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THE INFLUENCE OF PLASTIC BAG BANS ON PRO-ENVIRONMENTAL BEHAVIORS IN RHODE ISLAND COASTAL COMMUNITIES

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BY

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ABSTRACT

One of the greatest threats to the natural environment is marine debris pollution. Single-use plastics, one of many contributors to marine debris, are causing the greatest harm, affecting the well-being of humans and animals. In an effort to mitigate plastic pollution, environmental policies are implemented to reduce the availability of single-use plastic products to the consumer. This research looks explicitly at single-use plastic bag policies to see if implemented plastic bag bans promote pro-environmental behaviors and broader support for plastic bag policies. This study sampled two communities in Rhode Island, one with a single-use plastic bag ban, Middletown, and one without a single-use plastic bag ban, Warwick, performing face-to-face surveys with 50 individuals in each community (N = 100). The findings do not show support of a behavioral spillover effect; however, people living in the town with the implemented plastic bag ban used reusable bags more frequently than individuals in Warwick and showed greater support for a statewide plastic bag policy. In addition, age, gender, and environmental worldview (NEP) were predictors for some pro-environmental behaviors. In all, plastic bag polices could have broader implications for supporting similar and different environmental policies moving forward.

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CHAPTER 1

INTRODUCTION

Marine debris, the accumulation of manufactured materials in the natural environment, is classified as a global environmental issue (Sheavly & Register, 2007). Depending on geographic location, the approach to solve this issue will vary. Remediation plans may include implementing a new waste management system to cope with the influx of consumer waste, while other plans may focus on limiting the consumer to a specific resource through law and policy and general education about marine debris pollution and preventative actions an individual can take to help mitigate the issue on a local-scale.

Rhode Island, the smallest state in the United States, suffers from marine debris pollution, where marine debris build-up is found along most segments of the state's coastline. Marine debris is a complex topic because once debris enters the environment, it is hard to determine the origin of the debris – was it from recent nearby shoreline activities or did the debris wash in from off-shore? From the personal to the industrial to the governmental level it is easy to point fingers at an opposing party to take responsibility for the accumulation of marine debris. Once marine debris enters the natural environment, however, it becomes a public issue no matter the source.

One way that the communities in Rhode Island have started to address the build-up of marine debris in the environment is through policy, specifically plastic bag policies. Many studies have shown the detrimental effects of plastic bags on the

environment, starting off as litter on land and becoming marine debris, and then eventually harming organisms through ingestion and entanglement (Barnes et al. 2009; Derraik, 2002). Plastic bag policies range from local to state levels (as seen in the United States) to national levels. Bangladesh, the first country to pass a law banning single-use plastic bags, created this policy because plastic bag litter was causing a public health issue for citizens through the clogging of storm drains, which began to increase flooding after large storms (UNEP, 2018). However, in industrial nations with established waste management practices that can handle the proliferation of single-use products, public health is not the main driver for implementing plastic bag policies. In the United States, plastic bag policies are an accessible first step towards protecting sacred marine life and set the scene for other future environmental policies.

There is mixed support for plastic bag policies at the individual and municipal and state level governments. Some argue that education and raising awareness about the marine debris issue at large will be sufficient in solving marine debris pollution because the surplus of information will influence individuals to participate in environmentally friendly behaviors; however, the environmental behavior literature suggests that education alone is not sufficient in addressing environmental issues (Kollmuss & Agyeman, 2002). On the other hand, a combined approach of education and policy is said to be an effective measure at reducing forms of marine debris (Sheavly & Register, 2007). Currently in the United States, there is an influx of communities adopting various forms of plastic bag policies as a way to address littering behaviors and marine debris pollution; however, it is still unclear how this particular environmental policy is directly impacting the environment and people

living within communities with the implemented legislation. This research investigates whether an implemented plastic bag ban in one Rhode Island coastal community influences residents to participate in pro-environmental behaviors in both public and private-sphere environmentalism.

CHAPTER 2

REVIEW OF LITERATURE

2.1 MARINE DEBRIS

Marine debris pollution, commonly defined as unnatural solid waste that intentionally or accidentally finds its way into the terrestrial or marine environment, has become a widely accepted and acknowledged public phenomenon over the past decade (NOAA, 2008). Sheavly and Register, authors of "Marine Debris & Plastics: Environmental Concerns, Sources, Impacts and Solutions" (2007), identify the most pervasive forms of marine debris to be from consumer waste, boating and vessel activities, and all methods of fishing activities (recreational, local and commercial). As a result, consumer marine debris is often comprised of food wrappers, beverage bottles and cans, cigarettes and cigarette filters and other hard plastics; boating and vessel related debris includes Styrofoam, buoys, and ropes; while fishing related activities leave behind derelict and ghost fishing gear such as traps, netting and line.

The sources of marine debris are attributed to both land-based and ocean-based activities; however, research has proposed that 80 percent of all marine debris pollution comes from land-based sources (UN, 2016; Sheavly & Register, 2007, Barnes et al., 2009). Sheavly and Register (2007) suggest that of the land-based sources, both "legal and illegal waste handling practices contribute to marine debris" in the environment. Illegal dumping, littering, transportation of waste via truck, sewage treatment plants and overflows, and factories and industrial sites, are all

credited for adding to the marine debris crisis on land. No matter the source, marine debris is a pollutant that is negatively impacting all living organisms.

Countless research studies have indicated that marine debris is directly impacting animals of all trophic levels either through ingestion, entanglement or a combination of the two. Derriak (2002) discusses the effects of ingestion and entanglement on marine organisms in a literature review. Marine organisms become trapped in derelict fishing gear and discarded packaging materials, which often leads to death from drowning, starvation from decreased mobility and ability of reaching a food source, and/or results in intense wounds which can inhibit long-term movement and eventually cause death. Some large marine animals are lucky enough to become naturally untangled from debris with time or receive human help if they are near shore or are found while boating, but many are not this fortunate.

Ingestion of marine debris occurs because organisms mistake debris for their natural food source, but also marine debris is so pervasive in the marine environment, it is often hard to not consume debris with the natural food source (this is common for filter feeders). The most common form of ingested debris is plastics. Flexible plastics, like plastic bags, often get mistaken for jellyfish by sea-turtles, resulting in ingestion and often times entanglement (Derraik, 2002; Barnes et al., 2009). Derriak (2002) shares that another prolific example of ingestion of debris is in seabirds; many species of seabirds consume plastic pieces because they are indistinguishable from the natural food sources and end up feeding this plastic to their chicks. Ingestion of plastic at any size fills an organism's digestive tract leaving them feeling full but lacking any sustenance, leading to starvation and death.

Marine debris is an environmental issue that is wreaking havoc on marine and terrestrial ecosystems through indirect and direct human actions. However, there are scalable solutions for marine debris pollution, beginning with education and outreach, creating laws and policies that are directly related to waste management practices, and proper management and enforcement of these environmental regulations (Sheavly & Register, 2007). Marine debris is a global issue; however, addressing this issue on a local scale will help to address specific issues and needs tailored to a community.

2.2 THE PLASTIC ISSUE

Before it became recognized as a global environmental pollutant, plastic was admired for its durability, flexibility, and resiliency – it was the latest and greatest material for any and all product manufacturing. Industrial plastic began when polyethylene, a common form of plastic, was accidentally created by two chemists working at Imperial Chemical Industries plant in 1933. It took five years of experimentation to finally recreate this 'accident' at levels great enough for industrial use (BBC, 2010). Production of this type of plastic proliferated during World War II, both in Europe and the United States, because British defenses were using polyethylene to help insulate their radar cables (BBC, 2010). During World War II, plastic production increased by 300 percent in the United States alone (Science History Institute, 2016). World War II kickstarted the industrial age for plastics, and as a result, an estimated 8.3 billion metric tons of (mostly disposable) plastics have been created and used globally (Geyer et al., 2017). Plastic soon became the newest and greatest innovation; constituting most toys, food packaging, clothing and other consumer items. "Plastics heralded a new era of material freedom, liberation from

nature's stinginess," creating uniformity, convenience and affordability, and color (Freinkel, 2011). However, reveling in the new world of plastics would only last for a short amount of time.

During the developmental years of plastic, Americans were using an estimated 30 pounds of plastic products each year. Fast forward to today – the average American now consumes over 300 pounds of plastics products a year (Freinkel, 2011). In 1960, plastics comprised less than one percent of the United States total municipal solid waste; however, by 2005, plastics constituted almost 10 percent of municipal solid waste in reported countries around the globe (Jambeck et al., 2015). It is estimated that only 30 percent of all plastic produced in the past 70 years is still being used today (Geyer et al., 2017), suggesting that the remainder of all the plastic ever produced has either been recycled, incinerated, disposed into landfills, or are forms of litter in our terrestrial and marine ecosystems. Even if disposed properly, "plastic persists in landfill sites…durability of plastic ensures that wherever it is, it does not 'go away'; that is, by placing plastics in landfills we may be storing a problem for the future" (Barnes et al., 2009).

One important characteristic of plastics that has not been discussed is their mode of degradation. Plastics only breakdown via photodegradation, meaning that the sunlight breaks down plastic into smaller pieces (Andrady, 1990). However, using the term 'degradation' is a bit of a falsehood because plastic never fully degrades; plastic just breaks down into smaller pieces, becoming micro- and eventually nano-plastics. As a result, plastics have been monitored in every ocean, ranging from surface water to the deep sea (Li et al., 2016).

