"I thought the horseshoe crabs were part of my family": Investigating ocean connectivity in Falmouth, Massachusetts

by

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Abstract

Determining how citizens relate to the coastal zone is as an important element of coastal governance today. Previous research has identified several indicators to examine connections between coastal communities and marine environments, but do those data reflect the perceptions of the people who live there? A growing body of literature points to the importance of integrating public perceptions into coastal decision-making processes. Here, a 2017 survey conducted in Falmouth, Massachusetts acts as a case study, investigating how residents perceive connections to the ocean. Results point to 1) strong sensory and place-based attachments to the marine environment and a variety of social values or intangible connections tied to the coast, 2) uncertainty related to the adequate protection of the community regarding flood risk, 3) a significant importance for the protection of wetland and coastal habitats, 4) a call to limit human-made coastal structures and restore natural barriers, and 5) a desire for more public-scientist interaction, and accessibly communicated ocean science. Analysis includes recommendations on how public perceptions data can be used by science communicators and coastal planners, and identifies relational values as a means to frame connections in broader public discourse. This study suggests that public perceptions could provide the foundation for a community-based Ocean Connectivity Index, to better understand how social values relate to spatial parameters in coastal areas.

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1. Introduction

Many generations ago, human beings took to the ocean. Our maritiming roots can be traced back more than 50,000 years, to a small band of island-hoppers who once traveled south across more than 600 miles of Pacific archipelago to reach the Australian continent from mainland Asia, possibly on lashed bamboo rafts (Bellwood, Fox, & Tryon, 2006).

Since that pioneering expedition, humankind has long maintained a strong connection with the sea. Ultimately a fundamental driver for all life on Earth, the ocean plays a critical role in making the planet a habitable place. Sweeping ocean currents circulate the globe like a grand conveyor belt, bringing cold, nutrient rich water to the tropics, and warmth to the icy poles (Reid et al., 2009). These processes have allowed humans to thrive in many places that might otherwise be unsuitable for settlement. The ocean absorbs about half of the carbon dioxide produced by human activities globally, helping to keep the air breathable, and regulating the climate (Park et al., 2009). Furthermore, marine organisms are responsible for significant portions of the Earth's supply of oxygen (Sekerci & Petrovskii, 2015).

Beyond these features essential to life, relationships between people and oceans manifest in myriad other ways. Coastal regions host many of the world's biggest cities and geopolitical power centers. Nearly half the planet's population lives within 100-kilometres of a coastline, a figure that continues to expand (Kummu et al., 2016). More than half-a-billion depend on marine resources for food or income (Moffit & Cajas-Cano, 2014). Global systems of commerce transit long-established sea trade routes, with the world's marine economy valued at an estimated $24 trillion USD internationally (Hoegh-Guldberg et al., 2015). Hundreds of chemical and biological elements found in the ocean are used in medicines to treat diseases like HIV, tuberculosis, cancer, and other ailments that continue to plague people (Sithranga & Kathiresan, 2010; Vo & Kim, 2010). The potential for medical discovery in the microbial ocean remains one of the most exciting fields in science, as it is estimated that each millilitre of seawater contains an average of one million microscopic bacteria, and upwards of ten million viruses (Vierro et al., 2015). Many other disciplines from genetics and biotechnologies to materials sciences and renewable energy are now looking to the ocean to solve some of society's most intractable problems (Vierro et al., 2015).

But not all is well between people and oceans. An array of largely human-induced physical, chemical, and biological changes is beginning to shift the nature of the sea as we know it, sometimes altering the behaviour of entire coastal ecosystems, including often those that people rely on for livelihood and sustenance. Over the past several decades, the impacts of these changes have begun to manifest themselves in striking and often catastrophic ways around the globe, sometimes causing significant harm to coastal communities.

One of the clearest examples of this change has been the increasingly powerful hurricanes and elongated storm seasons recorded in the Atlantic basin. In August and September of 2017, hurricanes Franklin, Harvey, Irma, Katia, Maria, and Jose caused levelling destruction in Caribbean island nations like Cuba and Dominica, and billions of dollars in damages from Mexico to Texas to Puerto Rico. Early estimates placed costs in the United States alone upwards of $290 billion (AccuWeather, 2017). For only the second time in recorded history, three separate hurricanes simultaneously moved through the Gulf region (Jose, Irma, and Katia). Rising sea levels are likely to exacerbate these devastating storms, threatening coastlines and properties around the world (Church et al., 2013). Some communities now face the possibility of relocation in the face of swiftly receding shorelines and continually worsening flood patterns (Church et al., 2013; Jones et al., 2017).

