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THE EFFECTS OF ENVIRONMENTAL EDUCATION ON THE PUBLICS ATTITUDES AND LEVEL
OF POLICY SUPPORT FOR HABITAT RESTORATION IN NARRAGANSETT BAY

BY

CASTINE ELIZABETH AUDETTE

A THESIS SUBMITTED IN PARTIAL FULLFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS

IN

MARINE AFFAIRS

UNIVERSITY OF RHODE ISLAND

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OF
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ABSTRACT

This research aims to address how to increase support and understanding for coastal and marine policy as well as coastal habitat restoration in Narragansett Bay, Rhode Island. More specifically, the objective is to determine both the influences of environmental education on public attitudes and how environmental education influences the public's support for habitat restoration and protection policies. From this research one can discern whether environmental education plays a significant role in attitude formation, which can prove to be important for public support of policy. Research was conducted at and near an environmental education facility, the Save the Bay Aquarium in Newport, Rhode Island. Using an in-person questionnaire, three sub-groups (Entering, Exiting, and Non-visitor) were surveyed. The survey was designed to gather data about participant's environmental worldviews, knowledge of the marine environment, level of policy support, and demographics. Results were analyzed using a step-wise regression to determine the factors that predict levels of policy support. This study shows that in Rhode Island, respondents have a high level of policy support. That support is not directly correlated to visiting the educational facility, but correlates more directly to environmental beliefs and values. Although the data show there is support for policy, they also suggest that there is still opportunity to enhance the public's support for various environmental policy initiative in Rhode Island. It is hoped that the results of this study will be used by Save the Bay and similar institutions to 1) evaluate existing and future educational programs and 2) facilitate reflection about

organizational roles and responsibilities related to influencing the public's knowledge of and support for environmental policy.

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Chapter 1

Introduction

Introduction

The world's population has been increasing for centuries; the global population today is just over 7 billion people (U.S. and World Population Clock). As populations increase, so does the demand for land and natural resources. For centuries individuals have been seeking the coasts as a place to live and visit because of the abundance of resources, economic opportunity, and pure beauty. The increase in global population has resulted in a growth of coastal migration. The high concentrations of people in coastal regions have produced many economic benefits, including improved transportation links, industrial and urban development, revenue from tourism, and food production (Creel, 2003). Today, about half of the world's population lives within 200 kilometers of the coastline, by 2025, that figure is likely to double (Creel, 2003).

With increased human presence and activity comes more need for additional infrastructure. Humans have been altering the coastlines by building homes, roads, seawalls, bridges, etc., all of which alter and harm the natural marine processes and vital marine habitats. It has been observed that human influence has damaged and degraded vital habitats such as salt marshes, eel grass beds, and sand dunes to extreme levels. An area where this is evident is within Narragansett Bay, Rhode Island. To improve and protect these sensitive habitats from further degradation and loss, the Rhode Island

state government has enacted a multitude of policies designed to protect these habitats.

An environmental nonprofit organization, Save the Bay, a prominent player in policymaking in Rhode Island, contributes to Rhode Island's efforts by advocating for policies that are consistent with its mission. Save the Bay also implements environmental education programs and operates an aquarium designed to improve visitors' knowledge and support for policy related to Rhode Island's marine environment. Using a survey of visitors and non-visitors, this thesis examines the effectiveness of a visit to Save the Bay's Aquarium as a means for increasing general support for policies focused on restoring the ecology of Narragansett Bay.

Problem Statement

One of the most persistent problems facing Narragansett Bay is the ever-growing human presence that disrupts vital marine habitats found within the bay. In Rhode Island the number of year-round coastal residents has increased drastically over the past 25 years, altering coastlines and marine habitats. In addition, the tourism industry necessitates increased infrastructure and access to coastal areas. Disturbance of coastal areas affects how they can react to large coastal storm events, how beaches handle rising sea levels and erosion, how vital habitats are able to protect coastal communities, and how they are able to support the marine ecosystems. The problem that the state of Rhode Island faces is the need to protect its vital habitats within Narragansett Bay, while supporting a growing economy and tourism industry. To contribute to existing policy,

environmental advocates in Rhode Island rely on the use of environmental education programs as a way to inform and gain support from the public.

Often times, environmental education is used in an attempt to change an individual's behavior and their support for pro-environmental policy. The social science literature suggests that attitudes and knowledge play a significant role in behavior change, but much of the literature fails to identify the relationships among environmental education, knowledge, environmental attitudes, and behavior. This research aims to add to what is known about the impact of environmental education might have on attitudes of visitors to the Save the Bay Aquarium, as well as providing recommendations to Save the Bay regarding the role of the aquarium in achieving its education mission.

Objectives

This research explores how a visit to an informal education facility influences support for habitat restoration policy. More specifically, this research describes how a visit to the Save the Bay Aquarium influences adults' general support for policy to restore coastal habitats in Narragansett Bay, Rhode Island. From this research one can begin to discern whether this kind of environmental education plays a significant role in attitude formation, which can prove to be important for public support of environmental policy. This research also provides an opportunity to make recommendations to Save the Bay to evaluate and improve their environmental education programs.

Research Questions

To achieve these objectives, this research project is shaped around three major research questions:

- (1) How do various factors influence the public's level of support for proposed habitat restoration and protection projects and policies in Rhode Island?
- (2) In what ways does visiting the Save the Bay Aquarium influence those factors?
- (3) Does a visit to the Save the Bay Aquarium ultimately influence general support toward habitat restoration policies?

Chapter 2

Literature Review

Introduction

This chapter provides a review of the literature related to the effects of environmental education on the public's attitudes toward habitat restoration and protection policies in Narragansett Bay. To do so, the following sections provide summaries of the literature related to 1) environmental education, 2) relevant theoretical frameworks; the Value-Belief-Norm (VBN) theory and the New Ecological Paradigm (NEP), 3) important issues related to Narragansett Bay, 4) human impacts on vital marine habitats, and 5) relevant Rhode Island policy issues.

Environmental Education

In recent decades there has been a growing concern about the health of the environment. Various modes of providing the public with information have been used. Yet, the literature indicates that the majority of people may not be aware of important environmental issues. This may be due to lack of education. Environmental education can be used to raise awareness, change attitudes and values, and garner support for various initiatives. In order to provide effective education it is important to understand individual values and the potential for environmental education to change values and attitudes.

In general, environmental education aims to inform individuals about various aspects of the environment (Lynch et al., 1992). In 1975, the United Nations

Educational, Scientific, and Cultural Organization (UNESCO) met to establish objectives for environmental education. At this conference, the Belgrade Charter was adopted. This document states, "the goal of environmental education is to develop a world population that is aware of, and concerned about, the total environment and its associated problems, and which has the knowledge, attitudes, skills, motivation, and commitment to work individually and collectively toward solutions of current problems and prevention of new ones" (UNESCO-UNEP, 1976; Athman, 2001). The Tbilisi Declaration, expands upon the goals of the Belgrade Charter by establishing certain objectives of environmental education:

- Awareness- to acquire an awareness and sensitivity to the total environment and its allied problems;
- Knowledge- to gain a variety of experiences in and acquire a basic understanding of, the environment and its associated problems;
- Attitudes- to acquire a set of values and feelings of concern for the environment and motivation for actively participating in environmental improvement and protection;
- Skills- to acquire the skills for identifying and solving environmental problems; and
- Participation- to encourage citizens to be actively involved at all levels in working toward resolution of environmental problems (UNESCO, 1978; Athman, 2001)

Many environmental education programs aim to fulfill most, if not all, of these objectives. Accomplishing these objectives allows for programs to successfully communicate why the environment is important and what can be done to ensure future improvement and protection (Lynch et al., 1992). It is often assumed that a successful program will shift participants' attitudes, either positively or negatively, toward the given subject matter. In this case, effective environmental education can increase the public's awareness of habitat destruction, thus they may be more likely to have a positive attitude and a higher level of policy support for habitat restoration and protection policies.

An attitude is an individual's feeling toward and evaluation of some object or event. Attitude is measured by both intensity (strength of feeling) and direction (positive or negative) (Weladji et al, 2003). McGuire (1985) states four factors that "initially establish attitudes": genetic determinants; transient physiological factors; direct experiences with the attitude object; and social processes. When it comes to attitudes toward the environment, the last two (direct experience and social processes) seem to be the most significant factors (Stern et al., 1995). Stern et al. however, believes that there are additional factors that may contribute to attitude shifts. These include: personal background factors (age, income, education, etc.); individuals judgment of some attitude objects as a function of the risk they attach to those objects; environmental concern as a developmental phenomenon (higher order of needs); and, a process of activating personal moral norms based on altruism, emerging land ethic and biospheric value orientation (Stern et al., 1995). Stern further states that "attitudes

toward new objects must be built on something more stable" (1615), such as information and knowledge gained from education (Kollmuss et al., 2002).

Several studies have explored the effects of environmental education on both attitudes and behavior, which, in this case, would be policy support. The literature suggests that after participating in an environmental education program, attitudes of participants shift in a more positive (supportive) direction (Heberlein, 1991; Jenkins, 2003; Hungerford, 1990; Euler, 1989). The change in attitude is explained by the fact that participants have a better knowledge base and understanding of the subject matter (Jenkins, 2003). With a change in attitude, it is expected that the behaviors of those who participated will change to favor the environment (Hsu, 2004; Farmer et al, 2007). The effects of environmental education on behavior have been tested extensively in the United States and in Taiwan. One study in particular explores this relationship in great detail, and also explores the change and role of attitudes (Hsu, 2004). In a study done in Taiwan, college students participated in an environmental education program. The program was designed to teach the students about investigation evaluation and action training, a program which improves ones effectiveness at addressing environmental issues. This study examined a variety of variables that had the potential to contribute to a change in behavior, one of which was attitudes. Researchers found a positive correlation between the program and attitude change (Hsu, 2004).

Heberlein (1991) demonstrated similar findings and has formed a particularly important body of work that proves that environmental education has a significant role

in changing environmental attitudes and behavior (Williams et al., 2002; Heberlein, 1991). Along with other researchers, Heberlein explored the role that education plays in both attitudes and policy support. In one study he surmises that people will develop increasingly more positive attitudes as progress in education and urbanization occurs (Williams et al., 2002). However, these changes will occur even more rapidly if stronger, more influential attitudes and beliefs are changed (Williams et al, 2002). This suggests that there may be more to changing attitudes and behaviors than education alone. In particular, these researchers suggest that environmental beliefs and values, along with demographic information may play a significant role in the variation within the data. It is interesting to note that individuals with the "least experience" have been found to have more positive attitudes and higher levels of environmental policy support than those with greater experience (Williams et al. 2002).

Overall, the literature suggests that there is a positive correlation between environmental education programs and a positive change in attitude and behavior. After participating in an environmental education program, participants tend to display more positive attitudes toward the subject matter. Further, the literature indicates that a positive attitude can lead to a change in behavior (Heberlein, 1991; Williams et al., 2002; Kean, 1989).

Given these findings, individuals who visit Save the Bay's aquarium could be expected to gain a better understanding and knowledge of the local marine environment and habitat restoration, thus developing a more positive attitude toward

habitat restoration projects. This change in attitude could result in more public awareness and support for habitat restoration policies within Rhode Island.

Value- Belief- Norm Theory and the New Ecological Paradigm

Two important theoretical frameworks are frequently used to shed light on behavior and attitudes related to the environment. The first is the Value-Belief-Norm Theory and the second is the New Ecological Paradigm. Both also serve as a lens through which to examine the impact of environmental education.