In addition, there is curiosity regarding the "lifespan" of plastics, and some estimates suggest plastic will last from hundreds to thousands of years (Barnes et al., 2009). There is still much uncertainty about the impacts of plastics and whether the chemical composition of plastic will have greater impacts on the environment than just the tangible implications such as debris, entanglement or ingestion.

As previously noted, when plastics enter the natural environment, they infect every marine trophic level through ingestion and cause death by entanglement, but there is also evidence that plastics release toxic chemicals into the ocean from degradation, destroy marine habitats, and spread invasive species throughout the water column via floating marine plastic (UN, 2016). Plastics are so pervasive in the natural environment that "plastic is now considered as a geological marker of the Anthropocene, the emerging epoch in which human activities have a decisive influence on the state, dynamics and future of the Earth system" (Villarrubia-Gómez et al. 2018). Once a novelty, plastic has become a normal attribute in the natural environment and will remain part of varying ecosystems into the immediate and foreseeable future.

2.3 EVOLUTION OF THE PLASTIC BAG

Shortly after the birth of plastic came the plastic bag, a more durable, less expensive and lighter-weight alternative to the normal paper or cloth bag (Gardner et al. 2004). Versions of plastic bags began entering American households in 1957 via plastic "snack" bags, a new alternative for packing and carrying sandwiches and fruit, while by the 1960s people began using plastic trash bags to dispose of daily household waste (Gardner et al., 2004). In the meantime, Sten Gustaf Thulin, an engineer

working for Celloplast, a Swedish company that focuses on product engineering, created the single-use shopping bag from polyethylene in 1960. In 1965, this plastic shopping bag was patented by Celloplast and took hold in the European market (UNEP, 2018). Celloplast fought to maintain the patent for single-use plastic shopping bags in the United States but lost this battle to Mobil in 1977, the leader in petrochemical engineering at the time and arguably still the leader today (Rutan, 2015). By 1979, the plastic bag had officially entered the United States as a widely-accessible consumer product and was being marketed by many American companies. The popular grocery store chains, Safeway and Kroger, officially made the switch from paper bags to plastic bags in 1982, supporting a plastic future (UNEP, 2018).

Through the successive entrance of plastic bags into the United States, the use of plastic bags in many aspects of daily life quickly became the consumptive norm. By 2014, the United States alone consumed 103,465 billion single-use plastic bags (Wagner, 2017). The rapid increase and proliferation of the plastic bag in society has framed itself for disaster. In just a short time, plastic bags have wreaked havoc to waste management systems and the environment. Because of the thin and flexible design, the plastic bag has a very low recyclability rate in the United States and, if it is recycled, the bag often lowers the effectiveness of automated recycling machines (Wagner, 2017). If plastic bags are not recycled by the consumer, they often end up in landfills where they will remain indefinitely or become litter in the natural environment due to improper disposal. Due to the product's light weight, plastic bags quickly become airborne, becoming stuck in trees, clogging storm drains, and eventually becoming marine debris (Barnes et al., 2009). As soon as plastic bags

become litter, this creates an opportunity to harm terrestrial and marine organisms through entanglement and ingestion.

2.4 PLASTIC BAG SOLUTIONS

There are two ways that plastic bag pollution is currently being addressed: environmental policy and behavior change. In order to manage the number of plastic bags ending up in waste management facilities and the ecosystem, governments, both at the local and the state level, have and are continuing to implement environmental policies focused on limiting the use of single-use plastic bags. There are three widely recognized types of single-use plastic bag legislation in practice: (1) Bag fee where a fee is required for use of all carryout bags in a store, (2) Second Generation Ban – ban on thin plastic bags and a fee for using carryout bags that are paper, reusable or compostable, (3) First Generation Ban – ban only on thin plastic bags (Romer, 2018). Documented citizen science research has shown that first generation plastic bag bans are effective in reducing the amount of single-use plastic bags entering the land and coastline (COA, 2019). Currently in the United States, California is the only state to have a statewide uniform plastic bag law that uses a fee, while there are 311 communities in 24 states across the country that have unique community bag ordinances (Romer, 2018). Although there is evidence that environmental policies like the single-use plastic bag ban and tax, are effective at decreasing environmental impacts, the limiting factors of any effective policy are compliance and enforcement of the regulations.

The second way that plastic bag pollution can be addressed is through behavior change. The environmental conservation behavior literature provides many examples to help contextualize why individuals perform specific behaviors and how to influence behavior changes. De Young (1993) discusses three approaches for stimulating behavior change, the first being an informational technique. This technique uses informational messaging to educate people about why they need to change their behaviors to accommodate an environmental problem, and how they can then change their behaviors to consider the said environmental condition. This model was created in the 1970s and is referred to as the information deficit model of public understanding and action, as well as the linear model. Many social science experiments that use this model illustrate that the more environmental knowledge that a person has, does not guarantee a change in their attitude, and therefore does not drive more environmentally friendly behaviors (Kollmuss & Agyeman, 2002).

De Young (1993) suggests that individuals are more inclined to change their attitudes about an environmental problem (and therefore their behaviors) once they have experienced an environmental concern first-hand. This attitudinal shift was found in an experiment that looked at attitudes towards marine litter after participating in a beach cleanup. Researchers found that participating in a beach cleanup increased levels of well-being in individuals and these participants had greater short-term pro-environmental behavioral intentions, however, the study did not show that these intentions resulted in performance of behaviors (Wyles et al., 2017). Ideally, once people have a personal experience with the environment, they can more confidently

change a behavior because they have a deeper understanding and responsibility towards the environmental issue of concern (De Young, 1993).

The second approach that De Young (1993) suggests to influence behavior change is through the use of positive motivational techniques. This method uses incentives and self-recognition to influence behaviors. Studies that use a monetary incentive for participating in a behavior or provide a form of social acknowledgement after an individual performs a behavior result with positive behavior changes. The third approach involves using a coercive motivational technique, which provides a more negative approach to behavior change by disincentivizing certain actions with implementing a tax, producing negative and fearful advertisements, and creating physical barriers to restrict the behavior from occurring, such as a ban. Plastic bag policies are a type of coercive motivational behavioral technique because variations of the policy place a tax or a fee on either plastic bags or alternative paper bags to deter the consumer from using plastic bags, or a ban is placed on plastic bags altogether, completely preventing the consumer from using plastic bags into the future.

Depending on the environmental problem and the human behavior that needs to be changed, one of the previously described techniques may be more appropriate to use than the others. However, it is first important to understand when and why people are more inclined to participate in pro-environmental behaviors. Stern (2000) mentions in his early work that "personal norms to take pro-environmental action are activated by beliefs that environmental conditions threaten things the individual values and that the individual can act to reduce the threat." Here, the theoretical research focuses on the personal and how the individual reacts to behavior changes. However, Kollmuss &

Agyeman (2002) expand beyond the individual and suggest, “attitudes do not determine behavior directly, rather they influence behavioral intentions which in turn shape our actions. Intentions are not only influenced by attitudes but also by social (‘normative’) pressures.” Therefore, an individual’s behaviors are influenced by both their own beliefs and self-interest, as well as, the beliefs of persons in their surrounding community or social environment. These theories are essential for analyzing the behavior response to a specific environmental problem.

Furthermore, Stern (2000) defines the two types of environmentalism, also understood as categories of environmental behaviors: public-sphere environmentalism and private-sphere environmentalism. Public-sphere environmentalism involves participating in environmental activism or supporting environmental policy, both of which indirectly achieve an environmental goal. Other behaviors, such as volunteering for or donating to environmental organizations, fall into this category of environmentalism. Participating in public-sphere behaviors may result in a large environmental impact depending on the size of the policy and environmental organization being supported (Stern, 2000). Private-sphere environmentalism on the other hand, focuses on individual behaviors such as purchasing environmentally friendly products and disposing of household materials in an environmentally responsible way. Whereas public-sphere behaviors were indirect, private-sphere behaviors have a direct impact on the environment, however, unless these behaviors are performed by a group at large, they will have a relatively small positive impression on the natural environment (Stern, 2000).

The sparse literature on plastic-bag related behaviors focus on private sphere behaviors in communities that do not have a plastic bag policy. One study that takes place in Japan, used a "voice-prompt intervention" at the point of purchase, asking shoppers whether they would like a plastic bag, rather than automatically providing them one. The findings of this study report a five percent decrease in plastic bag usage after the voice-prompt intervention method was put in place. The authors claim that although this is not a large decrease in bag use, they only collected data for a week across four different grocery stores, so a longer period of data collection could attribute to a larger change in behavior (Ohtomo & Ohnuma, 2014).

Another study (Jones et al., 2013) looked at the effectiveness of messaging as a way to reduce plastic bag use and encourage reusable bag use. Researchers used three forms of messaging: (1) injunctive normative messaging that stated, "Shoppers in this store believe that re-using shopping bags is a worthwhile way to help the environment. Please continue to use your reusable bags;" (2) personal normative messaging that stated, "We thank you for helping the environment by continuing to reuse your bags;" and (3) combined normative messaging that used both previous statements as one new statement. The authors found that the combined messaging approach was the most effective at reducing plastic bag use, while the injunctive normative message and personal normative messaging were also effective at smaller degrees. This study shows that environmental messaging alone was not enough to deter people from using plastic bags, and the authors state that the most effective way to reduce plastic bag consumption is by not offering them for free or making them available at the point of purchase.