Ocean ecosystems have also seen major shifts. Global climate change, resulting from human-induced carbon emissions, drives ocean acidification. Some of the highest sea surface temperatures ever recorded are decimating much of the planet's coral reef habitats (Hönisch et al., 2015). Important fish nurseries crucial to fisheries and popular marine tourism locales have been adversely affected in places like Australia and Indonesia and elsewhere as a result (Hoegh-Guldberg et al., 2015). In the North Atlantic, once-bountiful Atlantic cod stocks were fished nearly to extinction (Kurlansky, 1998). Over 30,000 jobs related to the cod industry in Canada were lost almost overnight, when the federal government was forced to close the fishery in its entirety. After 25 years of moratorium, regional stocks have shown only a marginal capacity for recovery (Rose & Rowe, 2015).

This story of decline is not unique to cod. Marine animal populations globally have waned at a rate of more than 50 percent since 1972, some on the order of 90 percent (WWF, 2016).

Substantial biodiversity loss over the past half-century has driven the disappearance of entire species to extinction before scientists have ever had a chance to describe them (Lees & Pimm, 2015). Furthermore, ocean currents and warming waters have led to an increase in hypoxic "dead zones" in the Pacific, with decomposing organic matter absorbing oxygen from the water column, and suffocating life at the seafloor, a state feared by some as representative of other ocean spaces as temperatures rise (Praetorius et al., 2015).

In these situations and others, humans have contributed significantly to deteriorating ocean health or shifting oceanographic processes that negatively impact people (Hönisch et al., 2010; Moffit & Cajas-Cano, 2014; Neumann et al., 2015). This counter-productive relationship suggests a widespread misperception concerning the effect of particular anthropogenic behaviors on marine environments, and calls for a major adjustment in the societal actions that diminish ocean health. But why has this relationship between allowed to persist? As a globalized society, why are we so challenged by the stewardship of the oceans upon which we depend? The answers to this question are complex and context-dependent, varying across culture, location, and individual experience (Hamilton & Safford, 2014; Wynveen, Connally & Kyle, 2016). In North America, ocean literacy rates – or peoples' knowledge pertaining to the ocean and its processes – are low (Guest et al., 2015; Steel et al., 2005). Literature has long recognized the important role for civil society in affecting sustainable environmental policies (Frantz & Fuchs, 2014; Stern, 1999), but compounding socio-economic factors like poverty or inadequate systems of social support limit the capacity for widespread participation in ocean and environmental citizenship and pro-environmental behavior more broadly (Kollmuss & Agyeman, 2010; Mckinley & Fletcher, 2012). In the U.S., environmental management is a low priority to the public, and a near-triviality to some voters (Thirteen Years of the Public's Top Priorities, 2015). Seen mostly as abstract and irrelevant to many, human-ocean relations have fallen victim to disinterest and political neglect (Collumb, 2013; Nelson, 2012).

These perceptions point to the need for proactive attempts to engage citizens in the ocean affairs affecting their lives. Recent trends show an influx of regionalized or localized ocean governance plans administered by policymakers (Gorris, 2016). In cases requiring the management of shared resources, local actors have been identified as better-suited to address the root causes of marine resource depletion or ecosystem degradation (Cinner et al., 2012;

Ferse et al., 2010). Participatory engagements allow individual citizens not commonly involved in the construction of policy an opportunity to "be a force" in the support of marine management initiatives (Jefferson et al., 2014). These initiatives put the people closest to the managed area at the heart of governance, as opposed to the top-down structures that have typically deployed centralized powers to manage shared oceans on behalf of coastal residents. Plans that do not involve the public can often lead to an apathetic view of administered plans if not public protest (Ferse et al., 2010; Rodríguez-Rodríguez et al., 2015). Recognizing the power of local ocean citizenship in effective governance and positive ocean health outcomes, social scientists now seek to understand the enabling or disabling factors related to public engagement and participation (Fletcher & Potts, 2007; Hamilton & Safford, 2014; MacDonald, Soomai, De Santo, & Wells 2016).