Value- Belief- Norm Theory

The Value- Belief- Norm (VBN) Theory provides an important framework for understanding how a person's underlying core environmental values affect his or her beliefs related to the environment, personal norms, and ultimate behaviors and attitudes toward policy (Figure 1). The theory has been used in previous research to explore why people do or do not support environmental movements (Dietz et. al., 2005; Stern et. al., 1993, 1995, 1999).

Figure 1. A schematic representation of variables in the values-beliefs-norms theory of environmentalism. Arrows represent postulated direct effects. Direct effects may also be observed on variables more than one level downstream from a causal variable. Empirically, measures of self-interest values have been negatively correlated with indicators of environmentalism. The abbreviations NEP, AC, and AR refer to the new ecological paradigm, awareness of adverse consequences, and ascription of responsibility to self, respectively.

The literature indicates that changes in attitudes toward any given subject, may be more related to other “stronger attitudes and beliefs” (Williams et. al., 2002) than they are to education. In the case of this study, a person’s beliefs, values and personal norms may have a greater influence on whether or not he or she supports various marine policies, than exposure to education.

A values is defines as “the worth, usefulness, or importance of a thing; relative merit or status according to the estimated desirability or utility of a thing [and] (b)

estimate or opinion of, regard or liking for, a person or thing” (Dietz et. al., 2005). Values are often looked at as a way to understand how decision-making occurs; values are assumed to influence decisions (Dietz et. al., 2005). Changes in values leads to changes in decision-making, and thus, changes in individual behavior. In terms of environmentalism values are most often associated with an individual’s behavior, behavioral intentions, and other measures of environmental concern (Dietz et. al., 2005).

Dietz and his colleagues (2005) stated that in order to create a change in attitude - and subsequent pro-environmental behaviors- core values and beliefs must be influences and changed. The literature further suggests that changes in core values, beliefs, and norms creates longer lasting behavioral change (Dietz et. al., 2005), meaning that if a change in values is experienced, then the chances of a change in overall behavior (like supporting pro-environmental issues in general) increase. Values influence both individual and collective decisions, and if values change in a more pro-environmental way, decisions will be made to be protective of the environment (Dietz et. al., 2005). The Value- Belief- Norm (VBN) Theory can be applied to evaluate the relationship between values, beliefs and norms, and attitudes and behaviors more completely.

With a more thorough understanding of how values, beliefs, and norms affect attitudes, policy makers will better understand how and why people think and act the way they do. With a greater understanding of these relationships policy makers will

learn how to influence their target populations more effectively to create higher levels of policy support.

The VBN Theory suggests that “values influence our worldview about the environment (general beliefs), which in turn influence our beliefs about the consequences of environmental change on things we value, which in turn influence our perceptions of our ability to reduce threats to things we value. This in turn influences our norms about taking action” (Dietz et. al., 2005). In general, it is believed that self-interest, humanistic altruism, and biospheric altruism are the most fundamental factors for environmental concern. This makes them the most stable factors related to environmental concern. The above-mentioned literature describes these “stable” factors as being the most difficult to influence and change. This needs to be considered when developing educational initiatives aimed at changing attitudes and behaviors. Values seem to be the most critical component of the Model since they have been demonstrated to have the most significant leverage on environmental worldviews and specific beliefs. A change in core values seems to have the greatest impact on environmental opinions.

There is often a strong intersection of values, beliefs, and personal-norms (a sense of personal obligation linked to self-expectations) that compels individuals to act in ways that support the goals of a particular movement (Stern et. al., 1999). Personal norms play, perhaps, the most significant role. If personal norms align with the principles of the movement, there is a greater chance of support for the goals of the

movement through citizen participation, personal behaviors, and policy acceptance (Stern et. al., 1999). In addition, an individual may feel the need to change or alter his or her behavior for the overall good and not just for his or her own self-interest. Social movements rely on influencing people's personal norms and altruistic values to get them to act. When people feel that the things they value and believe are under threat they will take action.

The literature indicates that there may be several important personal factors that influence a person's attitude and behaviors related to environmental initiative and policy. It is the goal of environmental policy makers to gain as much support as possible from the public in order to get policies passes.

Changing the public's attitudes and behaviors is necessary to achieve determined goals. Therefore, it is vital for policy makers to understand how to gain that support by tapping into individual values and beliefs.

New Ecological Paradigm

In 1978 Dunlap and a group of researchers proposed that the rise of the environmental movement was – and is- connected to an ever-growing acceptance of the idea that humans can negatively impact the environment. This theory is known as the New Ecological Paradigm (NEP) (Dunlap et. al., 1978). As part of their work, they created a New Ecological Paradigm Scale to measure a person's feelings and beliefs about the environment and the effects that humans have on it (Anderson, 2012; Dunlap et. al., 1978). The scale consists of 15 statements which are scored on a five point Likert scale

(strongly disagree, disagree, neutral, agree, and strongly agree). The full list of statements is provided in APPENDIX C. Eight of the items, if agreed upon “reflect endorsement of the new paradigm” and seven, if agreed upon “reflect endorsement of the Dominant Social Paradigm (DSP)” (Anderson, 2012; Dunlap et. al., 2000)

The NEP Scale has been proven to be internally consistent and results in a final single measure of a person’s environmental worldviews. The NEP scale is used in many situations to explore the cross-sectional relationship between environmental worldviews, attitudes toward public policy, patterns of recreation participation, and pro-environmental behaviors. It has also been used to compare feelings and beliefs before and after educational interventions (Anderson, 2012; Dunlap et. al., 2000; Dunlap, 2008). Although this method of measuring one’s environmental worldview or paradigm has proven to be successful and provide valuable data, concerns have been raised about the validity of the tool and its ability to accurately measure these constructs. Three major concerns have surfaced. These are that the NEP scale is missing certain important pro-ecological worldview elements potential problems with validity, and problems with dimensionality (Anderson, 2012; Dunlap et. al., 2000; Dunlap, 2008). All in all, use of the New Ecological Paradigm Scale might enhance our understanding of people’s environmental worldviews and behaviors.

Education

Educational initiatives are often undertaken in an attempt to gain assistance and support for activities and policies related to environmental preservation and

restoration. Taking action can take many forms: political activism, voting (non-political activism), and endorsing pro-environmental policies. Activities might include letter writing campaigns, telephone campaigns, fund raising, or keeping up-to-date and informing others about important issues. Support efforts may include material sacrifice in order to achieve the movement's goals such as; paying higher prices for certain goods, paying higher taxes, or submitting to regulatory requirements (e.g., mandatory recycling, water bans, etc.). Often these sacrifices gain support and seem easier when all people must make the same necessary "sacrifices" in order to change (Stern et. al., 1999).

Previous studies exploring the usefulness of the Value-Belief- Norms Model as an explanatory model have indicated that personal values, beliefs, and behavioral norms have the greatest influence on participation in activities related to movement support (Stern, 1995, 1999). In addition, the utility of the Value-Belief-Norms Theory had been compared to the utility of the New Ecological Paradigm Scale for determining a person's support for environmental issues. It was found that both are useful when it comes to determining and understanding one's reason for support for environmental policy. In addition, studies exploring the usefulness of the Value-Belief-Norms Model as an explanatory model have indicated that personal values, beliefs and behavioral norms have the greatest influence on participation in activities related to the movement (Stern, 1995, 1999).

Overall, the literature suggests that values and beliefs of an individual influence his or her level of policy support. Utilizing the Values-Belief-Norms Theory and the New Ecological Paradigm to assess why people feel the way they do about policy will add to what is known about how to deliver educational initiatives and garner support for policy.

In relation to this research, Rhode Island has proposed a number of policies designed to best protect and preserve Narragansett Bay. To be successful and have the policies enacted, they need support and action from the public. However, gaining the support needed to approve or implement these policies is a difficult task and requires a thorough understanding of what influences people's attitudes. With a more clear understanding, policy makers can more effectively target the public and gain their support. One way of doing this is through the use of environmental education; Stern et. al. (1999) states, "the processes that lead someone to take small steps in support of a movement should be logically congruent with the process that leads to activism, and it appears that our value-belief-norm theory has such congruence with key arguments in the existing literature on activism," suggesting that there is not only one factor that accounts for one's level of support, but rather a combination of factors.

Background on Study Area

Narragansett Bay

Narragansett Bay (APPENDIX E) is located in Rhode Island and is New England's largest estuary covering 4,836 square kilometers, with 256 miles of coastline (Raposa;

“Fact and Figures about Narragansett Bay”). The bay acts as a natural harbor opening to the Atlantic Ocean in the south and parts extending into Massachusetts. There are more than 30 islands in Narragansett Bay, with the largest being Aquidneck Island, Conanicut Island, and Prudence Island (Raposa). There are several large suburban areas surrounding the bay, the largest being Providence; others include, Newport, Warwick, Cranston, Fall River, Narragansett, and Wickford (APPENDIX D). The contributing watershed covers 1,853 square miles; the majority (60%) of which is in Massachusetts with the remainder (40%) in Rhode Island (“Facts and Figures about Narragansett Bay”) (APPENDIX F).

Geologic Processes

The formation and shaping of the bay and its contributing watersheds, as described by Raposa were shaped primarily by the retreat and advance of glaciers occurring about 3 million years ago. As the glaciers retreated they left behind a deposit of sediments which created the current rocky and sandy beaches and coastlines of the bay. Fringing and meadow salt marshes, depositional areas, and human modified coastlines are also common along the shoreline of Narragansett Bay.

Current State of the Bay

Because Narragansett Bay is an estuary, the physical and biological characteristics of the bay are quite unique. The saltwater input comes from the Atlantic Ocean, while the freshwater comes from several large rivers that flow through the watershed (Raposa; “Facts and Figures about Narragansett Bay”).

Tides within the bay are semidiurnal (two tides per day) with an average tidal change of 1.1 meters at the mouth of the bay and 1.4 meters at the head of the bay (Raposa; "Facts and Figures about Narragansett Bay"). Tidal mixing is the dominant factor affecting circulation patterns within the bay while non-tidal factors such as wind, salinity gradients, and temperature gradients also contribute to the creation of currents. Although many of these non-tidal currents are slower than tidal ones, they are important to the system because they slowly "flush" water out of Narragansett Bay into Rhode Island Sound.

The mixing of water types has created an ideal estuarine environment. Estuaries are one of the most biologically diverse and productive ecosystems on earth. In the Narragansett Bay alone, there are 60 different species of fish and shellfish and about 200 species of birds and mammals (Raposa; "Facts and Figures about Narragansett Bay"). The bay is also home to several vital habitats such as sand dunes, eel grass beds, and salt marshes. However, expansion of coastal communities has contributed greatly to the degradation of these habitats.

Vital Marine Habitats and Human Impacts

For centuries people have sought the coast as a place to live and visit because of its abundance of resources and opportunity. As the U.S. population grows, so does the population in coastal areas. According to National Oceanic and Atmospheric Administration (NOAA), in 2003, 153 million people lived in coastal areas, which is 33 million more than in 1980 ("Coastal Hazards" 2014). Although there are benefits- such

as the economic growth caused by increased tourism- increased human presence has resulted in more direct human interaction with the environment and the need for more infrastructure (Appendix A) (Creel, 2003). These factors harm vital and vulnerable marine habitats.

In Narragansett Bay there are many vital marine habitats that benefit both the marine ecosystem and humans. These include eelgrass beds, salt marshes, and sand dunes (APPENDIX B). These habitats are vulnerable to the external stressors mentioned above, which cause extreme habitat degradation and loss.