Participation in behaviors that fall within private and public sphere environmentalism are rooted in an individual's fundamental values towards the environment. These values can be measured using two survey-based instruments. Two common approaches are: *New Ecological Paradigm (NEP)* and *Connectedness to Nature.* NEP is a common measure in environmental behavior literature that considers an individual's environmental worldview more broadly (Dunlap et al., 2000). The literature suggests that the NEP scale is composed of three ecological dimensions: "balance to nature, limits to growth, and human domination of nature" (Dunlap et al., 2000), all of which are embraced through a series of standardized questions regarding the environment. Research has shown that high NEP scores, which correlate to high environmental values, have been significant predictors of pro-environmental behaviors (Gatersleben et al., 2014). On the other hand, Connectedness to Nature measures how much an individual's self is related or connected to the natural world (Shultz et al. 2005; Mayer & Frantz, 2004). Unlike the NEP measure, Connectedness to Nature is a self-reported score through the use of a visual aid that features a series of seven different Venn-diagrams, all containing one circle representing "self" and the other "nature." Depending on how an individual perceives their personal relationship with nature, the respondent will circle the Venn-diagram with the appropriate level of overlap between "self" and "nature." Research has also found connectedness to nature to be a significant predictor of pro-environmental behaviors and environmental concerns as well (Davis et al., 2009).

2.5 BEHAVIOR AND POLICY SPILLOVER EFFECTS

A great deal of plastic bag policy research has focused on analyzing the after effects of implemented bag policies using the framework of behavioral and policy spillover effects.

Behavioral spillover effect describes the extent to which performing an environmentally behavior will lead to the performance of another pro-environmental behavior (Nilsson et al., 2016). There are two major types of behavioral spillover effects, positive and negative. A positive spillover effect occurs when performing one environmental behavior increases the chance of an individual performing the same or new pro-environmental behavior again over a period of time. A negative spillover effect occurs when performing a pro-environmental behavior reduces the chance of performing another pro-environmental behavior, often resulting in the previously described 'licensing effect.' (Nilsson et al., 2016). The literature has shown evidence of positive behavioral spillover effects for pro-environmental behaviors such as an increase in recycling habits and a reduction in overall resources, and the consumption of organic foods and increased recycling (Thomas et al., 2016); however, most of these behavioral spillover effects are based on correlational evidence rather than statistically significant relationships (Poortinga et al., 2013). To date, plastic bag policy research has not definitively concluded that plastic bag policies create behavioral spillovers (Poortinga et al., 2013, Thomas et al. 2016). Understanding the potential effects of behavioral spillover on environmental policies is important because often times governments want to know that the proposed policy will be a

valuable tool to solve an environmental concern, above and beyond the original intent of said policy (Thomas et al., 2016).

Despite the limited amount of statistically significant research regarding plastic bag policies and behavioral spillover to non-bag related behaviors, there is a substantial amount of research about spillover to bag-related behaviors. One study in particular looked at a community with a plastic bag policy to see if the use of reusable bags promoted more environmentally friendly shopping behaviors (Karmarkar & Bollinger, 2015). The researchers concluded that people who brought their own bags to shop were more likely to buy organic and indulgent foods. This finding is supported by literature about consumer choice and the licensing effect. It is found that when people engage in "good" behaviors, in this case using a reusable bag, this decreases the negative connotations that an individual might have when thinking of buying a "luxury" item, which is unhealthy foods in this study (Kahn & Dahr, 2006). In this case, the use of a reusable bag did not directly impact the physical environment, but instead both negatively and positively influenced the shopping behaviors of the consumer through private-sphere environmentalism.

A different study tried to understand consumer behavior as well as the motivations for certain bag use by (1) observing shoppers' plastic bag use before and after a charge for plastic bags was implemented in food stores and (2) asking consumers their reasoning for either agreeing or disagreeing with implemented plastic bag policy. In the end the researchers observed an increase in reusable bag use at the stores with the implemented policy than at the stores with no bag fee implementation. Additionally, support for the plastic bag fee was associated with intrinsic concerns,

mainly personal care for the environment; however, some people who opposed the plastic bag fee used reusable bags for financial reasons, mostly so they would save money (Jakovcevic et al., 2014). This plastic bag research suggests that an established and enforced plastic bag policy results in more reusable bag use, however, policy support and subsequent behaviors were contingent on an individual's inherent motivations and values.

Policy spillover is similar to behavioral spillover effects, except they explore the effects of an implemented policy causing support for different, but similar environmental policies. Thomas et al. (2019) examines policy spillover in their recent study assessing the effects of the plastic bag charge in the United Kingdom. They found that individuals who had greater support for a plastic bag fee were more likely to support a fee for purchasing plastic bottles and unnecessary packaging, illustrating that "support for the plastic bag charge predicted greater support for policies of similar scope and size." The authors note that there may be a limit to the effect of policy spillovers, meaning that the spillover is constrained to the original policy sphere in question, which in the study was single-use plastic and packaging. However, this acknowledgement does not suggest a downfall to the potential effects of policy spillover because this means many environmental policies regarding marine debris pollution have the potential of gaining public support. This study also notes that if or when behavioral spillover occurs, performance of behaviors is also restricted to context because conceptual connections are stronger among comparable behaviors and situations. Therefore, not only do environmental policies have the potential of

influencing more pro-environmental behaviors, but they also could be a catalyst for greater support of environmental policies at large.

2.6 RESEARCH QUESTION

This research analyzes the effects of implemented plastic bag bans in Rhode Island, using two coastal communities, one with a plastic bag ban and the other without, as a case study. The current bans on single-use plastic bags in Rhode Island were suggested and implemented to reduce the amount of litter in the environment, with the hopes that the policy would also raise community awareness and shed light to the greater issue of marine debris. This research is comprised of two main objectives (1) identify whether implemented plastic bag bans influence community members to participate in additional pro-environmental behaviors within private and/or public-sphere environmentalism; and (2) understand individual's general awareness of the plastic bag policy established in their community of residence.

2.7 STUDY CONTEXT

This section provides background information on marine debris pollution and current plastic bag policies specific to Rhode Island. Citizen science data collected during marine debris cleanups illustrates the effects of municipal level plastic bag policies on the natural environment.

As of January 1, 2019, the state of Rhode Island comprises 10 municipal ordinances that feature first generation plastic bag bans, meaning all retail stores no longer have plastic bags available at the site of purchase and are required to carry paper bags as a free alternative. These ordinances were designed to encourage reusable bag use, not a sudden prioritization to paper bags. At this point in time, all of the

plastic bag bans in the state are uniform and are implemented in the following communities (listed in order of implementation date): Barrington, Newport, Middletown, New Shoreham, Jamestown, Portsmouth, Warren, Bristol, South Kingston, North Kingston (Bag Laws, 2019).

Empirical data on the success of these policies has been collected primarily by a single nonprofit organization on Aquidneck Island. Clean Ocean Access is a nonprofit organization situated in Middletown, Rhode Island that focuses on addressing ocean health issues on and around Aquidneck Island. Clean Ocean Access is a community-driven organization whose environmental efforts are completed working with community members and the three municipalities on Aquidneck Island through citizen science and advocacy work. Citizen science programs such as shoreline cleanups have increased overall awareness of the marine debris issue both at the local, national and international level, however "while identifying the types and amount of debris that are frequently found on beaches is an important first step, understanding the impacts of those consumer items is critical if effective voluntary or regulatory measures are to be implemented to limit their impacts" (Wilcox et al. 2016). Clean Ocean Access has recorded the types of items found at all shoreline cleanups since 2013, documenting the impact of the cleanup and then using this data to influence environmental advocacy efforts.

More specifically, the organization used the citizen science data signifying the number of plastic bags removed from various stretches of coastline around Aquidneck Island to illustrate why a single-use plastic bag ban is necessary for protecting the environment and would be effective in reducing one type of single-use plastic

commonly found on and around beaches. As of 2018, Clean Ocean Access removed 20,266 single-use plastic bags from marine debris cleanups.

At the end of 2018, Clean Ocean Access had an entire year's worth of data to illustrate the impact of the ban on single-use bags had on local environment. In the two years leading up to the plastic bag ban, volunteers helped to remove 4,112 plastic bags in 2016 and 4,687 plastic bags in 2017, the largest number of bags recorded in one year to date. In 2018, 3,698 plastic bags were found at marine debris cleanups, 989 fewer plastic bags than the previous year.

Since the scope of the plastic bag policy research focuses on specifically two communities within Rhode Island, Middletown and Warwick, it is necessary to see how the implemented plastic bag ban impacted the coastline of Middletown, the community with the passed plastic bag ordinance. Similar trends were found to that of all cleanups where 1,284 plastic bags were removed in 2016, 1,815 removed in 2017, and 1,311 in 2018, 504 bags less than the previous year. Overall, the data reflects that the ban on single-use plastic bags is effective in reducing the number of plastic bags found on around the Aquidneck Island coastline, in addition to shoreline locations specific to Middletown.