An emerging element in this effort is research related to public perceptions of marine environments. Public perception is a broad concept encapsulating a variety of components including knowledge, beliefs, values, and interests (Jefferson et al., 2015). Restoring or preserving the health of the oceans requires policy initiatives that can communicate their relevance in meaningful and locally important ways, align with public interests, and transcend ocean-apathy or political barriers. By addressing these issues, scientists, community leaders, and decision-makers can begin to design ocean governance strategies to foster community engagement, reflect the values of local citizens, and improve marine outcomes. Here, a case study surveying residents at Falmouth, Massachusetts endeavors to understand how residents value ocean spaces and perceive connections to the marine environment, for use in policy and communication plans. At a broader scale, this study suggests that public perceptions and place-based values could provide the foundation for an "Ocean Connectivity Index" (OCI). An OCI could be used as a tool by researchers and planners to identify and characterize connections between people and the coastal zone at various spatial scales, compare coastal values across communities, and design policies that allow coastal citizens to achieve individual and collective goals.

2. Background

2.1. Engaging Citizens in Marine Conservation: Why Public Perceptions Matter

Just over a decade ago, a study conducted by the United States' Pew Oceans Commission (Paul, 2004) found that most people see little to no connection between their activities and the future of the ocean. This finding represents a long history of misperception surrounding the relationship between humans and the sea. Two illustrative examples of how these misperceptions have negatively affected marine environments over time relate to overfishing and plastic pollution. In European experience, it was long assumed that the resources of the ocean were essentially unlimited (Shepherd, 1997). The advancement of European fisheries tracked a paradigm delineated by thinkers like the British naturalist Thomas Huxley, who claimed in 1883: "Probably all the great sea-fisheries are inexhaustible; that is to say that nothing we do seriously affects the number of fish" (Kurlansky, 1998). Other fisheries followed this model around the world, as viable commercial markets began to spring up in the nations of the Americas, Africa, and Asia. With major advancements in fishing gear, technologies, and at-sea storage, strong consumer demand motivated the overfishing of many commercially viable marine species (Kurlansky, 1998). This legacy is seen today, with more than 80 percent of global fisheries fished to capacity or beyond, with still-underfished populations approaching similar designations (Moffit & Cajas-Cano, 2014).

In a similar manner, a long history of dumping waste into the sea has led to the rise of plastic pollution now found in nearly every explored area of the world's oceans. Today, some eight million metric tons of plastic enter the ocean every year (Jambeck et al., 2015). Plastic production is expected to continue to rise over the course of the next three-plus decades as more economies develop and global populations grow (Jambeck et al., 2015). Broken down plastics are now turning up in the stomachs of sea animals across the globe (Tavares et al., 2017; Taylor, et al., 2016), including some species frequently consumed by humans.

Coupled with economic forces, at the heart of issues related to both overfishing and plastic pollution are misinformed perceptions. Today it is clear that fish are not an inexhaustible resource, and that mismanaged plastic waste can cause serious harm to ocean ecosystems. However, prior misconceptions, left to endure for hundreds of years, were the structures upon

which many systems of fisheries harvest and plastic production were built through much of the 19th and early 20th centuries (Kurlansky, 1998; Pitcher & Lam, 2015). The potential for collapsing fish stocks or an influx of plastics was left unconsidered in many places, because the world's oceans were thought of by most maritime nations as "too big to fail" (Kurlansky, 1998).

Essentially, perceptions are a major part of the basis of reason upon which people rationalize decisions. Because most of us are fundamentally detached from the ocean in a way not true in many of the land-based places in which we live, there is often a cognitive disconnection between people and the sea, which can lead to misunderstanding about the complex feedbacks governing this relationship (Jefferson, 2014; Halpern, 2012).

An example of why public perceptions matter to marine conservation can be observed in studies involving marine protected areas (MPAs). In Europe, both England and France have committed to protect upwards of 20 percent of their respective territorial waters. These targets are substantially higher than international targets laid out by the Convention on Biological Diversity, which aims to protect 10 percent of oceans globally by 2020 (O'Leary et al., 2016). As part of these ambitious national initiatives, Rodríguez-Rodríguez et al. (2015) surveyed 36 organizations considered to be marine stakeholders likely to be affected by the development of a network of multi-use marine protected areas in the North Atlantic. The survey found that a majority of non-governmental organizations and research centres, as well as some local councils and other management bodies perceived MPAs as net positive. Conversely, more than 30-percent of respondents, including all fishing and shipping organizations, did not believe that MPAs would provide any environmental benefit (Rodríguez-Rodríguez et al., 2015). The authors postulate that because the survey was not administered exclusively from the accompanying MPA initiative, some organizations may have responded largely in protest to the idea of potential MPA-related restrictions (Rodríguez-Rodríguez et al., 2015). Furthermore, the survey found that a number of hospitality companies, tourism operators, recreational businesses, energy providers, and coastal residents believed MPAs to be of neutral or negative impact. This outcome led to speculation that there may be a lack of awareness about the local tourism and recreation benefits often associated with the

development of marine protected areas, or a misunderstanding about which activities are and are not regulated within multi-use MPAs (Rodríguez-Rodríguez et al., 2015).