Eelgrass Beds

Eelgrass beds are an important coastal feature, although not always recognized as such because they are a type of submerged aquatic vegetation (SAV) in the intertidal and subtidal zones (Nagelkerken et. al., 2000). Healthy eelgrass bed acts as an “underwater meadow” that provides a habitat for a variety of invertebrates, substrate for algal growth, a food source for marine life, and a nursery for many marine and anadromous species - - providing food, shelter and protection for juveniles (Nagelkerken et. al., 2000; Burdick et. al., 1999). Many species that are of ecological, commercial, and recreational importance spend a portion of, or all of, their life in eelgrass beds.

Eelgrass beds are also important for the protection of humans because they serve as a natural buffers for coastal areas. They absorb and soften the impact of waves and currents, thus preventing coastal erosion and protecting infrastructure in high risk areas (Nagelkerken et. al., 2000; Short et. al., 1996). They also catch and remove

sediments from the water column where they accumulate. These sediments are then naturally accreted on beaches, allowing them to remain stable and rebuild after large coastal storm events (Short et. al., 1996). Without eelgrass beds, the sediments have the potential to be lost to the larger expanse of the ocean.

Humans using Narragansett Bay have greatly impacted the health of eelgrass. With increased human presence in coastal regions, the amount of pollution and physical stress and harm to eelgrass beds has increased. The greatest human induced stressors are nutrient pollution such as fertilizers, sewage, pesticides, etc. (Short and Burdick, 1996; Short et. al., 1996), dredging, shoreline and over the water construction (Nagelkerken et. al., 2000; Short et. al., 1996, Burdick et. al., 1999), boating, oil spills, and shellfish production (Short et. al., 1996). There are several negative effects from these human actions. Algal blooms are common and decrease light penetration (Nagelkerken et. al., 2000; Burdick et. al., 1999; Short et. al., 1996) needed by the sea life, removal of plants and suspending sediments into the water column smothering organisms, reduces the ability to absorb wave energy (Burdick et. al., 1999), and increases shoreline and marine erosion.

Sand Dunes and Beach Grasses

Sand dunes are another example of a vital coastal habitat experiencing damage. Sand dunes form when sand is transported by wind and trapped by beach grasses (*Ammophila breviligulata*) (Maun, 1998) creating a hill or ridge on the back portion of the beach. Dune grasses “anchor” the dunes while the exposed portions of the plants

trap sediments and are critical for the expansion and stabilize the dunes (Maun, 1998; Maun, 2009). Dunes are constantly subject to the natural force of the coastal wind and waves. So without vegetation, there is potential for dunes to erode away.

The beach grasses in sand dunes provide many of the same benefits that eelgrass beds do; acting as a sand storage for beaches (Everard, 2010). In addition they provide a natural shield from storm surges, and wind and wave energy, which can damage coastal property and infrastructure (Maun, 1998; Everard, 2010). Although there may not be an obvious abundance of wildlife in dunes, marine and coastal birds rely heavily on the health of sand dunes since they serve as a location for nesting and hatching young (Maun, 2009). Sand dunes also provide an ideal environment for hundreds of plant species, many of which are rare or endangered (Maun, 2009).

The benefits of beach grasses sand dunes for humans are often overlooked. Humans are often unaware of the damage they are doing to sand dunes. The greatest human induced stressors on sand dunes are the removal of naturally occurring sediment to increase land stability (Everard, 2010; Maun, 1998), increased infrastructure, increased foot traffic (Hylgaard et. al., 1981), and removal of dune grasses. One result of these actions is that grasses and dunes can no longer trap sediments and create the necessary stability needed to protect against wind and wave erosion (Everard, 2010; Hylgaard et. al., 1981). Another result is the disruption and harm to the nesting, mating, and migration habitats of seabirds (Hylgaard et. al., 1981).

Salt Marshes

Salt marshes act as a transition zone from the ocean to the land. Salt marshes are composed of a variety of salt tolerant plant species that have the ability to adapt to frequent tidal water level changes (Vernberg, 1993; Redfield, 1972). Tidal flow is vital to the health and growth of salt marshes because tides carry in nutrients that are used for growth and carries out organic material and waste. In a healthy, well-established salt marsh, several plant species and substantial peat layers are present (Allen, 1995). Plant life, an the development and replacement of peat layers, are critical to the vitality and success of salt marshes. Peat built around the roots of the plant life, keeps marshes at an elevation at which they will not constantly flood or erode and allows marshes to keep up with rising sea levels (Allen, 1995).

Salt marshes are home to a wide variety of marine organisms that utilize the marshes as a nursery for offspring, a form of protection, and a food source. Life within the marsh itself is vital to marine birds that visit salt marshes frequently for food (Bromberg Gedan et. al., 2009; Bertness et al., 2002; Gedan et. al., 2011).

Salt marshes are not only beneficial to marine life, but they have also proven to be extremely important to the people who live in coastal communities close to the marshes. First, salt marshes are a natural flood plain, holding excess water during large storm events, they act as a natural buffer protecting communities from wind and wave energy. Second, many of the fish and other marine species relied on for commercial or recreational spend some or all of their lives in marshes. However, peoples' close

proximity to marshes has created some negative consequences. In an effort to control mosquitos, many marshes have been filled in (Bromberg Gedan et. al., 2009; Bertness et. al., 2002). Further, marshes have been filled in to allow for the building of bridges, roads, and dams that result in increased access and community expansion (Gedan et. al., 2011). With increased community access comes increased pollution from pesticides, fertilizers, and petroleum products. These sorts of inputs create a situation where the salt marshes can no longer break down and filter out toxins and sediments to create cleaner water, or be effective flood plains (Bromberg Gedan et. al., 2009; Gedan et. al., 2011; Bertness et. al., 2002). Change in the marshes may cause alterations in the flow of water, reduction in the water exchange period, changes in the flow of sediments and nutrients, a reduction of the marshes ability to keep up with the changing sea levels. Any combination of these factors can result in the complete loss of marshes, which are vital to the lifecycle and survival of a variety of marine species (Bromberg Gedan et. al., 2009; Gedan et. al., 2011).

Save the Bay

Founded in 1971, Save the Bay is a local nonprofit organization in the state of Rhode Island whose mission it is to “protect, restore and improve the ecological health of the Narragansett Bay region, including its watershed and adjacent coastal waters, through an ecosystem-based approach to environmental action; defends the right of the public to use and enjoy the Bay and its surrounding waters; and fosters an ethic of environmental stewardship among people who live in or visit the Narragansett Bay region” (“What We Do”). Save the Bay is a major contributor to environmental policy

development Rhode Island. The group not only collects and presents data, but also works with the local and state governments to “pass laws that protect the Bay and keeps lines of communication open with lawmakers on the importance of environmental action” (“What We Do”). However, to raise awareness of marine related issues and policy, Save the Bay has established an education department that works to educate the public on the Bay and its resources while “fostering an understanding and a sense of personal responsibility for the resource” (“What We Do”). The education department within Save the Bay plays a major role in their success in protecting, restoring, and improving Narragansett Bay. One way in which they accomplish this is through the Save the Bay Exploration Center and Aquarium, located on Easton’s Beach in Newport, Rhode Island (APPENDIX G). The main goal of the aquarium is to have people walk out of the aquarium feeling empowered to change their behaviors, feeling more knowledgeable about the life that lives right in their back yards, and how to preserve it for the future. Education on climate change is currently one of their main focuses. The aquarium also coordinates and conducts beach grass and salt marsh restoration efforts and beach cleanups with local students and organizations.

The aquarium is home to many native marine animals. Some of which are non-releasable or strays, others are rotated in and out to represent Bay marine life. They are then released back into their Bay communities. Healthy habitats are created to ensure they have a good place to live while educating the public. There are more than 140 species either native to- or found in- Narragansett Bay. Visitors are provided with a one-on-one, hands-on experiences where they have the opportunity to learn about Bay

marine life, local issues facing the Bay, and ways in which they can help to improve the quality of Narragansett Bay. Through touch tanks, interactive exhibits, educational exhibits and activities, and one-on-one interactions with educators are all part of a visit to the Save the Bay Exploration Center and Aquarium.

Visitors observing the shark touch tank.

Visitors observing the skate and horseshoe touch tank.

Visitors at the rocky shore touch tank.

Seahorse and eelgrass exhibit (left) and saltmarsh exhibit (right).

Rhode Island Policy Issues

However, there is still much progress that needs to be made to ensure environmental health. The development of policies to protect and ensure the health of ecosystems is critical. To do so, policy makers must have support from all stakeholders, including the public. Therefore, the public and other stakeholders need to be fully aware and educated about the issues at hand. Uninformed people are not fully able to support or oppose a proposed policy.

As has been discussed, several vital marine habitats in Narragansett Bay, have been altered and degraded by humans and their actions, through increased pollution, foot traffic, and infrastructure development. In efforts to reduce and prevent these effects and impacts, Rhode Island has established plans and programs aimed at restoring and preserving these habitats. Some examples include the Rhode Island Critical Lands Project, the North American Wetlands Conservation Act, and the RI Resource Protection Project ("Habitat Restoration", 2014). However, there are several areas where policies to address additional issues were needed. Therefore, in 2014, the following policies were proposed and served as a main focus for the policy department at Save the Bay.

Cesspools and Septic Systems

Cesspools are common to many Rhode Island homes. Cesspools are large holding tanks that act as a collection and storage facility for waste materials and must be emptied frequently (Siung-Chung, 2014). Typically, cesspools are made of brick or

cement and are designed to be watertight. However, if poorly constructed, emptied infrequently, or not properly/routinely maintained, leaching into the surrounding soil can occur (Siung-Chang, 2014). In this situation, waste makes its way into the surrounding groundwater and is then transported to larger bodies of water such as Narragansett Bay. The presence of waste material increases nutrients and organic materials which can cause harmful algal blooms, increase bacteria levels, cause fish kills, decrease species abundance, and can potentially harm human health (Siung-Chang, 2014; Laws and Redalje, 1979). Rhode Island has proposed the requirement that cesspools be replaced within one year of the transfer of a property. This policy would require new homeowners to replace an existing cesspool, or connect to public sewage systems, eliminating the potential for leaching of waste.

Septic systems are used in areas where there is no connection to main sewage pipes. They hold and treat sewage, which is then disposed of properly. When sewage is not properly treated and later released into the environment, the waste material creates negative effects similar to those of inefficient cesspools (Laws and Redalje, 1979; Mallin, 2000). New Rhode Island policy would establish a statewide wetland and septic system regulation task force. The taskforce would review State regulations on waste treatment, survey wetlands, and evaluate existing septic system processes. Based on the data collected, the task force would make recommendations to the government about how to improve septic system function, develop waste treatment regulations, regulate the disposal of waste, and create better ways to improve management practices.

Dams

Another area of policy development recommended by Save the Bay is related to the use of dams in Narragansett Bay. Dams are large hardened structures that are designed to block and restrict the flow of water in and out of any given area. They are primarily used to suppress floods, create hydropower, and to provide water for irrigation, human consumption, industrial use, and aquaculture (Kingsford, 2000). Dams, however, are a major contributor to the degradation of marine habitats and ecosystems because they block and restrict the natural flow of water (Kingsford, 2000) into these habitats. This disruption to the natural flow of water changes the transfer of nutrients, natural migration patterns, the transfer of sediments, and often causes erosion (Kingsford, 2000; Kondolf, 1997; McCully, 1996). These changes can harm the growth and health of marine habitats by decreasing habitat availability and species diversity (Kingsford, 2000; Kondolf, 1997; McCully, 1996).