CHAPTER 3

METHODOLOGY

In order to capture the effects of plastic bag bans on pro-environmental behaviors and knowledge about plastic bag policies, face-to-face surveys were conducted in two Rhode Island coastal communities, one with an implemented plastic bag ban and one without a plastic bag ban, as a case study. The Town of Middletown was chosen as the community with an implemented plastic bag ban, where a plastic bag ban went into effect on December 1, 2017. The City of Warwick was chosen as the community without an implemented plastic bag ban (Figure 1). As of June 2018, Warwick was one of the few coastal communities in Rhode Island that had not discussed the possibility of a plastic bag ban at the municipal level, so it was chosen as the control. According to Gerring (2004), case study research "is an intensive study of a single unit for the purpose of understanding a larger class of (similar) units," where a unit is identified as a person, state, community etc. and is "observed at a single point in time or over some delimited period of time." Therefore, this study looks into the effects of a plastic bag ban only post-implementation to understand how the policy is affecting people living within or outside one community with a plastic bag ban in Rhode Island, with the intention of analyzing the broader implications of the findings from this study at the state-level.

In order to understand how implemented plastic bag bans influenced the average person in each community, purposive sampling was used to select neighborhoods in each community. First, neighborhoods that were comprised of

similar median household incomes in each community were identified using census tract data, and second, neighborhoods within these identified areas were selected to make sure each survey sample was comparable. According to the 2013-2017 American Community 5-Year Estimates, the median household income in Middletown is $65,799 and is $71,191 in Warwick (DADS, 2017). Neighborhoods were chosen using an interactive map of the 2017 American Community 5-Year Estimates that mapped census tracts and census blocks within Newport County (Middletown) and Kent County (Warwick) according to median household income (DADS, 2017).

A series of five neighborhoods were chosen within each community and identified with a number. On the day of survey collection, numbers were pulled out of hat to ensure a random order. Face-to-face surveys were conducted by a single surveyor in both communities, ensuring reliability of the samples. The surveyor visited every house in a neighborhood and asked a year-round resident over the age of 18 to participate in the survey; these were determined by demographic questions that addressed age and residency. If the individual said ‘yes’, they participated in an anonymous verbal survey. If the individual said ‘no’, this counted as a ‘no response.’ If the door was unanswered, the surveyor returned to the unanswered house once more before identifying the no answer as a ‘no response’. To minimize the number of ‘no answers’, surveys were administered during weekday evenings and weekend days from August to September 2018. Surveys were administered using a quota sampling technique because surveying ended once 50 individuals in each community were sampled, reaching a total sample size of 100 (Robson, 2011).

The survey was comprised of six sections, the first section asking basic demographic questions such as age, gender, highest level of education, annual level of household income, town of residence and if the home was their primary address. Highest level of education was measured on a 5-point scale, where 1 = less than high school, 2 = high school, 3 = associate or junior college degree, 4 = bachelor's degree and 5 = professional or graduate degree. Age, gender, town of residence and household income were open-ended questions that required a hand-written answer by the participant, ensuring reliability of the sample (Table 2).

The next section measured an individual's Connectedness to Nature using a diagram from Davis et al. (2009) that uses a series of Venn-diagrams to describe how a person depicts their relationship with the environment. Connectedness to Nature was measured on a 7-point scale where 1 = no personal connection to the environment and 7 = a deep personal connection with the environment. The participant circled one of the seven diagrams. This diagram controlled for the possibility of proximity to the coastline influencing answers to pro-environmental behaviors questions because people who live near the coastline may have a higher personal connection to nature, which could impact behavioral intentions (Table 2).

The third section measured an individual's environmental worldview using the New Ecological Paradigm (NEP) Scale presented by Whitfield et al. (2009). Whitfield et al. (2009) used a series of seven questions that were answered using a 7-point Likert scale. This survey used the same seven questions, but respondents answered on a scale of agree, disagree or undecided. The NEP scale measures both pro- and anti-environmental worldviews, where positive environmental worldviews are the

agreeable answers for questions 1 through 4 and are the disagreeable answers for questions 5 through 7. The answers to questions 5 through 7 were reverse coded for each participant. After reverse coding, the answers to each of these seven questions were added together to create a NEP index that ranged from 1 to 7, which was used for data analysis (Table 1).

The fourth survey section gaged an individual's participation in environmental behaviors, also known as private-sphere environmentalism, by asking if they purchase bottled water, use a reusable water bottle, bring reusable bags to the grocery store, and recycle at home. These four questions were measured on a 4-point scale, where 1 = never, 2 = occasionally, 3 = frequently, and 4 = always (Table 2). The variables purchasing bottled water and using a reusable water bottle were chosen because like plastic bags, plastic bottles directly contribute to marine debris pollution, and using a reusable water bottle is a behavior that is similar in scope and size to using a reusable bag.

The fifth section looked at an individual's affiliation with environmental organizations, a form of public-sphere environmentalism, by asking how often they volunteer for an environmental organization, and if they donate and/or have a membership to an environmental organization. Frequency of volunteering was measured on a 4-point scale where 1 = never, 2 = once a year, 3 = once a month and 4 = weekly, however for data analysis this variable was recoded into 1 = has volunteered and 0 = has not volunteered. Donation and memberships to environmental organizations were measured on a 2-point scale, where 1 = yes and 0 = no (Table 3).

The sixth survey section measured knowledge of plastic bag policies through a series of seven questions. To control for potential biases, individuals were asked how often they shop for groceries in their town of residence on a 4-point scale where 1 = never, 2 = occasionally, 3 = frequently and 4 = always. If an individual was not shopping always shopping in their town of residence, they were asked what other towns they shopped for groceries in. Then, they were asked if their town of residence had a plastic bag ban, if there was an existing statewide plastic bag ban, and if plastic bag were available at the checkout counters at the grocery stores. Participants were given the options of yes, no or unsure. Participants were asked if there were fees on any bags at the grocery store, this variable was measured on a 4-point scale where 1 = no, 2 = paper bags only, 3 = plastic bags only and 4 = paper and plastic bags. The last question asked whether the individual supported a statewide plastic bag ban on a 4-point scale where 1 = not at all, 2 = somewhat, 3 = mostly and 4 = definitely (Table 4).

In order to interpret the results, independent sample T-tests, chi-square goodness of fit tests and multiple linear regression were used for data analysis using IBM SPSS V.25.

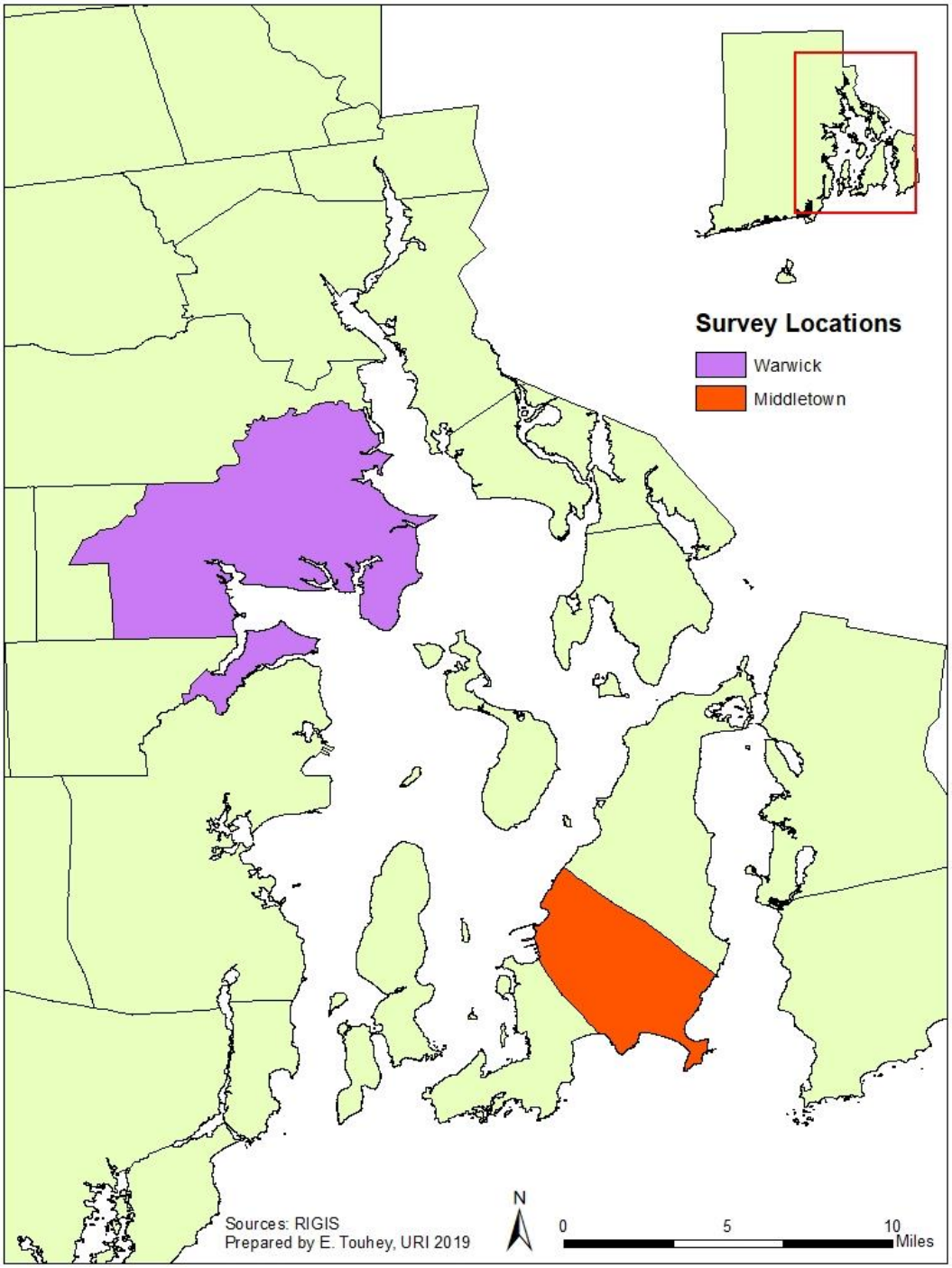

Figure 1. Map of survey locations: Middletown (plastic bag ban) and Warwick (no plastic bag ban).