Ultimately, the success of many ocean planning initiatives is tied closely to public perceptions of outcomes, impacts, and legitimacy (Bennett, 2016; Cliquet, 2010). Furthermore, understanding perceptions can provide direction in governance processes, by reflecting values of local citizens (Bennett, 2016; Voyer, 2015). Public perceptions also have significant implications for marine science communicators and ocean advocates. Understanding perceptions can help communicators to connect with audiences and give insight into areas of ocean knowledge deficit that could be targeted by ocean literacy campaigns (Bennett, 2016; Jefferson et al., 2015; Trenouth et al., 2012).

2.2. Study Location

The case study described here took place in Falmouth, Massachusetts. Falmouth is home to the Woods Hole Oceanographic Institution, responsible for hosting this project. Falmouth was identified as a town well-suited for an experimental, test of method approach because of a large marine science community and an engaged public. Falmouth is also highly reliant on the coastal tourism industry. The town is built on a wetland ecosystem, and consequently faces challenges in mitigating sea level rise and protecting biodiversity as demand for tourism and vacation housing continues to rise.

2.2.1. Cape Cod

Cape Cod, true to its namesake, is a place shaped by the sea. Jutting into the Atlantic like a flexing forearm, the Cape region has a long history of connection with the ocean. Since time immemorial, the Wampanoag people native to this coastline fished, trapped, and canoed the waters of Massachusetts Bay, carving out a lifestyle heavily influenced by the productive seas of the North Atlantic. Wampanoag culture is rich with ocean tradition, including a creation story involving Moshup, the benevolent giant responsible for the shape of the Cape-adjacent islands of Nantucket, Martha's Vineyard, Nomans Land, and those along the Elizabeth chain (Wampanoag Tribe of Gay Head, n.d.). Moshup was known as a teacher and a provider. The giant's favourite meal was whale, and he often used his supernatural powers to toss these great beings and other

treasures of the sea to the coastline, for the people to enjoy, when his stores were full. Through his generosity, Moshup taught charity and respect. As the story goes, refuse from Moshup's table can still be found in the sediment at Martha's Vineyard – shark teeth, fish bones, and petrified quahogs, thousands of years old, hide in the cliffside – stained red by the blood of Moshup's meals (Wampanoag Tribe of Gay Head, n.d.). Moshup and the Wampanoag can trace their regional roots through several millennia, with earliest known remnants of human habitation dating back more than 10,000 years (Jones, 2006).

It was not until 1602 that Bartholomew Gosnold became the first European to reach Cape Cod, credited with the name that the region keeps today (Mavor, 2002). One of Gosnold's crew, the scribe Gabriel Archer, gave the first written account of the area, which was soon to become known in Europe as a fisheries Mecca. Archer reported upon the bounty of Atlantic cod as the crew rounded the Cape for the first time: "We took great store of codfish and called it Cape Cod" (Mavor, 2002).

Figure 2.0. An Image of Moshup the Benevolent Giant at Aquinnah, MA. (Simon Ryder-Burbidge)

Eighteen years after the Gosnold expedition, a small group of English settlers now known as the Pilgrims sailed to the rough northern Cape shores, near today's Provincetown, to start a new life on the North American continent. Aboard their ship *The Mayflower*, they came soon after to the Massachusetts mainland. Adjusting to the new territory, the Pilgrims learned to fish, surviving harsh winters with the help of Native peoples. First they fished to survive, but soon fishing became a livelihood for many (Kurlansky, 1998). While there were several species available, it was the coveted meat of the Atlantic cod, which could be salted and shipped back to Europe without spoiling, that helped the early New Englanders establish a strong economy and a quality of life to accompany several colonies along the North American coastline (Kurlansky, 1998).

Receiving word of the freedom and abundance of resources available across the ocean, European settlers continued to flock to the North American coast. In New England, the British Crown incentivized settlement with the promise of land. Before long, once Indigenous-only regions were overrun by British colonists. Relations between Indigenous communities and Europeans began to sour progressively. Decimated by European disease or violent conflict with colonizers, Native populations suffered huge losses – on the order of 90 percent in some areas – and over time, nearly all the available coastal land was occupied by white settlers (Marr & Cathey, 2010).

