participants questions about their key takeaways from the course, and their willingness to recommend the course to someone else. A link to the survey and a picture of some of the questions asked can be found under Supplementary Materials (Fig. S1).

	Pre- and Post-Course Quiz Questions	Answer Choices
1.	What is your current level of knowledge about marine debris?	a. No knowledge b. Somewhat Knowledgeable c. Very Knowledgeable d. Expert knowledge
2.	Which statement best represents your opinion about marine debris?	a. Marine debris significantly contributes positively to environmental health. b. Marine debris somewhat contributes positively to environmental health. c. Marine debris is neither bad for the environment nor contributes positively to environmental health. d. Marine debris is somewhat bad for the environment. e. Marine debris is very bad for the environment.
3.	What is the most abundant type of debris found in the marine environment?	a. Metal b. Plastic c. Wood d. Glass
4.	Which statement(s) are accurate when discussing microplastics? (Select all that apply)	a. Microplastics can enter the marine environment from

		larger plastic items that break down over time. b. Microplastics can enter the marine environment as resin pellets used for plastic manufacturing. c. Microplastics can enter the marine environment through wastewater from washing machines. d. Microplastics pose a threat to marine organisms through possible ingestion. e. Microplastics have been found in bottled water, seafood, and human blood.
5.	Marine debris affects marine organisms by... (Select all that apply)	a. Entanglement b. Ingestion c. Disruption of habitat d. There is no effect on marine organisms
6.	The UGA Marine Extension and Georgia Sea Grant website has a page dedicated to marine debris.	a. True b. False c. I don't know
7.	Which of the below statements do you agree with the most? (This is an opinion question)	a. Recycling plastic material is the most effective way to stop debris from entering the marine environment. b. Reusing plastic material is the most effective way to stop debris from entering the marine environment. c. Reducing plastic material is the most effective way to stop debris from entering the marine environment. d. Refusing plastic material is the most effective way to stop debris from entering the marine environment.

Table 2. The questions and possible answer choices used in the course check-in knowledge assessment. The same questions were used in the check-out knowledge assessment. Questions #1, 2, and 7 were opinion-based questions. Questions with multiple correct answer choices are indicated by the phrase “Select all that apply” included at the end of the question.

2.3. Software

Marine Debris 101 was an online course that I created on the same platform as the CARE course, meaning that they share the same software. I created Marine Debris 101 using WordPress, an open-source content management system (CMS) that is free to the public and manages website content in an accessible manner so that non-experts can easily use it. A WordPress website can be modified by the use of plugins, which are software additions that can extend the functionality of the existing application, allowing for specific customizations. In creating Marine Debris 101, I used the plugins LearnDash and H5P.

LearnDash is an interactive learning management system (LMS) that is typically used in the creation of online courses thanks to its easy integration with other plugins, user-friendliness for course participants, and the ability for the creator to make regular updates and revisions as needed (Evans et al., 2021; Martin et al., 2018). LearnDash is commercially available for a relatively inexpensive yearly cost, and UGA Marine Extension and GA Sea Grant purchased a one-site license when they created CARE. Thus, I created Marine Debris 101 on the same site as the CARE certification course, but it exists as a separate course. LearnDash is structured so that the top level within a WordPress application is called a course, followed by lessons, then topics, and finally quizzes, if desired. I structured Marine Debris 101 to have 1 lesson, with 5 topics within it, as well as 2 quizzes.

I also used an H5P plugin in the creation of Marine Debris 101. An H5P plugin is free to use and works with existing CMSs (e.g., WordPress) and LMSs (e.g., LearnDash) to further enhance the user's learning experience. H5P allowed me to create interactive content within the course, such as videos, questions, games, and other media. Importantly, the content that I created with H5P is mobile-friendly, so participants using smartphones or tablets were still able to see and interact with the course content.

A final piece of software that I used in this project that was separate from the actual course was Qualtrics, a customer experience management (CXM) software. I used Qualtrics to create an optional course survey for the participants to complete after finishing Marine Debris 101, separate from the LearnDash-generated pre- and post-course quizzes used for assessing knowledge levels. Qualtrics is a cloud-based platform that allows the user to create web-based surveys, distribute them, and analyze them using a variety of generated graph types and reports.