Table 1. New Ecological Paradigm Scale showing frequency to responses in Middletown (N = 50) and Warwick (N = 50). These are responses before reverse coding questions 5 through 7.

	Middletown			Warwick		
	Agree	**Disagree**	**Undecided**	**Agree**	**Disagree**	**Undecided**
1. If things continue on their present course, we will soon experience a major ecological catastrophe.	38	7	5	43	3	4
2. The balance of nature if very delicate and easily upset.	38	9	3	46	1	3
3. The earth is like a spaceship with very limited room and resources.	34	11	5	37	5	8
4. Humans are severely abusing the environment.	40	9	1	46	1	3
5. The balance of nature is strong enough to cope with the impacts of industrial nations.	12	30	8	9	35	6
6. The so-called ecological crisis facing humankind has been greatly exaggerated.	7	39	4	6	41	3
7. Human ingenuity will ensure that we do not make the earth unlivable.	28	12	10	14	28	8

CHAPTER 4

FINDINGS

4.1 POPULATION DEMOGRAPHICS

The survey included 100 participants, sampling 50 adults in both Warwick and Middletown, Rhode Island. The total sample included 47 males and 53 females, who ranged in age from 20 to 86 years old. Other descriptive variables describing the demographics of the total survey population (N = 100) are listed in Table 2. There are minor differences between the two-survey populations. The mean age was higher for Middletown participants than Warwick participants, amounting to 59 and 50 years old, respectively. After running an independent sample T-test, there was a statistically significant difference in the mean education levels between the towns, with Middletown participants having a significantly higher ($p = 0.006$, $t = 2.816$) mean level of education (M= 3.54) than that of Warwick participants (M=2.94) (Table 2).

The annual income for Middletown respondents was higher than Warwick respondents, averaging $76,577and $60,069, respectively (Table 2). According to the 2013-2017 American Community 5-Year Estimates, the median household income in Middletown is $65,799 and is $71,191 in Warwick (Census 2017). The discrepancy between annual income levels from the survey sample and the census tract data may be attributed to missing survey data. Of the completed surveys, 23 Middletown respondents and 21 Warwick respondents failed to provide their annual income level. For this reason, annual income was not used as a predictive variable for data analysis.

Table 2. Description of demographic and pro-environmental behavior variables for the general survey group (n=100), Middletown respondents (n=50) and Warwick respondents (n=50); reporting the mean and standard deviation. Bolded values indicate statistical significance between town of residence (T-test $p < 0.05$).

		Total Sample		**Middletown**		**Warwick**	
Variable	**Description**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Gender	Dummy Variable (Male =1 and Female = 0)	0.47	0.50	0.46	0.50	0.48	0.51
Age	Age of the participant	54.61	17.89	58.86	18.50	50.28	16.31
Education Level	Highest level of education of the participant	3.24	1.10	**3.54**	1.15	**2.94**	0.98
Annual Income	Annual income of the participant	$67,873	$36,757	$76,577	$36,275	$60,069	$36,020
Connectedness to Nature	A 7-point scale measuring personal connection to the environment, where 1 = no connection and 7 = total connection with nature.	4.84	1.78	4.56	1.78	5.12	1.76
Environmental Worldview (NEP)	A sum of responses to seven statements where 7 represents the strongest environmental worldview.	5.07	1.88	4.62	1.98	5.52	1.68
Purchasing Bottled Water	A 4-point scale measuring the behavior of purchasing bottled water, where 1 = never and 4 = always.	2.30	1.07	2.18	1.10	2.42	1.03
Reusable Water Bottle	A 4-point scale measuring the behavior of using a reusable water bottle, where 1 = never and 4 = always.	2.54	1.22	2.42	1.28	2.66	1.15
Reusable Bags	A 4-point scale measuring the behavior of bringing reusable bags to the grocery store, where 1 = never and 4 = always.	2.94	1.20	**3.18**	1.08	**2.70**	1.27
Longevity of Reusable Bag Use	The number of years a participant has used reusable bags	4.91	55.54	4.24	5.92	5.58	8.73
Recycle	A 4-point scale measuring the behavior of daily household recycling, where 1 = never and 4 = always.	3.98	0.20	3.98	0.20	3.98	0.20

The measure *Connectedness to Nature* was comparable between the two communities, where the mean response on the 7-point scale for Middletown and Warwick respondents was 4.56 and 5.12, respectively (Table 2). An individual's

environmental worldview was measured using the New Ecological Paradigm (NEP) scale, a series of seven questions that were answered on scale of agree, disagree or undecided. NEP score was calculated by determining the number of statements that each individual responded to with an agreeable answer; agreeable answers varied depending on the format of each question, which resulted in reverse coding the answers to questions 5 through 7 (Table 1). A new variable, total NEP score, was created through the summation of the agreeable answers for each participant, resulting with Warwick respondents having a higher mean total NEP score (M = 5.52) than Middletown respondents (M = 4.62) (Table 2).

4.2 ENVIRONMENTAL ORGANIZATION AFFILIATION

Individuals were asked about their affiliations with environmental organizations regarding volunteering, donating and membership. Volunteering behaviors were similar between the sample populations, where 10 of 50 Middletown participants and 14 of 50 Warwick participants said they volunteer for environmental organizations (Table 3). 18 of 50 Middletown participants and 17 of 50 Warwick participants said that they have donated to an environmental organization in the past 12 months. Lastly, 10 of 50 Middletown participants and 5 of 50 Warwick participants said they have a membership to an environmental organization (Table 3). Memberships to environmental organizations included nonprofits that ranged from the local and state levels, to nationally recognized: Clean Water Action, Arbor Day Foundation, Clean Ocean Access, World Wildlife Fund, Save The Bay, Sierra Club, Nature Conservancy, Climate Action and Surfrider Foundation. Data analysis did not

find any of these variables to have statistically significantly differences in their means and were not significant predictors in regression analysis.

Table 3. Description of environmental organization affiliation variables for the general survey group (n=100), Middletown respondents (n=50) and Warwick respondents (n=50); reporting frequencies.

		Total Sample		Middletown		Warwick	
Variable	**Description**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Volunteering	If the participant has volunteered for an environmental organization in the past.	24	76	10	40	14	36
Donation	If the participant has donated to an environmental organization in the past 12 months.	35	65	18	32	17	33
Membership	If the participant has a membership to an environmental organization in the past 12 months.	15	85	10	40	5	45

4.3 KNOWLEDGE OF PLASTIC BAG POLICY

Individuals in each community were asked about their knowledge of plastic bag policies in their town of residence and at the state-level. To reduce the amount of incorrect knowledge about plastic bag policies within each community, respondents were asked how frequently they grocery shop within their town of residence, therefore accounting for any towns or stores they were shopping in that may or may not have complied with the bag policy established in their town of residence. Respondents in both communities reported a high degree of loyalty to shopping within their respective towns, with an average response of 3.62 in Middletown and 3.60 in Warwick (Table 4).

Second, when asked about current plastic bag policies within their community, 48 of 50 Middletown participants correctly responded that there was an implemented plastic bag ban in Middletown, while 46 of 50 Warwick participants correctly answered that there was not an implemented plastic bag ban in Warwick (Table 4).

Third, when asked about whether plastic bags are available at the checkout counters at grocery stores within each community, 39 of 50 Middletown participants correctly responded that plastic bags are not available at the checkout counter, while 49 of 50 Warwick participants correctly answered that there are plastic bags available at the checkout counter (Table 4). Fourth, when asked about whether there were fees for bags (paper or plastic) at the grocery stores in each community, 35 of 50 Middletown participants and 42 of 50 Warwick participants correctly answered that there are no fees for any bags at the grocery store in their respective communities (Table 4). Fifth, when individuals were asked if there was an existing statewide plastic bag ban in Rhode Island, 29 of 50 Middletown participants and 46 of 50 Warwick participants correctly responded that there was not an existing statewide ban in Rhode Island (Table 4).

Table 4. Description of plastic bag knowledge variables for Middletown respondents (n=50) and Warwick respondents (n=50); reporting frequencies, mean and standard deviation. Bolded values indicate statistical significance between town of residence (T-test $p < 0.05$).