The solution proposed is to remove dams in the bay area restoring the natural flow of water. This would result in more natural migration, spawning, and movement of fish and other marine life and the restoration of damaged marine habitats, thus improving species diversity and populations.

Sand Dunes and Beach Grasses

The health of sand dunes and the beach grasses that help to create them is yet another concern for Save the Bay. Dune grasses are imperative for the success of dunes, beaches, and the growth of coastal areas. These grasses trap and hold sand carried by

the wind and waves. Their underground root systems are also able to respond to the ever changing profile of the beaches and help to stabilize them (Maun, 1998; Maun, 2009). However, with more direct human interaction, the grasses are being removed and damaged, reducing their ability to preserve the beaches. The grasses also serve as an important habitat for hundreds of seabirds. To protect these habitats, and preserve the quality of the beaches, it has been proposed to plant native dune grasses to reestablish coastal sand dune habitats. By reestablishing these habitats coastal communities are protected, beaches are able to remain stable, erosion will be reduced, and seabirds will have an adequate habitat to nest and feed.

Community Action

The use of the Bay by humans has resulted in degradation of sand dunes and the important beach grasses resulting in destruction of habitats and the reduction of species population and diversity. Recreational and commercial fishing, swimming, boating, transportation, and shipping all contribute. These activities have resulted in chemical pollution, marine debris, and disruption of habitats. All of these human induced stressors have compromised the quality of the Bay and the health of its sand dunes and organisms. To combat this problem, Save the Bay has suggested that a community-based restoration group be established. The program would include the coordination and activation of, community members to work to remove marine debris (i.e. plastic bags, soda cans, bottles, fishing line etc.) and restore marine habitats. This would allow for the general public to be involved in restoration projects, raise awareness, collect data on the quality of the Bay, educate the public, and actively clean the Bay.

Conclusion

It is clear that there are still areas in the marine environment that Rhode Islanders would like to focus on and improve. In order to be successful in these attempts, policy makers need the additional support from all stakeholders, specifically the public. In order to gain support, it is ideal that policy makers understand how and why constituents think and act as they do. Therefore, research that examines how education might affect a person's environmental world-view, and thus affect his or her support for various policy would be beneficial. This information would be helpful to organizations such as Save the Bay whose aim is to educate and raise public awareness of particular environmental issues with the hope that this information might increase public support for a number of policies. These education attempts, specifically at Save that Bay, have not previously been studied.

This study is based on the hypothesis that after participants visit the aquarium, they will display a more positive attitude and higher level of support for habitat restoration projects and related policy in Rhode Island, due to an increased level of knowledge about habitat destruction and the marine environment within Rhode Island waters. The literature supports the premise that environmental education can play a role in changing attitudes. However, an interesting dichotomy exists because the literature also suggests that environmental worldviews influence one's support for policy. Based on the literature, it is expected that those with a higher level of knowledge, due to environmental education, will be more supportive of marine policy in Rhode Island.

Chapter 3

Methods

Introduction

Data used to test the hypothesis was obtained from responses to a questionnaire administered to two sample groups at Save the Bay's Aquarium and one at the nearby Easton's Beach. Results were analyzed using SPSS, a windows-based statistics program. The results of the statistical analysis performed on this survey data are presented in the subsequent chapters.

Study Location

This research was performed at Save the Bay's Exploration Center and Aquarium located on Easton's Beach in Newport, Rhode Island. This is a small aquarium open to all members of the public and school groups with the goal of educating the public about Narragansett Bay. Visitors are provided with a hands-on experience where they have the opportunity to learn about the Bay, its marine life, and current environmental issues it is facing through a series of games, activities, educational exhibits, and one-on-one interactions with Save the Bay staff members. This location was used because the aquarium has an established environmental education program and an established, varied visitor base of over 400 visitors during the summer season.

Questionnaire Development

An in-person survey (APPENDIX H) was used to gather information on the public's attitudes and level of support for habitat restoration and protection policies

within Narragansett Bay. Before the survey was administered, it was given to staff members at Save the Bay, peers, and faculty members at the University of Rhode Island for review. Based on the comments of the early reviewers, the survey was revised to more closely address the research objectives and concerns of Save the Bay. The survey was designed to determine the relationship between an environmental education experience and the level of policy support expressed by the public. The survey was composed of four sections: 1) environmental worldviews, 2) level of policy support, 3) knowledge of the marine environment, and 4) demographic information.

Independent variables

The section on environmental beliefs and values asked participants a variety of questions measuring 1) how much the participants believe the environment is important and 2) how much they value the environment's health and its resources. The questions asked were taken from Dunlap's New Ecological Paradigm scale (Dunlap et. al., 2000, Dunlap, 2008). Although the original NEP scale consists of 15 statements, only 9 of them were used for this survey. To reduce the length of the survey, I used an abbreviated scale developed by Noe et. al. (1990) and later used by Zelezny et. al. (2000). Responses for environmental beliefs and values (Part 1) were measured using a Likert scale, with answers ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree"). These questions were included to explore whether or not previous personal values and beliefs about the environment affect attitudes toward, and level of policy support.

The section on knowledge of the marine environment asked participants' to respond to 5 multiple choice questions. These questions were derived from information

displayed and presented in exhibits within the Save the Bay Aquarium. Aquarium staff members provided suggestions for the questions. Each question was displayed in a multiple choice format, each with one correct answer and a “do not know” option. These questions were included to see if knowledge is a factor related to the relationship between environmental education and level of policy support.

The section on demographic information asked participants to provide personal information for a variety of questions (age, gender, residency, income, etc.). Several questions in this section were demographic questions that Save the Bay was interested in. These questions were formatted as multiple-choice questions, where respondents were asked to select one answer. For some of the questions, an open text response option was provided so that respondents could write a narrative response if they chose to. These questions were included because demographic variables have the potential to play a role in the relation between environmental education and policy support.

Dependent variables

The section on policy support asked participants a variety of questions measuring their level of policy support for five proposed policies in Rhode Island. Each of the policies aims to protect and restore some aspects of the marine environment in Narragansett Bay. These propositions were provided by Save the Bay. Responses for policy support were also measured using a 5-point Likert scale, with 1 indicating “strongly oppose” and 5 indicating “strongly support”. These questions were included to gauge the participant’s level of support for habitat protection policies.

Data Collection

Surveys were distributed from July through September 2014. This timeframe was used because it is when the aquarium is open seven days a week (in the off-season, it is only open on the weekends) and receives the most diverse visitors with a mix of residents and tourists. Distributing the surveys in the summer months allowed for a more accurate representation of visitors that the aquarium targets, as well as a less discriminatory sampling period in relation to the time of day and days of the week. To create a random data collection schedule and reduce schedule related bias, an online random list generator was utilized. All available times, split into three categories A.M. (9:30 a.m. to 11:00 a.m.), midday (11:00 a.m. to 1:30 p.m.), and P.M. (1:30 p.m. to 4:00 p.m.) and days of the week (Sunday to Saturday). Based on this randomized list, a schedule of days and times for survey data collection was devised. This schedule was followed exactly and ensured the most accurate representation of visitors to the Aquarium possible.

A paper survey was distributed to three groups of participants:

- Group 1: Entering- Individuals entering the aquarium before receiving any education from the aquarium
- Group 2: Exiting- Individuals leaving the aquarium after receiving education from the aquarium
- Group 3: Non visitors- Individuals outside of the aquarium not receiving information from the aquarium

Randomization was achieved for each of the groups by approaching every fifth adult (18 years or older) individual encountered to ask if he or she was willing to participate in the survey. If the person agreed to participate, he or she was provided with an informed consent document which explained that participating in the survey was voluntary and all data would be anonymous. Then the survey was provided. Each survey was labeled with group, date, and time to distinguish between surveys. The survey and research did not discriminate based on race, ethnicity, or gender.

Data were collected from 151 completed surveys; there were 53 in sample Group 1 (Entering), 53 in sample Group 2 (Exiting), and 45 in sample Group 3 (Non-visitors).

Thirty-two people who were approached to participate did not want to participate. Many of those who did participate had a very positive response to the survey questions, and what they survey intended to measure.

Analysis of Data

The hypothesis was tested quantitatively using various statistical tests. Analysis of frequency statistics were used to describe the sample groups. One-way ANOVA tests were used to identify and significant differences between the sample groups, and a stepwise regression was used to determine which factors reflect the most overall significance and contribution to one's level of policy support. In addition, certain questions were selected for further analysis of their relationship to the hypothesis and

research questions and the ability to provide more substantial evidence for the acceptance or rejection of the hypothesis.

Chapter 4

Results

Introduction

In this chapter, the data analysis process and study findings are described. Responses to the survey were analyzed using SPSS, a Windows-based statistics program. Analyses explored data for the total participant sample group and between sample sub-groups. In addition, data were compared to U.S. Census Bureau Population Census Data as appropriated to determine if the sample was representative of the population at large.

This study was carried out based on the hypothesis that participants would display a more positive attitude and higher level of support for habitat restoration projects within Rhode Island after visiting the Save the Bay Exploration Center and Aquarium. It was hypothesized that this would be due to an increased level of knowledge about habitat destruction and the marine environments in Rhode Island waters. The data indicate that although knowledge of the marine environment is a factor that affects an individual's level of policy support, it is not the highest contributing factor. Rather, two more important factors; New Ecological Paradigm (NEP) and previous visits to the aquarium, were identified as having greater influence on the level of policy support displayed by participants.

Demographics

Descriptive statistics were carried out for participant demographics using frequency testing to determine how often any given response occurs. To compare the three sub-groups to one another, a one-way ANOVA was used to determine any statistically significant differences, with post-hoc tests to determine the specific differences between groups. Table 1 provides the demographic data.

Gender

In all sub-groups more participants were female. The ANOVA and Bonferroni post-hoc test determines that all groups are similar in terms of gender split.

Age

The mean age for the total sample was 38.74 years old. The mean age is similar to the mean age reported by the U.S. Census Bureau data (mean 37.3 years). Thus, the average age of the study participants is representative of the national population.

There was a significant difference in age across the Entering group (mean= 38.04 years), the Exiting group (mean= 41.47 years), and the Non-visitor group (mean= 36.33 years).

The mean ages for each of the subgroups were compared using a one-way ANOVA. Significant differences ($p=.05$) were found among the groups ($p= .044$). A Bonferroni post-hoc test was performed to further explore significant differences. This revealed that there is a significant difference (5.14 years) between the Group 2: Exiting and Group 3: Non-visitor groups.

Residency

A larger number of respondents were residents of Rhode Island (62.9%), while the remainder were non-residents (37.1%). Even though Group 1: Entering had more non-residents than in either of the other two groups, no significant difference between groups was found when the ANOVA and Bonferroni post-hoc tests were carried out. Therefore all groups were similar in terms of the residency.

Education Level

The majority of all respondents reported having a college level education (47.0%). Similar results were seen in Group 3: Non- visitors (51.1%). However, in Group 1: Entering and Group 2: Exiting groups, the majority of respondents indicated that they had a “graduate school” level education. None of the participants reported “middle school” level education as their highest level of education.

A one-way ANOVA was performed to determine if there were significant differences in the education levels of the three sub-groups. Significant differences ($p=.05$) were found among groups for education level ($p < .001$). A Bonferroni post-hoc test was performed to further explore the significant differences. This revealed that there is a significant difference between the Group 1: Entering and Non-visitor groups ($p = .000$) and Group 2: Exiting and Group 3: Non-visitor ($p = .003$). Group 3: Non-visitors tended to have lower levels of education than participants in the other two groups.