As colonies continued to advance further inland, New England's economy began to diversify away from fishing over the course of the 18th and 19th centuries, but much of the early wealth of the region remained in its original coastal power centers. Maritime trading cities including Boston, Providence, New Bedford, Bridgeport, and others were built largely on fishing, whaling, and similar seafaring endeavors (Kurlansky, 1998). Today, that tradition continues, and many towns along the New England coast still celebrate a proud fishing heritage.

In some areas of Cape Cod, dependence on fisheries has declined while coastal tourism as increased. Travellers from across the world come to explore the salt marshes, white-sand beaches, and colorful towns rich with tales of a past at sea. Coastal recreation opportunities along the shoreline include sailing, sea kayaking, sport-fishing, whale-watching, hiking, birding, and beach-combing, popular amongst locals and visitors alike. Furthermore, renowned New England seafood, ocean vistas, and warm summer temperatures characterizing Cape Cod attract thousands of tourists to the region each year.

2.2.2. Falmouth, Massachusetts

Falmouth, Massachusetts was first settled in 1660 and officially incorporated in 1686, named after Bartholomew Gosnold's home port in England. Early economic activities common to the area included salt production, farming, and marine-related industry in sperm whaling, ship-building, and commercial transport (LVWF, n.d.). In a unique 19th century enterprise, Falmouth's Pacific Guano company sold guano, dried seabird droppings hardened in the volcanic rock of remote Pacific Islands, as a soil enhancer (Stone Gaines, 2007). While some fishing activities took place, the opportunity offered by burgeoning commercial ports nearby at Gloucester or New Bedford, for instance, was not present in Falmouth.

Not until the late 19th century did Falmouth begin to form into many of the characteristics it is known for today. In the 1840s, the Cape Cod Branch Railroad began providing service from the greater Boston area to the Cape Cod town of Sandwich (Eldredge, 2003). Eventually the track stretched to incorporate neighbouring Hyannis to the south, where steamship services to Nantucket connected passengers to the island. Finally, in 1872 the track was extended further south to Woods Hole (Eldredge, 2003). When the railroad was completed, the steamship service moved across the Vineyard Sound from Hyannis and began departing from Woods Hole that same year. The convenient mix of critical infrastructure and geographical location catalyzed Falmouth's tourism industry based on its proximity to the Islands, which were becoming increasingly popular summertime destinations for wealthy East Coasters.

Figure 2.1. SS Nantucket, Approaching Woods Hole. (Simon Ryder-Burbidge)

Today, lifestyles in Falmouth remains largely tethered to the coast. Altogether, the Falmouth residential area covers 54.4 square miles (141.0 km^2), of which 10.3 square miles (26.8 km^2) is primarily water (approximately 19 percent). The town is popular for its white-sand beaches, and known also for a 10-mile bicycle and walking path, called the Shining Sea Bikeway, which runs from the ferry terminal at Woods Hole to North Falmouth. The route covers several ecosystems common to the Cape Cod region, traversing deciduous forest, pine scrubs, mixed-sediment beaches, coastal estuaries, and brackish ponds.

Commercially, Falmouth combines a variety of local, independent restaurants, accommodations, boutique shops and services with more commonly available chain stores and franchise food options scattered across the geographic range. The largest employers by industry in Falmouth include healthcare and social assistance at 17.9 percent, accommodation and food services at 14.2 percent, retail trade at 13.7 percent, and professional, scientific and tech services at 13 percent (Figure 2.2). This latter number can be largely attributed to the significant marine science presence in the village of Woods Hole, which includes the University of Chicago's Marine

Biological Laboratory, the Woods Hole Oceanographic Institution, the Sea Education Association, and the Woods Hole Research Center, among others. The Woods Hole Oceanographic Institution is one of the largest employers in the Cape Cod region, with nearly 1,000 employees.