Variable	**Description**	**Middletown**			**Warwick**		
		Yes	**No**	**Unsure**	**Yes**	**No**	**Unsure**
Town Plastic Bag Ban	Knowledge if there is a plastic bag ban in towns of residence.	48	2	0	1	46	3
Plastic Bag Availability	Knowledge if there are plastic bags available at the checkout counters in grocery stores.	8	39	3	49	1	0
Existing Statewide Ban	Knowledge if there is a current statewide plastic bag ban in RI.	11	29	10	0	46	4
		Mean		**SD**	**Mean**		**SD**
Shopping for Groceries	A 4-point scale measuring the frequency of shopping for groceries in town of residence, where 1 = never and 4 = always.	3.62		0.67	3.60		0.57
Fees for bags at the grocery store	A 4-point scale measuring whether there are fees for bags at grocery stores, where 1 = no fee, 2 = paper bags only, 3 = plastic bags only and 4 = paper and plastic bags)	1.22		0.58	1.14		0.50
Support for a Statewide Plastic Bag Ban	A 4-point scale measuring the support for a statewide plastic bag ban, where 1 = not at all and 4 = definitely.	**3.66**		0.77	**3.28**		1.01

4.4 PRO-ENVIRONMENTAL BEHAVIORS

A series of multiple linear regression models were created to understand how several factors, including town of residence, related to the performance of pro-environmental behaviors and environmental policy support, while controlling for other predictive variables. Individuals were asked about their participation in the following pro-environmental behaviors: purchasing bottled water, using a reusable water bottle, bringing reusable bags to the grocery store, household recycling, and the duration of reusable bag use. For all regression analyses the model runs for dependent variables consisted of six predictors: gender dummy, town dummy, age, education level, Connectedness to Nature and total NEP (Table 5). For gender and town, dummy variables were created; males and the town of Middletown were used as the reference variable.

On average, responses to purchasing bottled water were in the middle of the 4-point scale, with a mean response of 2.18 for Middletown participants and 2.42 for Warwick participants (Table 2). Further data analysis did not find bottled water purchases to be predicted by any of the six predictor variables.

There was a difference between the mean frequencies of reusable water bottle use in Middletown ($M = 2.42$) and Warwick participants ($M = 2.66$) (Table 2). When classified as an independent variable in a regression model, gender, age and total NEP score were statistically significant predictors for reusable water bottle use. Gender and age both showed a significant negative relationship for reusable water bottle use. Male participants reported using reusable water bottles less frequently than female participants ($p = 0.041$, $\beta = -0.205$), while reusable water bottle use decreases as age

increases ($p = 0.006$, $\beta = -0.282$). Lastly, there was a significant positive relationship between total NEP score and reusable water bottle use ($p = 0.021$, $\beta = 0.235$), indicating that higher NEP totals result in greater reusable water bottle use. This model run had an R Square value of 0.181 and age is noted as more effective predictor for reusable water bottle use than gender. Town of residence, education level and Connectedness to Nature were not statistically significant predictors for reusable water bottle use (Table 5).

Furthermore, there was variation in the mean frequencies of bringing reusable bags to the grocery store for Middletown ($M = 3.18$) and Warwick respondents ($M = 2.70$) (Table 2). An independent-sample T-test concluded that there was a statistically significant difference between these means ($p = 0.044$, $t = 2.038$), suggesting that reusable bag use is significantly higher in Middletown than Warwick. In addition, the multiple regression model for reusable bag use revealed town of residence, total NEP score and age as statistically significant predictors for the behavior, all of which exhibited significant positive relationships within the model. As a predictor, town of residence ($p = 0.035$, $\beta = 0.227$) explains that Middletown participants bring reusable bags to the grocery more frequently than Warwick participants. Similarly, higher total NEP scores ($p = 0.008$, $\beta = 0.272$) result with bringing reusable bags to the grocery store more frequently. Age produces an almost significant result ($p = 0.056$, $\beta = 0.198$), suggesting that an increase in age also results in more frequent reusable bag use. The R squared value for this regression model was 0.183. Gender, education level and Connectedness to Nature were not statistically significant predictors for bringing reusable bags to the grocery store (Table 5).

A new variable was computed to determine how many participants started using reusable bags at the grocery within the past year in each community. A chi-square goodness of fit test suggests that there was a statistically significant association between residence and starting to use reusable bags within the past year ($p = 0.002$, $x^2 = 9.756$), indicating that Middletown respondents began to use reusable bags in the past year significantly more than Warwick respondents.

In addition, the responses for participating in household recycling in Middletown and Warwick was rated highly on the 4-point scale, averaging a response of 3.98 in both communities (Table 2). Participants were asked about the duration of their reusable bag use at grocery stores; where on average Middletown respondents have used reusable bags for an average of 4 years, Warwick respondents have used reusable shopping bags for an average of 5.5 years (Table 2). Neither of these variables showed any statistical significance in data analysis.

4.5 SUPPORT FOR STATEWIDE POLICY

Individuals were asked about their support for a statewide plastic bag ban in Rhode Island, resulting with a mean response that equated to a high degree of support for both Middletown ($M = 3.66$) and Warwick ($M = 3.28$) participants. An independent sample T-test concluded that there was a statistically significant difference in the means between town of residence and support for a statewide plastic bag ban ($p = 0.037$), suggesting that Middletown participant's support for a statewide plastic bag ban was significantly higher than Warwick participants. In addition, when classified as the dependent variable in the multiple linear regression model, town of residence and total NEP score were significant positive predictors for support for a

statewide plastic bag ban. Middletown participants were more likely to support a statewide plastic bag ban than Warwick participants ($p = 0.008$, $\beta = 0.279$), while individuals that scored higher total NEP scores had greater support for a statewide plastic bag ban ($p = 0.000$, $\beta = 0.361$). The R Square for this regression model was 0.212. Total NEP score had a higher standardized coefficient (0.361) than town residence (0.279), suggesting that total NEP score is a somewhat more effective predictor for support for a statewide ban. Education level, connectedness to nature, gender and age were not significant predictors for support of a statewide plastic bag ban (Table 5).

Table 5. Multiple Linear Regression Results. Bolded values indicate statistical significance between town of residence ($p < 0.05$).

	Reusable Water Bottle		*Reusable Bags*		*Support for a Statewide Ban*	
Variable	**Standardized Coefficient**	**P-Value**	**Standardized Coefficient**	**P-Value**	**Standardized Coefficient**	**P-Value**
Gender Dummy	-0.205	**0.041**	0.006	0.951	-0.036	0.711
Town Dummy	0.017	0.872	0.227	**0.035**	0.279	**0.008**
Age	-0.282	**0.006**	0.198	**0.056**	0.063	0.524
Education Level	0.084	0.396	0.021	0.831	0.072	0.463
Connectedness to Nature	0.089	0.376	0.065	0.523	0.126	0.204
Total NEP	0.235	**0.021**	0.272	**0.008**	0.361	**0.000**
R Square	0.181		0.164		0.212	

CHAPTER 5

DISCUSSION

This research had two main objectives (1) identify whether implemented plastic bag bans influence community members to participate in additional pro-environmental behaviors within private and/or public-sphere environmentalism; and (2) understand individual's general awareness of the plastic bag policy established in their community of residence.

Middletown respondents had a significantly higher level of education than Warwick participants; however, since education level was not a significant predictor in the behavioral analysis, this difference is inconsequential. All other data involving personal characteristics such as age, gender, Connectedness to Nature and total NEP score were uniform between the two communities. The analysis of environmental organization affiliation showed that the majority of participants in both communities are not active volunteers and do not donate or have a membership to environmental organizations. Therefore, this specific study does not support that living in a community with a plastic bag ban encourages community members to become outwardly involved or more financially supportive of environmental organizations, both of which fall within the public-sphere environmentalism.

Regarding participant's knowledge of plastic bag policies in their town of residence, there were no significant differences between the two samples, suggesting that participants in each community were 'correct' about the respective plastic bag policy in their community of residence. More specifically, Middletown participants

acknowledged that there was an implemented plastic bag ban in the town of Middletown, plastic bags are not available at the checkout counter in grocery stores, there is no fee for plastic bags in grocery stores, and there is currently not a statewide plastic bag ban in Rhode Island. However, despite being correct, only 29 out of the 50 respondents in the Middletown sample answered the question about an existing statewide plastic bag policy correctly, suggesting that many people living in the community with the plastic bag ban were unsure whether this was due to a local or a statewide policy. Comparatively, 42 of 50 Warwick respondents answered this question correctly. Warwick respondents also correctly answered that there is not an implemented citywide ban, plastic bags are still available in the grocery stores and there is not a fee for any bags currently in grocery stores. Therefore, the majority of respondents in both communities are knowledgeable about the presence or absence of a plastic bag policy in their community.

When analyzing whether the plastic bag ban influenced individual pro-environmental behaviors, recycling and purchasing bottled water did not yield any significant results. It was found that age, gender and total NEP score were all significant predictors for reusable bottle use. This suggests that overall, females use reusable bottles more frequently then male participants; reusable water bottles are used more frequently with younger participants; and individuals that scored a higher NEP score are more likely to use a reusable water bottle. Although these results are not significant between the two communities, they do point out overall trends within the sample population. Literature on environmentalism reveals that historically, females report greater participation in environmental behaviors than males (Zelezny et al.,

2000). Also, as mentioned in the literature review, there is evidence for high NEP scores leading to the practice of environmentally friendly behaviors (Gatersleben et al., 2014). In addition, there is extensive research regarding the use of age as a predictor for environmental behaviors. Research has shown discrepancies between age and environmental attitudes and pro-environmental behaviors; however, these differences can be attributed to the various dimensions of environmentalism. Overall, studies have supported that younger individuals participate in more pro-environmental behaviors and have a greater concern for the environment than older individuals (Wiernik et al., 2013).