Income level

The majority of all study participants reported having a household income between \$75,000 and \$99,999. Participants in Group 1: Entering (43.4%) also most frequently reported this level of income. However, in Group 2: Exiting, 17 respondents (32.1%) reported a household income of \$50,000 to \$74,999, and only 17 respondents (32.1%) reported household incomes of \$75,000 to \$99,999. In Group 3: Non-visitors a majority (33.3%) reported having a household income between \$50,000 and \$74,999. The majority of participants reported higher household incomes than National Census Bureau average household income data (\$53,046).

A one-way ANOVA was performed to determine if there were significant differences between the three groups for household income. Significant differences ($p=.05$) were found among groups ($p=.001$). A Bonferroni post-hoc test was performed to further explore significant differences. This revealed that there were significant difference between all groups, Group 1: Entering and Group 3: Non-visitor ($p=.001$) and Group 2: Exiting and Group 3: Non-visitor ($p=.011$) with Group 1: Entering and Group 2: Exiting groups being higher than Group 3: Non-visitors.

Overall, analysis of the three groups sampled reveals aquarium visitors are older, wealthier, and better educated than the Non-visitor sample group. The total sample is similar to the general U.S. population in age, but with higher incomes.

Table 1: Demographics

	Entering n = 53	Exiting n = 53	Non visitors n = 45	Total sample n = 151	U.S. Population
GENDER					
Male	18 (34.0%)	20 (37.7%)	12 (26.7%)	50 (33.1%)	
Female	35 (66.0%)	33 (62.3%)	33 (73.3%)	101 (66.9%)	
AGE*					
Min-Max (mean)	23-72 (38.04)	19-71 (41.47) ^a	19-60 (36.33) ^a	19-72 (38.74)	37.3
RI RESIDENCY					
Resident	30 (56.6%)	35 (66.0%)	30 (66.7%)	95 (62.9%)	
Nonresident	23 (43.45%)	18 (34.0%)	15 (33.3%)	56 (37.1%)	
Education level*^b					
Middle School	0	0	0	0	
High School	1 (1.9%)	2 (3.8%)	10 (22.2%)	13 (8.6%)	
College	23 (43.4%)	25 (47.2%)	23 (51.1%)	71 (47.0%)	
Graduate School	29 (54.7%)	26 (49.1%)	12 (26.7%)	67 (44.4%)	
Income*^b	n = 52				
Less than \$24,999	2 (3.8%)	1 (1.9%)	10 (22.2%)	13 (8.6%)	
\$25,000-\$49,999	2 (3.8%)	5 (9.4%)	2 (4.4%)	9 (6.0%)	
\$50,000-\$74,999	12 (22.6%)	17 (32.1%)	15 (33.3%)	44 (29.1%)	\$53,046
\$75,000-\$99,999	23 (43.4%)	17 (32.1%)	14 (31.1%)	54 (35.8%)	
More than \$100,000	13 (24.5%)	12 (22.6%)	4 (8.9%)	29 (19.2%)	

* ANOVA shows difference among groups at $p < .05$

^a Bonferroni post-hoc test shows difference at $p < .05$

^b Bonferroni post-hoc test shows differences between Entering and Non-visitor groups and Exiting and Non-visitor groups at $p < .05$

Coastal and Similar Establishment Visits

Participants were asked to report how often they visit coastal regions for recreation each year, how often they visit similar establishments each year, and whether or not they have visited the Save the Bay's Aquarium.

Table 2 displays frequency data related to coastal visits. In each of the sub-groups the majority reported visiting coastal regions more than 10 times a year. Successively smaller numbers of respondents reported visiting coastal regions with less frequency. The ANOVA and Bonferroni post-hoc tests revealed that all groups are similar.

Study participants report visiting “similar establishments” less often. In Group 1: Entering (47.2%) and Group 2: Exiting (47.2%) sub-groups the majority reported visiting similar establishments 4 to 7 times a year, while the majority (46.7%) of Group 3: Non-visitor reported visiting similar establishments 0 to 3 times a year. No respondents in Group 1: Entering reported visiting similar establishments more than 10 times a year.

A one-way ANOVA was performed to determine if there were significant differences between the three groups for how often they visit similar establishments each year. Significant differences ($p=.05$) were found among groups ($p=.026$). A Bonferroni post-hoc test was performed to further explore significant differences. This revealed that there is a significant difference ($p=.027$) between Group 2: Exiting and Group 3: Non-visitor, with Group 2: Exiting being more likely to visit informal education facilities more frequently.

Table 2: Visits per year

Response ^{*a}	Entering n= 53	Exiting n= 53	Non visitors n= 45	Total sample n= 151
0-3 times				
Visit coastal regions	1 (1.9%)	2 (3.8%)	1 (2.2%)	4 (2.6%)
Visit similar establishments	9 (17.0%)	9 (17.0%)	21 (46.7%)	39 (25.8%)
4-7 times				
Visit coastal regions	9 (17.0%)	6 (11.3%)	8 (17.8%)	23 (15.2%)
Visit similar establishments	25 (47.2%)	25 (47.2%)	13 (28.9%)	63 (41.7%)
8-10 times				
Visit coastal regions	9 (17.0%)	9 (17.0%)	9 (20.0%)	27 (17.9%)
Visit similar establishments	19 (35.8%)	13 (24.5)	8 (17.8%)	40 (26.5%)
More than 10 times				
Visit coastal regions	34 (64.2%)	36 (67.9%)	27 (60.0%)	97 (64.2%)
Visit similar establishments	0	6 (11.3%)	3 (6.7%)	9 (6.0%)

* ANOVA shows difference for “visit similar establishments” at $p < .05$

^a Bonferroni post-hoc test shows difference between Exiting and Non- visitor groups for “visiting similar establishments” at $p < .05$

Aquarium Visits

Participants were asked if they had been to the Save the Bay Aquarium before, answering either “yes” or “no” (Table 3). The data show that the numbers of those who had and had not visited the aquarium were similar. The very small majority (51.0%) had not been to the aquarium before. This pattern however, is not seen across the three sub-groups. Group 1: Entering has findings that are the most similar to the total sample data. In that sub-group, the majority (52.8%) had not been to the aquarium before. Group 2: Exiting data differ with the majority (64.2%) reporting that they had been to the aquarium previously. In Group 3: Non-visitor a larger majority (66.7%) reported never having been to the aquarium before.

A one-way ANOVA was performed to determine if there were significant differences between the three groups in visitation of the aquarium per year. Significant

differences ($p=.05$) were found among groups ($p= .009$). A Bonferroni post-hoc test was performed to further explore significant differences. This revealed that there is a significant difference ($p= .007$) between Group 2: Exiting and Group 3: Non-visitor. Group 2: Exiting group had significantly more participants who had visited the aquarium previously compared to the other two sub-groups.

Table 3: Visitors to the aquarium

Response	Entering n= 53	Exiting* n= 53	Non visitors* n= 45	Total sample n= 151
Yes	25 (47.2%)	34 (64.2%)	15 (33.3%)	74 (49.0%)
No	28 (52.8%)	19 (35.8%)	30 (66.7%)	77 (51.0%)

* ANOVA shows differences among groups at $p< .05$. Bonferroni post-hoc test shows difference at $p< .05$.

New Ecological Paradigm (NEP)

Frequency tests with means and standard deviations were completed to determine differences in environmental worldviews among groups. Data are reported in Table 4. When the data related to environmental beliefs and values were analyzed, the data show that the entire sample population has a higher than neutral stance on environmental worldviews. The data show that Group 2: Exiting had the highest mean NEP score (3.916) when compared to the two other sub-groups. However, a one-way ANOVA among the three groups shows that there is no significant difference between them ($p=.122$) in terms of how highly participants value the environment. Overall, the data suggests that among all groups, participants have similar environmental worldviews.

Table 4: New Ecological Paradigm

Entering n= 53	Exiting n= 53	Non visitors n= 45	Total sample n= 151
3.666 (.832)	3.916 (.943)	3.555 (.887)	3.72 (.895)

Policy Support

Participants' levels of support for policies proposed in Rhode Island last year to protect and restore the marine environment in Narragansett Bay were collected. Levels of support (Likert scale data) are reported in Table 5. The data indicate that overall, participants have a high level of policy support for all statements, with the highest values for answers being between the 3-5 range. The total sample tended to respond "3- Neutral" for all proposed policies. Similar results can be observed in Group 1: Entering group where the majority selected "3- Neutral" for all statements, except for the statement on dune grasses. Statement Four on planting native dune grass to reestablish coastal sand dune habitats, had the majority select "4- Support". Group: 2 Exiting reported higher levels of support for the policies presented. For each of the statements the majority selected "5- Strongly Support". It is important to note that for this group, statement five, related to community based restoration, did not have a clear majority. Selections "4- Support" and "5- Strongly Support" were equal at 32.1% each. Group 3: Non-visitors results are the same as those of the total sample population, with the majority selecting "3- Neutral" for each statement. No participants in either Group 2: Exiting or Group 3: Non-visitor selected "1- Strongly Oppose" for any statement.

Table 5: Policy (frequencies)

Policy	Level of Support*	Entering n= 53	Exiting n= 53	Non visitors n= 45	Total sample n= 151
2.1 Require cesspools to be replaced within one year of the transfer of a property.	1	2 (3.8%)	0	0	2 (1.3%)
	2	6 (11.3%)	4 (7.5%)	8 (17.8%)	18 (11.9%)
	3	19 (35.8%)	17 (32.1%)	21 (46.7%)	57 (37.7%)
	4	18 (34.0%)	13 (24.5%)	6 (13.3%)	37 (24.5%)
	5	8 (15.1%)	19 (35.8%)	10 (22.2%)	37 (24.5%)
2.2 Establish a statewide wetland and septic system regulation task force that would review state regulations and make recommendations for local protection.	1	2 (3.8%)	0	0	2 (1.3%)
	2	2 (3.8%)	4 (7.5%)	6 (13.3%)	12 (7.9%)
	3	21 (39.6%)	14 (26.4%)	19 (42.2%)	54 (35.8%)
	4	18 (34.0%)	10 (18.9%)	9 (20.0%)	37 (24.5%)
	5	10 (18.9%)	25 (47.2%)	11 (24.4%)	46 (30.5%)
2.3 Remove dams to ensure the natural flow of water and passage of fish for spawning.	1	2 (3.8%)	0	0	2 (1.3%)
	2	2 (3.8%)	3 (5.7%)	5 (11.1%)	10 (6.6%)
	3	25 (47.2%)	17 (32.1%)	25 (55.6%)	67 (44.4%)
	4	13 (24.5%)	12 (22.6%)	2 (4.4%)	27 (17.9%)
	5	11 (20.8%)	21 (39.6%)	13 (28.9%)	45 (29.8%)
2.4 Plant native dune grass to reestablish coastal sand dune habitats.	1	1 (1.9%)	0	0	1 (.7%)
	2	4 (7.5%)	4 (7.5%)	6 (13.3%)	14 (9.3%)
	3	17 (32.1%)	14 (26.4%)	22 (48.9%)	53 (35.1%)
	4	20 (37.7%)	12 (22.6%)	4 (8.9%)	36 (23.8%)
	5	11 (20.8%)	23 (43.4%)	13 (28.9%)	47 (31.1%)
2.5 Establish a community- based restoration program, where members of the community work to remove marine debris and restore habitats.	1	2 (3.8%)	0	0	2 (1.3%)
	2	2 (3.8%)	5 (9.4%)	10 (22.2%)	17 (11.3%)
	3	23 (43.4%)	14 (26.4%)	17 (37.8%)	54 (35.8%)
	4	13 (24.5%)	17 (32.1%)	8 (17.8%)	38 (25.2%)
	5	13 (24.5%)	17 (32.1%)	10 (22.2%)	40 (26.5%)

*1 = Strongly Oppose, 2 = Oppose, 3 = Neutral, 4 = Support, 5 = Strongly Support

Table 6 provides mean and standard deviation information for group comparisons of levels of support for each of the five policy statements. The data indicate that Group 2: Exiting ratings each of the proposed policies were higher than those of Group 1: Entering and Group 3: Non-visitors.