2.4. Participants

The first cohort of ecotour guides to participate in the Marine Debris 101 course were those who had already completed the CARE certification in either the year 2021 or 2022. Thus, participants were in the process of becoming CARE recertified, and had the option of completing Marine Debris 101 for 2 credit hours towards their ongoing environmental education requirement. A total of 33 CARE-certified guides were offered a chance to participate in the course, coming from the Savannah, Brunswick, or St. Simons Island region, and I have kept their identities anonymous for the purpose of this study. Ecotourism experiences offered by the guides included a wide range of activities such as: charter fishing, barrier island expeditions, river and

marsh boat tours, sunset cruises, kayak tours, canoe tours, and paddleboard tours. Ecotour guiding experience levels of participants ranged from beginners to some with up to 30 years of guiding experience. Participation in Marine Debris 101 was free of cost to the guides since it was a subset of the CARE certification which had funding support through the National Sea Grant.

3. Results

Knowledge Assessments

Of the 33 CARE-certified guides who were eligible to participate in the course, 6 in total began the course with 2 finishing it. All 6 participants completed the pre-course quiz to assess prior knowledge levels, and the 2 participants who finished the course completed the post-course quiz as well as the course evaluation survey. More than half (66.7%) of participants received a score of less than 100% on their first pre-course quiz attempt (Table 3), and all of these participants retook the quiz. The 2 participants who fully completed the course received scores of 100% on both the pre- and post-course quizzes. The average score of the pre-course quiz was 71% with a standard deviation of ±29%, and the average score of the post-course quiz was 100% with a standard deviation of 0% (Fig. 8). Only answers to the questions with right or wrong answers (i.e., questions 3, 4, 5, and 6) were used in calculating the participant's final quiz scores.

Individual Participant Scores						
Pre-Course Quiz Score	100%	100%	75%	75%	50%	25%
Post-Course Quiz Score	100%	100%	-	-	-	-

Table 3. The individual participant scores on the check-in and check-out knowledge assessments. 6 participants completed the check-in knowledge assessment with scores ranging from 25% to 100%, while only 2 participants completed the check-out knowledge assessment, both scoring 100%.