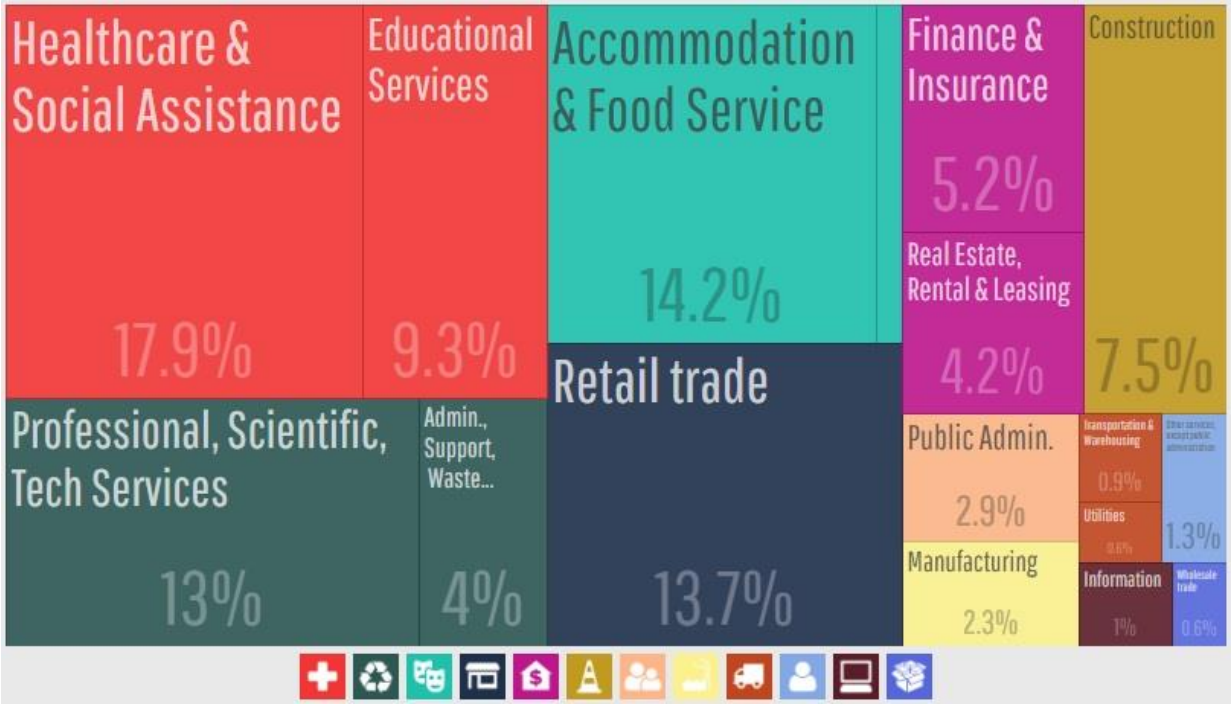

Figure 2.2. Industry in Falmouth by Employment Percentage, 2015. (Data USA, 2017).

Falmouth also maintains a relationship with the islands of Martha's Vineyard and Nantucket via the Steamship Authority (SSA) operating a nine-vessel passenger ferry fleet from port at Woods Hole. The SSA employs nearly 800 people at peak season, running dozens of trips each day and transporting anywhere from 150 to 1,200-plus people to and from mainland Massachusetts. The SSA facilitates a variety of supportive infrastructure and employment opportunities as well, including shuttle services from the Falmouth town center and Boston Logan International Airport, among others. Ferry traffic counts as a major economic driver for Falmouth, particularly in the summer season. Expensive island accommodations mean that many visitors keen to see the Islands prefer a more affordable stay in town, opting for day trips to visit the islands on foot or by bicycle, e.g., 40 minutes to Martha's Vineyard, or about two hours to Nantucket. Visitors to the area account for a sizable increase in human traffic, mostly during the months of July and August, when Falmouth's population balloons from just over 30,000 people to about 100,000.

Falmouth operates as one of fifteen "towns," or units of local government comprising Barnstable County, one of fourteen counties in the state of Massachusetts with a measure of distinct political autonomy. Barnstable County is largely synonymous with Cape Cod, but the Cape Cod name does not carry any political significance, referring instead to an informal geographic region. Nantucket, Martha's Vineyard, and the Elizabeth Islands, for instance, are typically referred to as part of Cape Cod, but are not included within the jurisdiction of Barnstable County. Plymouth County, which includes the Boston metro area and is Massachusetts' most highly-populated, borders Barnstable County to the west.

For census and postal service purposes, the town of Falmouth is further divided into six census-designated places (CDPs), including Falmouth, North Falmouth, West Falmouth, East Falmouth, Teaticket, and Woods Hole. The following demographic data is adapted from estimates provided by the United States Census Bureau (2016):

> Falmouth is home to 31,473 people and 13,638 household units. The median household income (MHI) in Falmouth is $66,670 USD annually, ranking it eighth amongst Barnstable County's fifteen total towns. Falmouth has an unusually wide range of income distribution for the region, however, as three of the town's six CDP's (Falmouth, West Falmouth, and Teaticket) each fall beneath an MHI of $47,000, while the MHI for the village of Woods Hole is $136,171, second highest of all 191 CDPs in Barnstable County. These numbers are relative to a Massachusetts statewide MHI of $67,846, and a national MHI of $53,482. More than 42 percent of Falmouth residents 25 or older hold at least a bachelor's degree, compared to just over 40 percent statewide. In Falmouth, 58 percent of the population aged 16 or older is categorized as "in the civilian labor force," compared to 67.5 percent in Massachusetts generally. The town's population is approximately 7.8 percent foreign-born, as opposed to 15.5 percent statewide.