A one-way ANOVA was performed to determine if there were significant differences between the three groups in terms of how strongly they oppose or support each of the given policy statements. Significant differences were found among groups for policy statements 2.1, 2.2, 2.3, and 2.4. A Bonferroni post-hoc test was performed to further explore significant differences. This revealed that there is a significant difference between Group 2: Exiting and Group 3: Non-visitor in relation to support for policy statements on cesspools ($p = .056$) and septic systems ($p = .044$). The data suggest that Group 2: Exiting has a significantly higher rating (support) for the policies on cesspool and septic system regulations. The one-way ANOVA shows that the statement on dam removal shows a significance of $p = .043$. However, the post-hoc test notes no significant differences among groups. The three groups also differed in their level of support for policy statement on planting native dune grasses however, this difference was not significant ($p = .056$). Although significant differences were not found in this study, it is possible that with larger sample groups, the trend may continue and could be seen as significant. Overall, the data suggest that Group 2: Exiting has the highest level of policy support for all proposed policies compared to the other sub groups.

In addition to the frequency data analysis, average mean scores were calculated for each group to be used as the “Policy” factor ($p = .033$) in the subsequent regression analyses explained later in this chapter.

Table 6: Policy (means and standard deviations)

Policy	Entering n= 53	Exiting n= 53	Non visitors n= 45	Total sample n= 151
2.1 Require cesspools to be replaced within one year of the transfer of a property.*	3.45 (1.011)	3.89 (.993) ^b	3.40 (1.031) ^b	3.59 (1.028)
2.2 Establish a statewide wetland and septic system regulation task force that would review state regulations and make recommendations for local protection.*	3.60 (.968)	4.06 (1.027) ^a	3.56 (1.013) ^a	3.75 (1.021)
2.3 Remove dams to ensure the natural flow of water and passage of fish for spawning.*	3.55 (.992)	3.96 (.980)	3.51 (1.036)	3.68 (1.016)
2.4 Plant native dune grass to reestablish coastal sand dune habitats.*	3.68 (.956)	4.02 (1.009) ^b	3.53 (1.057) ^b	3.75 (1.020)
2.5 Establish a community-based restoration program, where members of the community work to remove marine debris (i.e. plastic bags, soda cans, bottles, fishing line etc.) and restore habitats.	3.62 (1.023)	3.87 (.981)	3.40 (1.074)	3.64 (1.035)
Average mean	3.58	3.96	3.48	3.68

*ANOVA shows difference among groups at $p < .05$

^a Bonferroni post-hoc test shows difference at $p < .05$

^b Significance $p = .056$

Knowledge

The data collected about participants' knowledge of specific marine information were explored (Table 7). In general, the data show that survey participants have a high level of knowledge about the marine environment. Overall, the total sample population had the majority of correct answers for each question asked, yet the numbers of incorrect responses varied for each question. The same pattern can be seen in Group 1:

Entering and Group 2: Exiting, with the majority giving correct responses for each question. In contrast, Group 3: Non-visitor had a majority of correct responses for question #2, and more incorrect responses for the remaining questions. It is clear that across all three groups, there existed a high level of understanding of what an eelgrass bed is. Both Group 1: Entering and Group 2: Exiting displayed high levels of understanding of what an estuary is, and what an invasive species is. There is slightly more uncertainty in Group 3: Non-visitor about what an estuary is and what an invasive species is. However, there is uncertainty among all groups as to what a salt marsh is. The total number of correct responses answers served as the “Knowledge” factor in the subsequent regression analyses. Overall, more participants in Group 1: Entering and Group 2: Exiting were more knowledgeable about the marine environment than those in Group 3: Non-visitor.

Table 7: Knowledge

Question	Answer	Entering n= 53	Exiting n= 53	Non visitors n= 45	Total sample n= 151
What is an estuary?	Correct	28 (52.8%)	30 (56.6%)	16 (35.6%)	74 (49.0%)
	Incorrect	25 (47.2%)	23 (43.4%)	29 (64.5%)	77 (51.0%)
What are eelgrass beds?	Correct	27 (50.9%)	39 (73.6%)	29 (64.4%)	95 (62.9%)
	Incorrect	26 (49.0%)	14 (26.4%)	16 (35.6%)	56 (37.1%)
What are salt marshes?	Correct	25 (47.2%)	26 (49.1%)	14 (31.1%)	65 (43.0%)
	Incorrect	28 (52.9%)	27 (51.0%)	31 (68.9%)	86 (57.0%)
What is an invasive species?	Correct	26 (49.1%)	39 (73.6%)	17 (37.8%)	107 (70.9%)
	Incorrect	27 (50.9%)	14 (26.4%)	28 (62.3%)	43 (28.5%)
Average Number of Correct Responses		49.75%	63%	42.15%	56.45%

Policy Regression

In the final stage of data analysis a stepwise regression was carried out. This method was used to analyze which factors have a significant contribution to the level of policy support in each group. To begin, a factor analysis using principle component analysis and a reliability test using Cronbach's alpha were performed on NEP and policy questions (Table 8). The factor analysis determined that each could be used as a single variable ("NEP" and "Policy") in the regression. The reliability test reveals that each new factor has a high reliability.

Table 8: Factor analysis and reliability

Factor	Loading	Total	% of variance	α
Policy		4.529	90.586	.974
Cesspools	.950			
Septic systems	.970			
Dams	.931			
Dunes	.962			
Restoration	.946			
NEP		6.919	76.876	.961
Humans have the right to modify the natural environment to suit their needs.	.832			
When humans interfere with nature, it often produces disastrous consequences.	.926			
Humans are severely abusing the earth.	.930			
Plants and animals have as much right as humans to exist.	.921			
The balance of nature is strong enough to cope with the impacts of modern industrial nations.	.632			
Despite our special abilities, humans are still subject to the laws of nature.	.935			
Humans were meant to rule over the rest of nature.	.806			
The balance of nature is very delicate and easy to upset.	.929			
If things continue on their resent course, we will soon experience a major environmental catastrophe.	.933			

Once factors were determined, the stepwise regression was carried out to create a predictive model by successively adding or removing variables. Using a step-wise regression allows for analysis and identification of which factors hold the most significance when it comes to level of policy support. Based on R-square, R-square change, and Significant F change values, the regression indicates that the initial five steps add significant explanatory power to the model (Table 9). Adding the sample group (Entering, Exiting, or Non-visitor) (Step 6) did not contribute a significant amount of explanatory power to the model. Therefore, the sample groups were removed from the final model (Table 10). The model explains nearly 84 percent of variation in policy support (R-square= .842).

Table 9: Policy regression models

Added variables	R square	R square change	Sig. F change
Step 1: (constant) Gender Income Education level Age	.121	.121	.001
Step 2: Residency Visit coastal areas	.195	.073	.002
Step 3: Visited Save the Bay Similar establishments	.359	.164	<.001
Step 4: Knowledge	.417	.056	<.001
Step 5: NEP	.842	.428	<.001
Step 6: Coming Going	.845	.003	.285

Table 10 provides in depth information about the values derived from the five-step model. The data indicate that the two most significant factors are NEP and previous visits to the Save the Bay Aquarium. This model indicates that people with a high NEP and those that have not been to the aquarium tend to support policy more highly than those with lower NEP and visitation scores. NEP in this model is the greatest predictor for policy support by a large margin ($B=.836$). When NEP is removed, then knowledge becomes a significant predictor (Table 11). These factors have the most significant weight in predicting one's attitudes toward policy. No significance was noted for the three different sample groups (Step 6). The entire regression can be viewed in APPENDIX I.

Table 10: Best model (Model 5)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
5 (constant)	.082	.318		.258	.797
Gender	-.059	.069	-.039	-.854	.395
Income	.047	.072	.023	.657	.512
Education level	.003	.004	.031	.805	.422
Age	-.004	.044	-.005	-.099	.922
Residency	.135	.089	.067	1.522	.130
Visit coastal areas	.018	.048	.015	.375	.708
Visited Save the Bay	-.168	.088	-.086	-1.914	.058
Similar establishments	.070	.052	.061	1.341	.182
Knowledge	.048	.029	.062	1.637	.104
NEP	.916	.048	.836	19.211	.000

Table 11: Model 4 for Policy Regression

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
4 (constant)	2.955	.538		5.491	.000
Gender	-.135	.133	-.088	-1.017	.311
Income	-.056	.138	-.027	-.404	.687
Education level	.008	.007	.085	1.139	.257
Age	.011	.085	.012	.126	.900
Residency	.043	.171	.021	.253	.800
Visit coastal areas	.024	.092	.020	.264	.792
Visited Save the Bay	-.638	.162	-.326	-3.935	.000
Similar establishments	.311	.097	.274	3.223	.002
Knowledge	.195	.054	.254	3.614	.000

Knowledge Regression

To better understand the role of knowledge in the previous regression, a second step-wise regression was carried out to create a predictive model, with “Knowledge” as the dependent variable. Based on R-square, R-square change, and Significant F change values, the regression indicates that all steps add significant explanatory power to the model (Table 12). Adding the variables of visiting coastal regions and visiting Save the Bay before did not contribute a significant amount of explanatory power to the model. Therefore, these factors were removed (Table 13).

Table 12: Knowledge regression models

Added variables	R square	R square change	Sig. F change
Step 1: (constant) Gender Income Education level Age	.050	.050	.117
Step 2: Residency Visit coastal areas	.120	.069	.005
Step 3: NEP	.155	.076	<.001
Step 4: Coming Going	.180	.035	.048

Table 13 provides in-depth information about the values derived from the four-step model. The data indicate that the two most significant factors are NEP and visiting the aquarium. NEP has the largest effect on knowledge level ($B = .285$). Visiting the aquarium does, in fact, increase knowledge. This model indicates that people with high NEP scores and those leaving the aquarium tend to have a greater knowledge of the marine environment than those with lower NEP scores, those entering the aquarium, or non-visitors. These factors have the most significant weight in predicting one's knowledge level. The entire regression can be viewed in APPENDIX J.