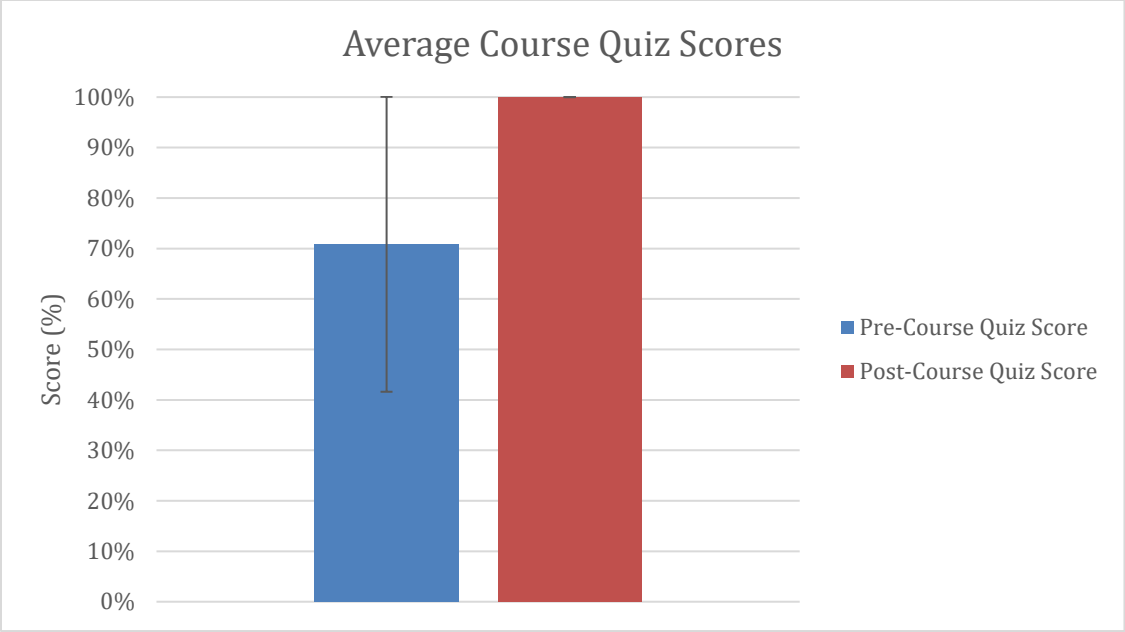


Figure 8. The average quiz scores of both the check-in knowledge assessment (blue bar) and check-out knowledge assessment (red bar). The check-in knowledge assessment average includes 6 scores with an average of 71% ± 29%, while the check-out knowledge assessment average includes only 2 scores with an average of 100% ± 0.

The first question on the course quiz was an opinion question, "*What is your current level of knowledge about marine debris?*", and each of the possible answers was assigned a score ("No knowledge" = 1, "Expert knowledge" = 4). The participants on average rated themselves as being "Somewhat knowledgeable" on marine debris before the course (avg. = 1.83), with a slight increase post-course (avg. = 2.5). For the 2 participants who completed the course, their individual answers to question #1 increased by a level. Participant 1 increased from "Somewhat knowledgeable" pre-course to "Very knowledgeable" post-course. Similarly, participant 2 increased from "No knowledge" pre-course to "Somewhat knowledgeable" post-course.

The second quiz question was also opinion-based, "*Which statement best represents your opinion about marine debris?*", and answers were given a similar score weight ("Marine debris is very good for environmental health" = 1, "Marine debris is very bad for the environment" = 5). The average score pre-course was 4.8, with the majority of participants believing that marine debris is very bad for the environment, and the post-course score average was 5.0.

The question most often answered correctly in the pre-course quiz was #3, "*What is the most abundant type of debris found in the marine environment?*", as 100% of respondents correctly identified plastic as the most common type of human-derived marine debris. Similarly, question #5, "*Marine debris affects marine organisms by... (Select all that apply)*" was correctly answered 83.3% of the time with respondents identifying entanglement, ingestion, and disruption of habitat all as impacts of marine debris.

Questions #4 and #6 were equally answered correctly by 50% of the participants in the pre-course quiz. Question #4 asked about microplastics (e.g., their sources, impacts, and pervasiveness) and although every participant selected at least one correct answer, all correct answers had to be selected in order to receive a point. Question #6 was the only true/false question, which stated, "*The UGA Marine Extension and Georgia Sea Grant website has a page dedicated to marine debris*" and had possible answer choices of "True", "False", or "I don't know". In order to receive a point for this question, respondents had to choose the correct answer of "True", however, 50% of respondents answered, "I don't know".

The last question in the course quiz, #7, was again an opinion-based question. This question asked, "*Which of the below statements do you agree with the most?*", and had participants choose 1 out of 4 options as to which method they thought was the most effective at stopping plastic debris from entering the marine environment, i.e., the four R's: recycling, reusing, reducing, or refusing. The majority (66.7%) of participants choose "Refusing plastic material" as the most effective way to stop plastic debris from entering the marine environment, and the remaining (33.3%) participants chose "Reducing plastic material" as the most effective way (Table 4). Regarding the 2 participants who completed the post-course quiz, neither changed their answer to question #7 upon completing the course.

Responses to question asking which of the following methods is the most effective way to stop debris from entering the marine environment						
Participant #	1	2	3	4	5	6
Pre-Course Answer	Reduce	Refuse	Reduce	Refuse	Refuse	Refuse
Post-Course Answer	Reduce	Refuse	-	-	-	-

Table 4. Participants responses to the question asking which of the following methods (recycling, reusing, reducing, or refusing) is the most effective way to stop debris from entering the marine environment. 6 participants answered in the check-in knowledge assessment, while only 2 participants answered in the check-out knowledge assessment.