Furthermore, the results show that reusable bag use is significantly higher among Middletown respondents than Warwick respondents, suggesting that the implemented plastic bag ban in Middletown most likely caused residents to start bringing reusable bags to the grocery store. This conclusion is further supported by the significant result that Middletown participants began using reusable bags significantly more within the past year compared to Warwick respondents. Surveying for this study was performed almost an entire calendar year after the ban on single-use plastic bags went into effect in Middletown (implementation date December 1, 2017), suggesting that the plastic bag ordinance likely caused this behavioral change through the encouragement of using reusable bags. In addition, it is important to note that this plastic bag policy provides Middletown residents with a free choice of paper bags and the option of purchasing or bringing their own reusable bags. Therefore, even with a choice of using the free alternative, there was still an increase in reusable bag use overall, further justifying this significant finding.

In addition, reusable bag use hinted to trends among the entire sample because total NEP score and age were also significant predictors of this behavior. Similar to reusable water bottle use, a higher total NEP score resulted with more frequent reusable bag use. Also, older participants reported more frequent reusable bag use; however, this result was not quite significant at $p < 0.05$. The finding that older people use reusable bags more frequently is consistent with other studies exploring the effects of plastic bag policies on demographics (Thomas et al., 2019), therefore supporting this almost significant result.

Lastly, it was found that town of residence and total NEP score were significant predictors of support for a statewide plastic bag ban. The results show that Middletown respondents were more supportive of a statewide plastic bag ban than Warwick participants, and, similar to reusable water bottle and reusable bag use, participants with a higher NEP score showed greater support for a statewide plastic bag ban. This study suggests that NEP is a predictor for both private-sphere and public-sphere environmentalism, however, within the public-sphere it was only a predictor for supporting policies, not involvement in environmental organizations. NEP is an important control in this study because since there was not a significant difference between total NEP scores among the two communities, this means respondents in both communities have equivalent environmental worldviews, showing that the implemented plastic bag ban is the likely cause for the changes in reusable bag use and support for a broader plastic bag policy in the state, not the respondents view on environmental issues. In addition, the significance of town of residence and support for a statewide ban suggests that people are more likely to support a scalable

environmental policy once they have experienced the policy firsthand. Because policy spillover refers to supporting different but similar environmental policies, the support for a broader plastic bag policy in Rhode Island does not support this framework in particular since the support is for the same environmental policy; however, previous studies have found that support for plastic bag charge increased after a month of its implementation, which helps to support this result (Poortinga et al., 2013; Thomas et al., 2019).

There were a few methodological weaknesses in this study that need to be acknowledged. First, annual income could not be used as a predictor for multiple linear regression analysis because almost half of the total sample population failed to provide a value for income, resulting with an inaccurate mean representation of income levels. To address this in future studies, providing a scale or range of income levels that the participant can circle instead of voluntarily write in will make the participant more inclined to answer the question. In addition, there needs to be a better record of survey participation results documenting the number of houses approached, number of refusals and number of no answers. This information was not recorded while administering surveys for this project.

This research reveals the need for further research on plastic bag reduction policies. Even though the results of this research did not find that an implemented plastic bag ban has behavioral spillover, this does not mean that behavioral spillover did not occur within Middletown. The survey that was administered provided a very select group of behaviors to analyze, so perhaps expanding the list of private-sphere environmentalism behaviors will include a better representation of the behaviors being

performed in the community and the results would therefore be more applicable to the behavioral spillover framework. In addition, it would be interesting to see if there is policy spillover to support other environmental policies such as a bottle tax or a ban on the release of balloons, two environmental policies that are popular topics of conversation among Rhode Island residents. Furthermore, asking an individual's political affiliation as a survey question could provide insight into what people within each community are more supportive for a broader plastic bag policy, as well as, general support for other environmental policies. Lastly, it would have been interesting to gather a sense of an individual's fundamental understanding of environmental policy, such as defining the main goal of environmental policy at large and what purpose the plastic bag policy serves in their community.

Likewise, there are opportunities to improve the methodology of this research, first by reaching a larger sample. Data collection within this study was restricted to about two months, so with a longer survey period, the researcher could obtain a much larger sample. A more robust data set could result with more statistically significant results as well. Second, a longitudinal study could be performed, capturing pre- and post-implemented bag ban. This type of methodology could measure the differences in support of the policy and more clearly delineate behavioral and policy spillover effects. Lastly, this study only measured one community with an implemented plastic bag ban in Rhode Island; moving forward more than one community with an implemented plastic bag ban could be surveyed to identify whether the trends found in Middletown are consistent across other communities with plastic bag bans in the state.

CHAPTER 6

CONCLUSION

This study investigated the effects of a first-generation plastic bag ban on behavioral spillover of additional pro-environmental behaviors in both the private and public-spheres of environmentalism. It also assessed community member's knowledge of plastic bag policies within their community of residence. Face-to-face surveys were completed within two communities in Rhode Island: Middletown, a town with an implemented plastic bag ban, and Warwick, a community without a plastic bag ban.

The major results of the study found that NEP, an indicator for environmental worldview, was a significant predictor for using reusable bags and reusable water bottles, and for supporting a statewide plastic bag policy in Rhode Island. Age was also a significant predictor of reusable bag and reusable water bottle use; however, age range was inversely related to these two these behaviors. Additionally, gender was a predictor for reusable water bottle use. Lastly, the most noteworthy finding illustrated that town of residence was a significant predictor for reusable bag use and support for a statewide plastic bag ban in Rhode Island, suggesting that people who lived in a community with an implemented plastic bag ban had greater support of a plastic bag policy at the state level and used reusable bags more frequently.

This study provides a preliminary look into the possible effects of plastic bag policies on environmental behaviors and environmental policy in the state of Rhode Island. The results of this study could suggest broader support of environmental policies in the state; however, a study encompassing more than one community with an implemented plastic bag policy needs to be completed in order to be more

conclusive about this recommendation. In addition, even though this study did not show behavioral spillover, this does not indicate that the plastic policy did not influence other environmental behaviors that were not included in this study.

For policymakers, the findings in this study suggest that implemented plastic bag bans in Rhode Island lead to greater use of reusable bags, even when the consumer has the choice of using a free paper bag at the point of purchase. In addition, this study illustrates that to some degree, the establishment of local environmental policies can create the opportunity for support of similar statewide policies. Therefore, studying the effects of environmental policies is important to assess current policy and the implementation of future policies at the local and state-level. Single-use plastics, like the plastic bag, are littering the environment and causing harm to all living organisms, while their complete effect on ecosystems is still unknown. Nevertheless, research focusing on marine debris solutions provides important insight about the global issue and how to improve remediation plans moving into the future.

APPENDIX A: SURVEY

Demographic Questions

What is your age?	

What is your gender?	

What is the highest level of education you have completed? (*please check a box below*)	
	Less than High School
	High School
	Associate's or Junior College
	Bachelor's degree
	Graduate or Professional degree

What is your annual level of income?	

What town do you live in?	

Is this your primary address?	

Connectedness to Nature

Please circle the picture below that best describes your relationship with the environment (nature) (self = you; nature = the environment):

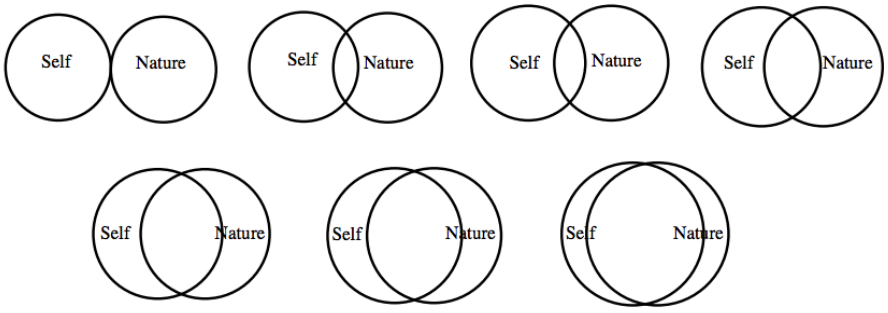

Fig. 1. Inclusion of Nature in the Self.

New Ecological Paradigm Scale

Scale: Agree, disagree or undecided

1. If things continue on their present course, we will soon experience a major ecological catastrophe
2. The balance of nature is very delicate and easily upset
3. The earth is like a spaceship with very limited room and resources
4. Humans are severely abusing the environment
5. The balance of nature is strong enough to cope with the impacts of modern industrial nations
6. The so-called ecological crisis facing humankind has been greatly exaggerated
7. Human ingenuity will ensure that we do NOT make the earth unlivable

Individual Behaviors

- Do you use purchase bottled water?
    - Never, Occasionally, Frequently, Always
- Do you use a reusable water bottle?
    - Never, Occasionally, Frequently, Always
- Do you bring reusable bags to the grocery store?
    - Never, Occasionally, Frequently, Always
    - If O/F/A, when did you start using reusable bags? _____
- Do you recycle at home?
    - Never, Occasionally, Frequently, Always

Participation in Environmental Organizations

- How often do you volunteer for environmental organizations?
    - Never, Once a year, Once a month, Weekly
- Have you donated to an environmental cause in the past 12 months?
    - Yes/No
- How aware are you of the following groups?