Table 13: Model 4 for Knowledge Regression

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
4 (constant)	-.405	.801		-.506	.614
Education level	.173	.201	.086	.861	.391
Gender	-.034	.209	-.013	-.165	.869
Age	-.005	.011	-.043	-.496	.620
Income	.038	.121	.033	.313	.755
Visit coastal areas	.098	.136	.064	.723	.471
Residency	-.366	.239	-.138	-1.528	.129
NEP	.408	.121	.285	3.357	.001
Coming	.178	.257	.066	.692	.490
Going	.594	.251	.221	2.368	.019

Chapter 5

Discussion and Conclusion

Introduction

As described through the literature and global statistics, it is clear that the marine environment has been increasingly subject to the stresses of human activity. This has been the case in Narragansett Bay, where these trends have been observed first hand. Although an increase in human presence may be beneficial for the local economy, the impact that humans have had on the marine environment has been detrimental. To support growing communities, roads, bridges, dams, buildings, and hardened structures, such as sea walls, have been built which has slowly destroyed the surrounding marine environments. These marine environments provide many benefits, and their destruction is a prominent issue for those interested in the health of Narragansett Bay. To protect and restore these habitats, the state of Rhode Island has proposed a variety of policies to address these issues. However, to be successful in getting these policies passed and implemented it is important for policies and policy makers to have the support of all stakeholders, including the public. This support tends to be lacking. There are a number of reasons why this may be, but one discussed in the literature is the use of environmental education. Environmental education is known to have significant impacts on the attitudes and behaviors of individuals. Institutions, such as Save the Bay, have implemented education-based strategies in hopes that the education they provide will have an impact on the visitors' attitudes and behaviors, so

that visitors become more knowledgeable and therefore, more supportive of such policies in Rhode Island.

This study focused on the effects of environmental education provided at the Save the Bay Aquarium and the potential it has to change the public's attitudes toward marine policy, and explored other factors that might influence policy support.

Sample Population

To gain a better sense of the potential factors that affect how one feels toward policy, it was important to understand the population in terms of demographics. Each of the proceeding sections provides a further explanation of factors contributing to policy support.

Age and Education Level

Overall, it looks like each of the sub-groups represents the mean age according to the U.S. Census Bureau. However, a significant difference in age (5.14 years) between the Exiting and Non-visitor groups, with the Exiting group being higher, can be explained by the fact that beach visitors tend to be younger, without families, a demographic that is observed less in the aquarium. Those that visit the aquarium are slightly older; this is most likely because aquarium visitors are families with children. The differences in education level between groups is attributed to the age of the members in each group, with non-visitors having the lowest education level directly explained by the younger demographic.

Income and Visiting Similar Establishments

The majority of participants earned a significantly higher level of income compared to the national census data, explained by the cost of living in the Northeast and the nature of Newport as a tourist destination. Significant differences between the Non-visitor group and the other two groups, show that those visiting the aquarium had a higher income than non-visitors. It is understood that those with more money are willing to spend it on experiences, such as visiting the aquarium, which might explain the differences between groups when it comes to how often participants visit similar establishments. Higher income has also been correlated with pro-environmental attitudes and behaviors (Hanemann, 1984; Kotchen, 2000), which could lead to those with a high income to be more inclined to visit aquariums and similar establishments.

Previous Visits to Save the Bay

The small majority of all participants said that they had not been to the aquarium before. However, this pattern is not observed across all groups, only the Exiting group had the majority of people say that they had visited previously. This is attributed to the fact that many participants were Rhode Island residents, making the aquarium more accessible to them. Via the guest tracking system at Save the Bay, many visitors are members of Save the Bay, implying that they tend to visit the aquarium often. In the other groups the majority had not been to the aquarium before, which is explained by the fact they may not have been aware of the aquarium previously, due to a lack of advertising.

Other Demographics

There were no significant differences among groups in terms of gender, residency, and how often they visit coastal regions. However, the data for how often they visit coastal regions may be slightly skewed given the fact that the aquarium is located on the beach, so participants are biased in the regard. This was one limitation discussed during the study design process when deciding how to obtain a control group. This potentially eliminates those that do not visit coastal regions altering the overall data. But, when it came to designing this study, this was the best option for recruiting respondents. When it comes to gender, all groups are similar, with the majority of respondents being female. From personal experience, the majority of visitors coming into the aquarium are mothers with children. This automatically skews the data to have more female respondents. This may also be explained by the fact that the majority of participants who agreed to take the survey were female, the majority of those that declined to take the survey were male. It is important to note that females also tend to have more pro-environmental attitudes than men (Stern et. al., 1993; Mohai, 1992) potentially increasing the number of female participants.

Policy support

Overall, the majority of participants displayed a high level of policy support (3.68); in other words, they are in favor of implementing policies that improve and protect the local marine ecosystem. The group exiting showed the highest level of policy support. The high scores represented by the Exiting group may be directly related to group characteristics including their NEP scores, which is known to be a significant

factor in policy support. It may also be attributed to the information and interactions that they had and experienced while visiting the aquarium.

Research questions

Identify environmental beliefs

Based on the literature, it is known that environmental worldviews, have the potential to influence how strongly one supports or opposes policy. The group exiting the aquarium had a higher ecological mindset. This could be the result of having just left the aquarium. By visiting the aquarium, there is the potential that being in that atmosphere caused them to think about their environmental beliefs and values, making them more salient and causing them to rate the provided statements higher. The second highest scoring group is the group entering the aquarium. This may be a correlated to visiting the aquarium, since they may already have a higher appreciation for the environment and its health, thus, resulting in higher NEP scores. The Non-visitor group scored the lowest in the NEP category. They may have less concern for the health of the environment and may be less aware of human impacts than those visiting the aquarium or similar establishments. It is interesting to note however, that all of the mean scores were above “3- Neutral,” showing that all three sub-groups believe in an ecological worldview and that humans can impact the environment. The high NEP scores among all groups can be explained by the fact that all participants were experiencing the environment in one way or another, whether it was visiting the aquarium and having a hands-on experience, or visiting the beach for recreation. This

data may have been different if the control group (Non-visitors) was not surveyed at the beach, and instead at a different location.

Measuring knowledge levels of the subjects

The data show that the majority of people answered the multiple choice questions about the environment correctly. This demonstrates that the people taking the survey have a relatively good understanding of the marine environment and its processes. It is clear that the non-visitors had less people answer correctly for each question. This could be attributed to the fact that they have not received the proper education about the local marine environment or they are not as interested in the subject matter. The responses from the Exiting group were as expected, with a consistent trend for each question, with the majority of the group answering correctly, while the remaining respondents answered incorrectly. This was expected because those that answered correctly may have been to the aquarium before and knew the information or they may have already had an interest in the subject matter, this is an area for future studies. One potential limitation is that some participants were doing the survey on their way out of the aquarium; they may have had prior obligations or were ready to leave, so they may not have read the survey thoroughly thus, answering more questions incorrectly. It was expected that it would be difficult to get individuals to participate or answer the questions honestly based on the fact that they were done with their experience and ready to leave. It can be implied that the rest of the participants answered incorrectly simply based on the fact that they have not received any of the education provided in the aquarium yet if they are new visitors. The Entering group

tended to score lower than expected. In most cases, the majority of people answered correctly, however, when you look at the numbers for how many people answered incorrectly, the numbers are higher than expected. This may be explained by the fact that they have not yet received the education provided through the aquarium resulting in incorrect answers. However, those who answered correctly may have learned the information from another source or just from their own inquiry.

What factors determine the public's level of support toward proposed habitat restoration and protection projects and policies in Rhode Island?

To determine all of the factors that carried the most weight when it comes to policy support, a stepwise regression was carried out. The regression determined that adding the group conditions (Entering, Exiting, Non-visitor) did not add significant explanatory power to the model. Holding a number of variables constant, the model revealed two variables to be significant independent predictors of policy support. NEP carried the greatest weight by far for reasons mentioned previously. Visiting the aquarium previously held the least amount of weight. Although the significance was higher than $p=.05$, the significance factor is close enough to assume that if there were more responses in each group, the factor may hold a higher significance value. This factor (not having visited the aquarium before) is an inverse factor for policy support. This may have been due to the fact that survey participants were 18 years old or older. At this point, it is common for adults to have decisions, values, and beliefs already determined. It is difficult to change or alter those pre-determined thoughts in adults.

Having access to only adults was one limitation of the study. This limits the ability to see if the education program does in fact have an effect on attitudes.

Adding the group condition to the model did not contribute significant explanatory power to the model. This is interesting because the separate comparison of means for the policy items and an overage policy rating revealed significant differences between the Exiting visitors and Non- visitors. It is possible that differences in environmental worldview, as measured by the NEP, account for the differences from the group, and that when these are held constant, aquarium visitation has no experience. However, there is potential that if there were more respondents in each group, the influence of aquarium visitation may be determined to be statistically significant.

Another area of interest is in step four of the regression. Before NEP is added to the model, knowledge becomes the most significant factor. However, this is overpowered by NEP when it is added in step five of the regression. To further explore the knowledge factor and its contribution to policy support, a second step-wise regression was carried out. The results show that NEP and visiting the aquarium are significant factors in one's level of knowledge. NEP may be a contributing factor to knowledge of the marine environment because it can be expected that one that has a high ecological worldview would be interested in learning more about the subject or visiting the aquarium. The most important piece of information, when it comes to this research, provided by this regression is that attending the aquarium does increase knowledge. This reaffirms that the information provided at the aquarium and attending

environmental education programs does, in fact, increase knowledge. With this increased knowledge comes higher NEP, which as discussed, is the leading factor for policy support. Therefore, it can be assumed, that although attending environmental education programs or visiting the aquarium is not the leading factor, these factors have an underlying contribution and provide a basis for higher levels of policy support.

Policy Implications

The study is directly related to local marine policy in Rhode Island because it brings to light the reasons why the public may think and act when it comes to supporting or opposing local policy. For policy to be approved, passed, and successfully implemented it is vital for policy makers to have support from all stakeholders, including the public. With higher levels of public support, more people will vote to pass policy, and it is likely that people are more likely to follow the law, thus, ensuring the success of the policy once it was implemented. To gain this support, it is important for policy makers to understand what factors are important to support. A better understanding allows policy makers to more carefully target specific demographic groups (such as younger people), design new or improved education programs, design new ways to educate the public (public hearings and meeting, pamphlets, etc.), and open lines of communication between policy makers and the public. When it comes to designing and presenting and given policy, these improvements will result in higher levels of support, thus reducing opposition.

The regression shows that NEP is the greatest factor when it comes to policy support. Knowing this, policy makers can better target those values, beliefs, norms,

attitudes, and demographics to gain support. The hope is that with higher levels of support from the public, more policies will be passed, lines of communication will be opened, policy will be implemented and followed successfully, and the health of Narragansett Bay will be improved.

Benefits to Save the Bay

This research is location specific to the education program at the Save the Bay Aquarium. However, this research can be modified and applied to other institutions. Performing this research is not only beneficial to policy makers, but also to Save the Bay. Save the Bay can use this new information to evaluate and improve their programs. This data provides them with information about demographic groups they should target, as well as information about how best to present data and information. The data from this study show that many of the people on the beach outside, or in other areas of Rhode Island lack information that might help Save the Bay and their policy initiatives. Knowing this allows them to improve advertising and improve exhibits to draw in more members of the public. The use of the information related to the “knowledge” factor described in this study is also very beneficial. The overall goal of the aquarium is to successfully educate the public about the local marine life, the issues threatening marine environments, and to teach the public how they can help improve marine environments. However, the data show that visiting the aquarium does not add any significant explanatory power to policy support. This could mean that visiting the aquarium has little influence on the level of policy support in adults. This means or gives the aquarium a reason to focus their efforts on building environmental worldviews in

children. However, it is fair to say that it may be beneficial for them to focus on building an environmental worldview and policy support in adults. This information can be used at the aquarium to improve existing exhibits, to create new exhibits, and provide the information that coincides with their goals, all targeted to all types of visitors.