Course Evaluations

Two of the 6 course participants finished the course and completed the course evaluation survey. In terms of overall course expectations, one participant stated that it exceeded expectations while the other participant stated it met expectations. The participants were then asked about their satisfaction with different course components, specifically the course length, course content, and site logistics. Course content and site logistics were both labeled as being "Exceptional"; however, course length was rated one level lower as only "Exceeding expectations", although whether this refers to the course being too long or too short remains unknown.

The participants were then asked if they would recommend this course to others interested in the topic, and why or why not. Both respondents stated that yes, they would

recommend it, with reasons given including that the course was very informative, and that the information learned from the course can be incorporated into discussions with clients. One participant answered that, now equipped with the information learned from this course, they can, "… make an impact on the perceptions of [their] clients". Both participants stated that they plan on putting into use something they learned from this course within the next year.

Lastly, the participants were asked what they thought was an important takeaway from this online course. One participant stated, "The vast quantity of marine debris and the detrimental effect on all marine life", while the other answered, "The four Rs, especially refuse". A final optional blank area was left for the participants to leave any additional comments or suggestions, with one participant reiterating how impressed they were with the course and stating a desire to see more relatively short, informative courses like this.

4. Discussion

With this project, I sought to provide marine debris education to coastal ecotour guides in Georgia through a free online course titled Marine Debris 101. My intentions for this course were to increase the marine debris knowledge levels of these ecotour guides so that they could become knowledgeable and sustainable guides who then disseminate this information to their clients, typically tourists. Preliminary results of this project suggest that Marine Debris 101 does indeed increase marine debris knowledge levels of the ecotour guides, with a seemingly overall increase in average quiz scores from before the course versus after. It is not possible to draw definitive conclusions yet as the sample size of the participants is still relatively small, but the results so far are promising.

When asked to evaluate their overall marine debris knowledge levels before and after the course, the two participants who completed the course reported higher levels of knowledge despite perfect scores in both the pre- and post-course quizzes (Table 2). This indicates an increase in self-reported knowledge levels, illustrating that the participants believe they learned something from the course that they did not know before. Answers to the pre-course quiz indicate that most of the participants have some basic understanding of marine debris; for example, all participants correctly identified plastic as the most common type of human-derived marine debris, and nearly all of the participants identified three ecological impacts of marine debris (per question #5).

One of the questions that participants missed most often was question #4, regarding microplastics. This could be due to misunderstanding the question, as it had multiple correct answers that all had to be selected for full credit, yet the participants may have misread this. Additionally, low knowledge levels of microplastics could have contributed to the incorrect answers to this question. As a relatively new discovery, members of the general public may not be as aware of microplastics as experts are, or of their sources and potential impacts (Deng et al., 2020; Henderson & Green, 2020). This possibility only supports the necessity of the course, however, as microplastics are a growing concern not only in the marine environment but in

countless other areas of the world, and even in daily human life (Henderson & Green, 2020; Kelly et al., 2020; Leslie et al., 2022; Napper et al., 2020).

Although only 2 participants completed the course and course evaluation, their answers indicated an overall high level of satisfaction with the course, including course content and site logistics. Both respondents answered positively to the question of recommending the course to others, as well as stating their intentions to put into use something learned from this course in the next 12 months. Positive comments on the course mainly mentioned how informative it was, with the participants stating that their key takeaways from the course were how detrimental marine debris is to marine life, and the differences between the four R's in addressing marine debris.

A major limitation of this study was the sample size, as only 2 participants fully finished the course, while 4 participants started it but have not yet finished the course. This low participation rate can most likely be attributed to the fact that the course has only been available for a short amount of time thus far and that the ecotour guides can participate in this course at any time during their 2-year recertification process. It is believed that as time goes on and the guides reach the end of their recertification deadlines, more people will participate in the course. Another limitation of this project is that it is online learning, which has challenges associated with it compared to in-person learning. One potential challenge to online learning is the issue of accessibility. For example, financial issues can limit online course accessibility if a person cannot afford the technology or internet connection needed to participate (Barrot & Llenares, 2020; Talebian et al., 2014). Additionally, online learning can potentially present a challenge to users with certain disabilities, such as those with vision, hearing, or motor impairments (Baldwin & Ching, 2021). Accessibility issues could be of major concern especially if this course was ever expanded and made available to more members of the public; however, adjustments could be made to the course to accommodate for certain disabilities, such as including alternative tags to graphics that can be read by screen readers (Baldwin & Ching, 2021). Furthermore, some studies have found that there can be numerous benefits to online learning as compared to in-person learning, such as allowing the user to go at their own pace and the ability to reach a wider range of participants geographically (Talebian et al., 2014; Weber et al., 2022).