2.2.3. Woods Hole Village

One of Falmouth's distinguishing attributes, relative to neighboring Cape Cod locales, is its relationship to the seaside village of Woods Hole, where a large portion of the town's marine-related activity takes place. Located at the southern extent of Falmouth, Woods Hole is home to

just over 700 people. The village hosts several restaurants, galleries, and retail outlets operating on a primarily seasonal basis.

In 2010, the National Oceanic and Atmospheric Administration (NOAA) released the national *Long Form Fishing Community Profiles* series, which included a detailed look at a variety of fisheries- and oceans-related topics at Woods Hole between 1997 and 2006 (Colburn et al., 2010). As was true at the time of the *Profiles* publication, there remains only one commercial fishing pier in Woods Hole. Vessel permits naming the village as home port ranged between six and eleven from 1997 to 2006, primarily engaged in trawling or pot fishing. The greatest value derived by species during this time came from summer flounder, scup, and sea bass, followed by squid, mackerel, and butterfish. Commercial incomes were highest in 2001 and declined each year thereafter. The report alludes also to the vibrant sport fishing community at Woods Hole, referencing the annual Monster Shark Fishing Tournament that many from the village attend, in which participants travel miles offshore to target bluefin, bigeye, and yellowfin tuna, albacore, Mako and thresher sharks, and white marlin, among other species.

Woods Hole is also home to a United States Coast Guard base, the Steamship Authority's primary mainland port, several marine science institutions, and NOAA's Northeast Fisheries Science Centre (NEFSC). The NEFCS is the body primarily responsible for reporting to federal administration and advising on fisheries and ocean policy in the Northeast U.S. The unusually extensive marine science community in combination with federal marine governance infrastructure at Woods Hole makes Falmouth a place uniquely well-positioned for ocean-related research attempting to interface with marine conservation or government policy.

3. Methodology

3.1. Survey Construction and Ethics Approval

To conduct this study, an online survey was administered to residents of Falmouth, Massachusetts (see Appendix A for full survey instrument). The survey questions were developed and tested within the interdisciplinary Environmental Information: Use and Influence research program at Dalhousie University. The instrument was then revised on the basis of feedback obtained during an internship at the Marine Policy Center at the Woods Hole Oceanographic Institution. The online survey included multiple choice, ranking, rating and open-ended questions to determine the relationships between Falmouth residents and the ocean. The survey aimed to gauge how residents perceived connections across a variety of pre-determined themes broadly related to coastal change, marine economy, ocean literacy, and place-based values. These themes were selected based on available datasets developed by previous natural and social science studies investigating human-ocean relations and ocean change encapsulating the North Atlantic region. These datasets included those associated with the United States Geological Survey Coastal Change Hazards Portal (Doran, Long, & Overbeck, 2015), NOAA's social and economic indicators research related to fishing communities (Colburn & Jepson, 2012), and the Ocean Health Index (Halpern et al., 2012).

Ethics approval to proceed with the survey was obtained from the Faculty of Management at Dalhousie University under the Faculty of Management Ethics Review Policy (see Appendix B) and from the Massachusetts Institute of Technology (see Appendix C).

Upon receipt of ethics approval, the survey was set up within Opinio software licensed by Dalhousie University and invitations to complete the survey were disseminated to residents of Falmouth (see further details about the dissemination efforts below). The survey opened on July 10, 2017 and was closed on August 22, 2017.

3.2. Promotion of the Survey

Invitations to complete the survey were extended through a combination of online and in-person initiatives. Outreach through social media involved three primary platforms. The most effective was through invitations sent to several local Facebook groups or pages with memberships or

followings of more than 100 people. First, messages were sent to administrators of all known open discussion or local news groups (i.e., those that anyone within the Falmouth community could join, and without an exclusive or themed membership). Of these six groups, administrators from four were responsive, and two or three posts were made on each discussion page while the survey was open. The posts included a message encouraging participation by Falmouth residents, and were accompanied either by a digital photography album or a short video on the so-called *Ocean Connectivity Project* featuring interviews with Falmouth residents (see Appendix D for sample outreach message).