Conclusion

The results of this study suggest that one's knowledge of marine issues, previous visits to the aquarium, and personal values and beliefs about the environment are the most significant factors when it comes to the public supporting policy to improve Narragansett Bay. Although this study presents data that provides a better understanding about how people think and act when it comes to policy support, this is a preliminary study. The results of this study do however suggest that further studies would be helpful in creating new policies, understanding the public's thought processes, and gaining public support for important environmental initiatives. The results of this study suggest that further research would be helpful for creating new policies and gaining public support. Subsequent studies of this nature conducted in Rhode Island should be designed to analyze behavioral effects of environmental education in before (pre) and after (post) situations. These studies might explore how environmental education affects children's environmental beliefs, values, and behaviors, and the potential effects of marine policy on the public. It may also be beneficial for the aquarium to ask the visitors what draws them to visit the aquarium, if they are aware of marine issues and policy in Rhode Island, and how they can target the public more successfully.

This study revealed a high level of policy support among respondents. This support, however, it is not directly correlated to an informal education experience, but more closely associated with environmental beliefs and values. Although data show there is policy support, they also suggest that there is still room for improvement in gaining public support. It is hoped that this study will be of use to Rhode Island policy makers and Save the Bay, but might be used by other institutions to evaluate their education programs and their role in public policy support.

APPENDIX A

Examples of coastal manmade structures

Seawall

Jetties

Groins

Breakwaters

Marinas

Docks

Coastal roads

Coastal dams

APPENDIX B

Examples of vital marine habitats

Eelgrass beds

Sand dunes

Salt marsh

APPENDIX C

Full list of NEP statements

1. We are approaching the limit of the number of people the Earth can support.
2. Humans have the right to modify the natural environment to suit their needs.
3. When humans interfere with nature it often produces disastrous consequences.
4. Human ingenuity will insure that we do not make the Earth unlivable.
5. Humans are seriously abusing the environment.
6. The Earth has plenty of natural resources if we just learn how to develop them.
7. Plants and animals have just as much right as humans to exist.
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations
9. Despite our special abilities, humans are still subject to the laws of nature.
10. The so- called “ecological crisis” facing humankind has been greatly exaggerated.
11. The Earth is like a spaceship with very limited room and resources.
12. Humans were meant to rule over the rest of nature.
13. The balance of nature is very delicate and easily upset.
14. Human will eventually learn enough about how nature works to be able to control it.
15. If things continue on their present course, we will soon experience a major ecological catastrophe.

APPENDIX D

Map of Rhode Island with towns

APPENDIX E

Map of Narragansett Bay

APPENDIX F

Narragansett Bay watershed

APPENDIX G

Study area (Easton's Beach, Newport, Rhode Island)

APPENDIX H

Publics Attitudes and Level of Support for Habitat Restoration in Narragansett Bay

Thank you for participating in this survey. **Part I** will ask you about your environmental beliefs and values. **Part II** will ask about your level of support for current and proposed habitat restoration policies and projects. **Part III** will gauge your knowledge level about the local marine environment. **Part IV** will ask you for general information about yourself. Please remember that all data is anonymous and final results are based on aggregated data.

Part I: In this section, questions will be asked to evaluate your environmental beliefs and values. How much do you agree or disagree with the following statements? Circle the one best answer. 1= strongly disagree; 2= disagree; 3= neutral; 4= agree; 5= strongly agree

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
(1.1) Humans have the right to modify the natural environment to suit their needs.	1	2	3	4	5
(1.2) When humans interfere with nature, it often produces disastrous consequences.	1	2	3	4	5
(1.3) Humans are severely abusing the earth.	1	2	3	4	5
(1.4) Plants and animals have as much right as humans to exist.	1	2	3	4	5
(1.5) The balance of nature is strong enough to cope with the impacts of modern industrial nations.	1	2	3	4	5
(1.6) Despite our special abilities, humans are still subject to the laws of nature.	1	2	3	4	5
(1.7) Humans were meant to rule over the rest of nature.	1	2	3	4	5
(1.8) The balance of nature is very delicate and easy to upset.	1	2	3	4	5
(1.9) If things continue on their present course, we will soon experience a major environmental catastrophe.	1	2	3	4	5

Part II: In this section, questions gauge your level of support for proposed and current habitat restoration projects. Habitat restoration seeks to repair areas that have been subjected to habitat destruction. How much do you oppose or support each of these policies? Please indicate your level of support by circling one answer.
1=strongly oppose; 2= oppose; 3=neutral; 4= support; 5=strongly support

	Strongly Oppose	Oppose	Neutral	Support	Strongly Support
(2.1) Require cesspools to be replaced within one year of the transfer of a property.	1	2	3	4	5
(2.2) Establish a statewide wetland and septic system regulation task force that would review state regulations and make recommendations for local protection.	1	2	3	4	5
(2.3) Remove dams to ensure the natural flow of water and passage of fish for spawning.	1	2	3	4	5
(2.4) Plant native dune grass to reestablish coastal sand dune habitats.	1	2	3	4	5
(2.5) Establish a community-based restoration program, where members of the community work to remove marine debris (i.e. plastic bags, soda cans, bottles, fishing line, etc.) and restore habitats.	1	2	3	4	5

Part III: In this section, questions will be asked that measure your knowledge on the marine environment. Each question has one correct answer. Please circle the answer you think is correct.

Note: Productivity means the rate of production of new biomass (plants, animals, nutrients, etc.) in a marine ecosystem.

(1) What is an estuary?

- a. An area where freshwater from rivers and streams flows into the ocean mixing with saltwater.
- b. An area where there is only saltwater and low productivity.
- c. An area where there is only freshwater and high productivity.
- d. An area of freshwater ponds.
- e. Do not know

(2) What are eelgrass beds?

- a. Areas that provide a vital food source for marine species
- b. Areas that provide coastal protection by reducing the impact of waves.
- c. Areas that Provide a nursery habitat for fish and shellfish.
- d. All of the above

- e. Do not know
- (3) What are salt marshes?
 - a. Productive areas that protect shorelines, keep the bay healthy, and provide a nursery for fish.
 - b. Areas that are not located near coastal areas and have low productivity.
 - c. Areas that do not serve as a vital habitat.
 - d. Productive areas that are not important to shorelines.
 - e. Do not know
- (4) What is an invasive species?
 - a. A native species living in a new location.
 - b. A non- native species that has negative effects on the marine ecosystem.
 - c. A non- native species that has positive effects on the marine ecosystem.
 - d. A native species that is beneficial to the marine ecosystem.
 - e. Do not know

Part IV: For the following questions, please provide information about yourself. Reminder: all responses will be kept confidential.

- (1) Are you a Rhode Island resident (circle one)? Yes No
 If no, in what state are you a resident?

- (2) What is the highest level of education that you have *completed* (circle one)?
 Middle School High School College Graduate School
- (3) What is your gender? _____
- (4) What is your age? _____
- (5) What was your annual household income last year (circle one)?
 Less than \$24,999 \$25,000-49,999 \$50,000-74,999 \$75,000-99,999 More than
 \$100,000
- (6) How often do you visit coastal areas for work or recreation per year?
 0-3 4-7 8-10 More than 10 times
- (7) Have you visited the Save the Bay aquarium in Newport before? Yes No
- (8) How often do you visit similar establishments per year (i.e. zoos, aquariums, museums, etc.)?
 0-3 4-7 8-10 More than 10 times

APPENDIX I

Complete policy step-wise regression

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1	(Constant)	2.332	.450	5.184	.000
	4.4	-.164	.165	-.079	.320
	4.6	.181	.092	.209	.050
	4.3	.064	.155	.042	.680
	4.5	.014	.009	.148	.098
2	(Constant)	2.189	.572	3.826	.000
	4.4	-.141	.160	-.068	.378
	4.6	.199	.091	.229	.031
	4.3	.021	.152	.014	.888
	4.5	.013	.008	.138	.108
	4.1	-.428	.179	-.211	.018
	4.7	.119	.105	.100	.260
	(Constant)	3.116	.559	5.572	.000
	4.4	-.061	.144	-.029	.672
	4.6	.017	.089	.020	.845
	4.3	-.099	.138	-.064	.476
	4.5	.008	.007	.084	.279
	4.1	-.040	.176	-.020	.821
	4.7	.043	.096	.036	.653

4	4.8	-0.674	.169	-.344	-3.994	.000
	4.9	.351	.100	.309	3.508	.001
	(Constant)	4.117	.599		6.871	.000
	4.4	-.008	.139	-.004	-.060	.952
	4.6	.015	.085	.018	.180	.857
	4.3	-.169	.133	-.110	-1.269	.206
	4.5	.012	.007	.123	1.646	.102
	4.1	.037	.170	.018	.216	.829
	4.7	.053	.091	.045	.579	.563
	4.8	-.647	.162	-.330	-4.004	.000
5	4.9	.308	.096	.271	3.190	.002
	Knowledge	-.079	.021	-.259	-3.710	.000
	(Constant)	.545	.357		1.526	.129
	4.4	.066	.071	.032	.931	.353
	4.6	-.003	.043	-.004	-.078	.938
	4.3	-.079	.069	-.051	-1.150	.252
	4.5	.005	.004	.047	1.221	.224
	4.1	.144	.087	.071	1.655	.100
	4.7	.027	.047	.023	.569	.571
	4.8	-.170	.086	-.087	-1.975	.050
6	4.9	.064	.051	.057	1.261	.209
	Knowledge	-.031	.011	-.103	-2.813	.006
	NEP	.908	.046	.829	19.639	.000
	(Constant)	.546	.356		1.531	.128
	4.4	.070	.072	.033	.970	.334
	4.6	.007	.043	.008	.163	.871

4.3	-.062	.069	-.040	-.890	.375
4.5	.003	.004	.036	.922	.358
4.1	.150	.088	.074	1.712	.089
4.7	.032	.047	.027	.684	.495
4.8	-.159	.087	-.081	-1.824	.070
4.9	.064	.051	.056	1.259	.210
Knowledge	-.033	.011	-.109	-2.905	.004
NEP	.901	.046	.823	19.559	.000
Coming	-.127	.089	-.062	-1.428	.156
Going	.023	.088	.011	.258	.797

APPENDIX J

Complete knowledge step-wise regression

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.680	.611		1.113	.267
	4.3	.297	.211	.148	1.407	.162
	4.4	-.090	.223	-.033	-.402	.688
	4.5	.003	.012	.022	.241	.810
	4.6	.092	.124	.081	.737	.463
2	(Constant)	.560	.781		.717	.475
	4.3	.239	.207	.119	1.155	.250
	4.4	-.058	.218	-.021	-.265	.792
	4.5	.002	.011	.013	.149	.882
	4.6	.118	.125	.104	.943	.347
	4.7	.134	.143	.087	.935	.351
	4.1	-.565	.245	-.213	-2.305	.023
3	(Constant)	-.557	.810		-.688	.493
	4.3	.219	.199	.109	1.100	.273
	4.4	.023	.210	.009	.111	.912
	4.5	-.003	.011	-.021	-.247	.805
	4.6	.041	.122	.036	.340	.735
	4.7	.096	.138	.062	.697	.487

	4.1	-.349	.242	-.132	-1.442	.152
	NEP	.443	.122	.310	3.622	.000
4	(Constant)	-.405	.801		-.506	.614
	4.3	.173	.201	.086	.861	.391
	4.4	-.034	.209	-.013	-.165	.869
	4.5	-.005	.011	-.043	-.496	.620
	4.6	.038	.121	.033	.313	.755
	4.7	.098	.136	.064	.723	.471
	4.1	-.366	.239	-.138	-1.528	.129
	NEP	.408	.121	.285	3.357	.001
	Coming	.178	.257	.066	.692	.490
	Going	.594	.251	.221	2.368	.019

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