A final significant limitation of this project is that it uses education to encourage pro-environmental behavior; however, human behavior is something that cannot always be changed. A 2013 study of beachgoers in Chile found that, of all those interviewed, those who admitted to littering more frequently were typically less supportive of environmental education programs (Eastman et al., 2013). Essentially, it can be more difficult to change the behavior of someone who does not want to change, or who thinks that one person cannot make a difference anyway. Environmental education programs like Marine Debris 101 have the potential to alter human behavior for the better, but only if a person chooses to participate in said program. Fortunately, social norms and pressure also play a significant role in influencing the environmental behavior of people. Several studies have found that increased social pressure to be environmentally conscious (such as refusing plastic materials) can lead to pro-environmental behavior, even if a

person has not participated in an environmental education program themselves (Arı & Yılmaz, 2017; Carrigan et al., 2011; Heidbreder et al., 2019; Musa et al., 2013). In this way, Marine Debris 101 has the potential to influence people who are not participating in ecotourism activities by educating guides (and thus, the public) who may then add to social pressure and norms of being sustainable.

Future adjustments to Marine Debris 101 could include incorporating some form of in-person activity, such as participating in a local beach cleanup. Studies show that participating in activities like beach cleanups leads to increased feelings of responsibility, increased perceptions of and measures taken against marine debris, and potential alterations of behavior (Brennan & Portman, 2017; Heidbreder et al., 2019; Rayon-Viña et al., 2019; Wyles et al., 2017). By including an in-person activity such as a beach cleanup in the Marine Debris 101 curriculum, the participants can see the issue they are learning about first-hand, which can potentially enhance long-term learning through emotional connections. Another future possibility for Marine Debris 101 would be to include a long-term evaluation, such as retesting the participants on their knowledge levels 6 months post-course. The post-course quiz that is currently used is useful for assessing participant's immediate knowledge gains; however, there is currently no assessment in place to evaluate how well they retain the information learned in the long term, nor to determine if they actually incorporate some of the information they learned from the course into their ecotourism activities. Therefore, a long-term evaluation piece could be created to assess the knowledge levels of the participants over time.

5. Conclusion

Marine Debris 101 is not the first educational tool for marine debris, but it is the first (to the best of my knowledge) online course created to educate ecotour guides on marine debris. There have been marine debris educational programs over the years and across the globe, most of which show positive behavioral outcomes for the participants. One of the most well-known is the MARLISCO project, a marine debris initiative that begin in 2012 across 15 European countries. The goal of MARLISCO was to increase societal engagement and awareness of marine debris, which it did through educational tools, public exhibitions, and other events (Veiga et al., 2016). The results of this initiative showed an improvement in the participant's perceptions and knowledge of marine debris but, perhaps even more importantly, created a sense of connection to the problem and a feeling of being part of the solution (Veiga et al., 2016).

My goal for this project was not only to increase the marine debris knowledge levels of the participants but also to promote pro-environmental behavior, which sometimes requires behavioral change. The challenge in fostering pro-environmental behavior in people is that, oftentimes, it comes at a personal cost to them through their time, money, or just inconvenience, and change can only occur if a person recognizes the benefits of their actions outside of themselves (Rice & Miller, 2023). Courses such as Marine Debris 101 can help individuals to reach this realization by providing the necessary information, which includes the ‘why’ and the ‘how’ to make a change.

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Supplementary Materials

How did this online learning program align with your expectations?