World Wildlife Fund	Not at all, Somewhat, Familiar, Very Aware
Nature Conservancy	Not at all, Somewhat, Familiar, Very Aware
Sierra Club	Not at all, Somewhat, Familiar, Very Aware
Ocean Conservancy	Not at all, Somewhat, Familiar, Very Aware
Save the Bay	Not at all, Somewhat, Familiar, Very Aware

Surfrider Foundation	Not at all, Somewhat, Familiar, Very Aware
Clean Ocean Access	Not at all, Somewhat, Familiar, Very Aware

- Do you have a membership to any environmental organizations?
    - Yes/No, if yes, what are they _____

Awareness of Plastic Bag Ban

- When you shop for groceries, how often do you shop in (Middletown) or (Warwick)?
    - Never, Occasionally, Frequently, Always
- When you are not shopping in (Middletown) or (Warwick), what town are you shopping for groceries?
    - _____
- Does your community have a plastic bag ban?
    - Yes/No
- To your knowledge is there a statewide plastic bag ban in Rhode Island?
    - Yes/No
- Are plastic bags available in your grocery store at the checkout counter?
    - Yes/No
- Are there fees for the following types of bags in the grocery store in (Middletown) or (Warwick)?
    - No
    - Yes, for paper bags
    - Yes, for plastic bags
    - Yes, for both
- To what degree do you support a statewide plastic bag ban?
    - Not at all, Somewhat, Mostly, Definitely

Final Questions?

- Is there anything else you would like to share after answering these survey questions?
- Do you have any questions about the current state of plastic bag bans in Rhode Island?
- Provide them with a fact sheet if they would like more information

APPENDIX B: TOWN OF MIDDLETOWN PLASTIC BAG ORDINANCE

CHAPTER 92B: PLASTIC BAG REGULATIONS

Section

§ 92B.01 LEGISLATIVE FINDINGS AND INTENT.

(A) The Town Council has the authority under Article 13 of the Rhode Island Constitution and the Middletown Town Charter to regulate issues of solid waste, litter and pollution as a local concern.

(B) The production, use and disposal of plastic checkout bags, which are commonly not recycled, has been shown to have significant detrimental impacts on the environment, including but not limited to contributing to pollution of the terrestrial and coastal environment, clogging storm water drainage systems, and contributing to the injury and death of terrestrial and marine life through ingestion and entanglement.

(C) The manufacture, transport and recycling of plastic checkout bags requires substantial energy consumption and contributes to greenhouse gases.

(D) Plastic checkout bags create a burden to solid waste collection and recycling facilities.

(E) Prohibiting the use of plastic checkout bags is necessary to protect the environment and the public health, safety, and welfare of all residents and visitors.

(Ord. 2017-7, passed 5-1-17; Am. Ord. 2017-15, passed 11-20-17)

§ 92B.02 PURPOSE.

The purpose of this chapter is to improve the environment in and around the town and the health, safety, and welfare of its residents by reducing the number of plastic and paper bags being used, encouraging the use and sale of reusable checkout bags and banning the use of plastic bags for retail checkout of goods.

(Ord. 2017-7, passed 5-1-17; Am. Ord. 2017-15, passed 11-20-17)

§ 92B.03 DEFINITIONS.

For purposes of this chapter the following definitions shall apply unless the context clearly indicates or requires a different meaning.

BUSINESS ESTABLISHMENT. Any commercial enterprise that provides carryout bags to its customers, including sole proprietorships, joint ventures, partnerships, corporations, or any other legal entity, and includes all employees of the business and any independent contractors associated with the business. *BUSINESS ESTABLISHMENT* does not include sales of goods at yard sales, tag sales, other sales by residents at their homes, and sales by nonprofit organizations.

CARRYOUT BAG. A bag provided by a business establishment to a customer, typically at the point of sale, for the purpose of transporting purchases.

DOUBLE-OPENING PLASTIC BAGS. Any thin plastic bag with a double opening (top and bottom) to protect clothing or other items for transport.

PLASTIC BARRIER BAG. Any thin plastic bag with a single opening used to:

(1) Transport fruit, vegetables, nuts, grains, small hardware items, or other items selected by customers to the point of sale;

(2) Contain or wrap fresh or frozen foods, meat, or fish, whether prepackaged or not;

(3) Contain or wrap flowers, potted plants, or other items where damage to a good or contamination of other goods placed together in the same bag may be a problem; or

(4) Contain unwrapped prepared foods or bakery goods.

PLASTIC CARRYOUT BAG. Any plastic carry-out bag that is provided by a business establishment to a customer, typically at the point of sale, for the purpose of transporting purchases. *PLASTIC CARRYOUT BAG* does not include plastic barrier bags or double-opening plastic bags, as defined herein, or plastic bags measuring larger than 28 inches by 36 inches.

RECYCLABLE PAPER BAG. A paper bag that is fully recyclable overall and contains a minimum of 40% post-consumer recycled content and contains no old growth fiber. The bag should display the words "Reusable" and "Recyclable" or the universal recycling logo on the outside of the bag.

REUSABLE BAG. A bag with handles that is specifically designed and manufactured for multiple reuse and is made primarily of cloth or other nonwoven textile or

durable plastic with a minimum thickness of four mils. Any straps must be stitched and not heat fused.

(Ord. 2017-7, passed 5-1-17; Am. Ord. 2017-15, passed 11-20-17)

§ 92B.04 PROHIBITED ACTS.

(A) No business establishment shall provide or make available any plastic carryout bag (either complementary or for a fee) for any sales transaction or other use to members of the public, that does not comply with the definition of a reusable bag under § 92B.03 of this chapter.

(B) All business establishments that provide plastic barrier bags or double opening bags shall offer a recycling opportunity onsite for the recycling of any plastic bags or clean plastic bag film as defined by the Rhode Island Resource Recovery Corporation RESTORE program.

(C) Nothing in this section shall preclude business establishments from making reusable bags or recyclable paper bags, as defined in § 92B.03 of this chapter, available to customers, by sale or otherwise.

(Ord. 2017-7, passed 5-1-17; Am. Ord. 2017-15, passed 11-20-17)

§ 92B.05 EXEMPTIONS.

This chapter does not apply to:

(A) Laundry dry cleaning bags, door-hanger bags, newspaper bags, or packages of multiple bags intended for use as garbage, pet waste, or yard waste;

(B) Bags provided by pharmacists or veterinarians to contain prescription drugs or other medical necessities, provided that the bags are recyclable within the state's recycling program; and

(C) Plastic barrier bags, double opening plastic bags and bags used by a consumer inside a business establishment to:

(1) Contain bulk items, such as produce, nuts, grains, candy, or small hardware items;

(2) Contain or wrap frozen foods, meat, or fish, whether or not prepackaged;

(3) Contain or wrap flowers, potted plants or other items to prevent moisture damage to other purchases;

(4) Contain unwrapped prepared foods or bakery goods; or

(5) Bags used by a non-profit corporation or other hunger relief charity to distribute food, grocery products, clothing, or other household items.

(Ord. 2017-7, passed 5-1-17; Am. Ord. 2017-15, passed 11-20-17)

§ 92B.06 ENFORCEMENT; VIOLATIONS; PENALTIES.

This chapter shall be enforced by the Police Department, or any other Town Department designated by the Town Administrator. Any person who violates any of the provisions of this chapter shall be subject to the following penalties:

(A) For a first offense, the person charged with a violation of this chapter shall be served with a warning letter by delivering it to him or her personally, or by posting a copy upon a conspicuous portion of the retail sales establishment and sending a copy of the same by certified mail to the person to whom the notice is directed. The warning letter shall inform the person charged of the nature of the violation and that it must be corrected within 14 days of the date of the letter, and shall include a copy of this chapter.

(B) For a second offense more than 14 days after service of a warning letter, a fine of $150. The person charged shall, for a second offense, be given the opportunity to pay the fine assessed by mail, which shall be indicated on the summons issued by the charging officer. Should the alleged violator elect not to pay the fine assessed by mail, said person shall be entitled to a hearing before the Municipal Court.

(C) For a third or subsequent offense, a fine of $300, and a hearing before the Municipal Court shall be required.

(D) Each occurrence of a violation more than 14 days after service of a warning letter, and each day that such violation continues, shall constitute a separate violation and may be cited as such.

(Ord. 2017-7, passed 5-1-17; Am. Ord. 2017-15, passed 11-20-17)

§ 92B.07 HARDSHIP VARIANCE.

The Town Administrator may grant a variance from the requirements of this chapter only after determining that:

(A) Application of this chapter would cause undue hardship based upon unique circumstances; or

(B) Application of this chapter would deprive a person or business of a legally protected right.

(C) The requested variance shall be submitted on the towns prescribed forms.

(D) Any variance granted under this section must be the minimum variance necessary to address the hardship.

(E) The Administrator shall prepare a written report of findings to support the grant or denial of the variance.

(Ord. 2017-7, passed 5-1-17; Am. Ord. 2017-15, passed 11-20-17)

§ 92B.08 EFFECTIVE DATE.

This chapter shall take effect on passage and its provisions shall supersede any inconsistent or contrary provision in any other ordinance, provided however, that enforcement shall be stayed until November 30, 2017.

(Ord. 2017-7, passed 5-1-17; Am. Ord. 2017-15, passed 11-20-17)

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