- It exceeded my expectations
- It met my expectations
- It did not meet my expectations

Please rate your satisfaction on the following aspects of this online learning program:

	Unsatisfactory	Improvement needed	Meets expectations	Exceeds expectations	Exceptional
Program length	○	○	○	○	○
Program content	○	○	○	○	○
Site logistics	○	○	○	○	○
Registration process	○	○	○	○	○

Based on this service program, would you recommend UGA Marine Extension and Georgia Sea Grant to others interested in this topic?

- Yes
- No

Why or why not?

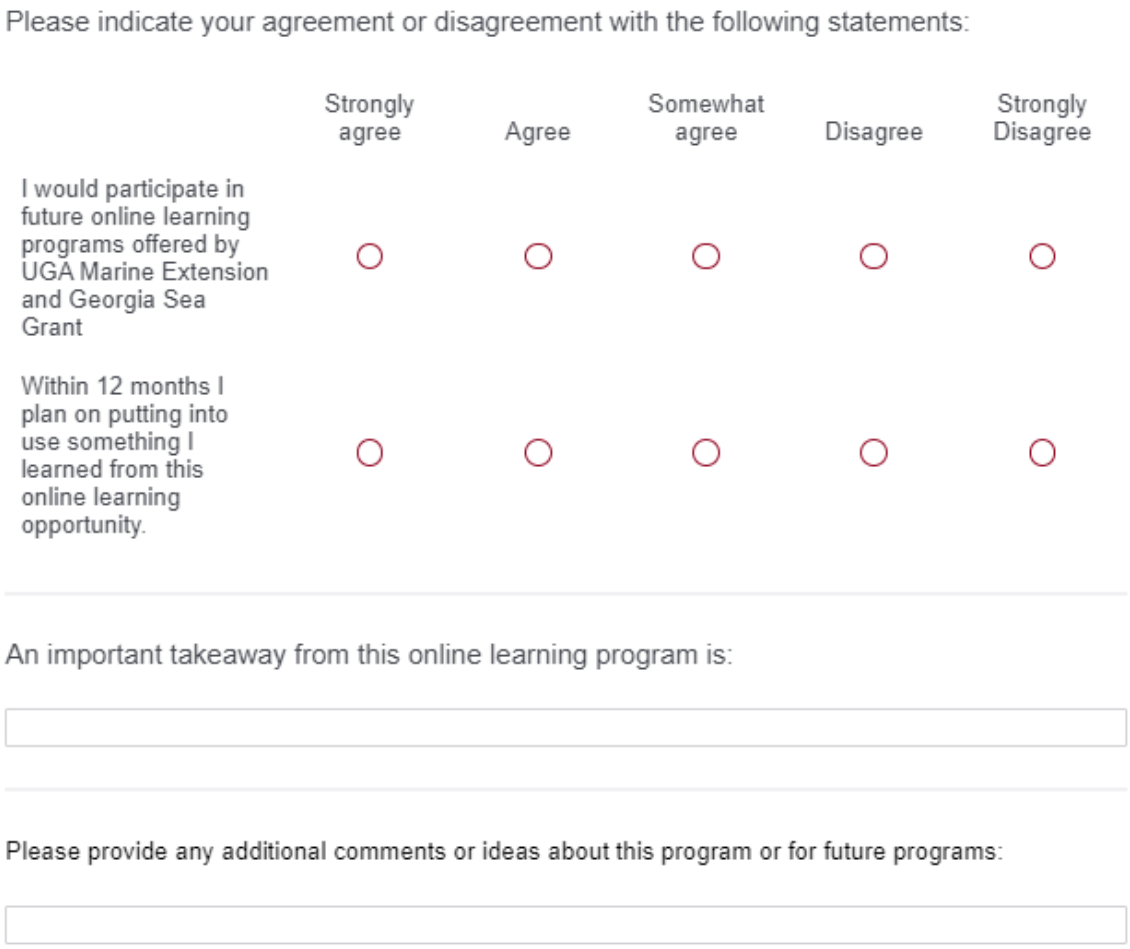

Figure S1. Picture of the voluntary Qualtrics course survey that course participants can complete upon completion of Marine Debris 101. Link to the survey: https://ugeorgia.ca1.qualtrics.com/jfe/form/SV_bCsGvm5mkpQR5f8