Figure 3.0. Sample of Falmouth Photographs Used for Survey Distribution. (Simon Ryder-Burbidge)

Overall, invitations were extended to the administrators of 35 groups or pages in order to reach residents in Falmouth. In cases of groups with several administrators, messages were sent to each. For the four Facebook groups, the administrators suggested joining and posting the invitation to the survey directly to the discussion page. This method allowed for interaction with individual group members and explanation of the project concepts beyond an original one-way

posting. In each discussion page post, group members who were able to participate in the survey were encouraged to provide feedback, ideas, or thoughts on both the content of the survey instrument and their participatory experience. From this process, a number of insightful comments and questions emerged, and group members were able to share the invitation to the survey on personal pages outside the targeted discussion groups.

When the group or page administrators did not allow private Facebook messages, organizational representatives were contacted via phone or email when possible. These phone and email follow-ups proved fruitful in engaging a variety of local organizations including the Falmouth Academy, Sea Education Association, Falmouth Public Libraries, Falmouth Community Television, the Falmouth Recreation Department, the Falmouth Art Center, and the Falmouth Fish Market. Representatives from each agreed to assist in the distribution of survey invitations by social media posts to the administered accounts.

In August, Facebook advertisements were employed over a two-week period to encourage participation from Falmouth residents. Advertisements featured a fourteen-second excerpt adapted from the longer *Ocean Connectivity Project* video. One advertisement was directed specifically toward Facebook accounts held by residents within a 50-kilometre range of the Falmouth town center. The second was directed towards a broader geographic region incorporating the greater Boston area for a wider distribution. Both were intended for all Facebook users aged 18 and older.

Invitations to complete the survey were also posted via Instagram and Twitter. Like the steps taken with Facebook, a variety of organizational or commercial accounts were identified for their potential to reach Falmouth residents through followings of 100 people or more. Once chosen, a message briefly explaining the survey and the target audience was sent by tagging targeted accounts. Furthermore, organizations outside the target area to which the study might be of interest (e.g., regional media outlets or governing bodies) were included via tags as well.

During the data collection period in July and August, several public events occurred in Falmouth, providing an opportunity to meet residents face-to-face and to invite their participation. At each event, the primary method of invitation involved providing original photographic prints of coastal areas in Falmouth, along with a handwritten note thanking potential respondents, and a

link to the online survey. Furthermore, three local media outlets featured the project at various times during the data collection period. As an incentive to participate, potential respondents were offered an opportunity to be featured on National Public Radio's local *Living Lab Radio* show, with a short story on their own connection with the ocean. This offer was also extended as part of the social media outreach described above, and on the website of the Environmental Information: Use and Influence research program (www.eiui.ca).

Other organizations in the Falmouth area agreed to promote the survey through advertising at publicly accessible locations. In these cases, a series of free photographic prints were left at reception desks or pinned to event calendars with an explanatory note for potential participants (Appendix E). Organizations allowing free access to buildings and informational resources were targeted specifically, as were those with a shared interest in ocean research.

3.3 Data Analysis

The responses to multiple choice, ranking, and rating questions in the survey were recorded in the Opinio software, which generated descriptive statistics that were used in the data analysis, and produced accompanying histograms. For the free text responses obtained via the open-ended questions, categories for the responses were not determined prior to the analysis. As part of this exploratory study, categorizations were developed directly from the responses of Falmouth residents. This qualitative data underwent thematic analysis (Braun & Clarke, 2006; Fereday & Muir-Cochrane, 2006), involving inductive coding, seeking repeated themes or "sensitizing concepts" as they emerged (Bowen, 2006; Fereday & Muir-Cochrane, 2006). Themes were then totalled for each open-ended response set and transferred into frequency tables. All of the survey results were grouped into seven categories outlined in the results chapter below: 4.1 Demographics, 4.2 Coastal Change, 4.3 Coastal Access and Activity, 4.4 Marine Conservation and Seafood Preferences, 4.5 Marine Economy and Sectoral Influence, 4.6 Ocean Literacy, and 4.7 Coastal Values. Following presentation of the results, the discussion chapter integrates and relates the findings to policy implications and outlines their potential for adoption into an Ocean Connectivity Index.

4. Survey Results

The survey, titled *Understanding Public Perception: Ocean Connectivity in Falmouth, Massachusetts*, opened on July 10, 2017 and closed on August 22, 2017. During this period a total of 288 respondents entered the survey online. Except for an initial screening intended to prevent multiple completions by the same individual, respondents were not required to answer all questions, nor were they required to provide responses to open-ended queries. Respondents were informed that they could skip any question, if they wished, and continue through the survey. As a consequence, the number of responses to each question varied. The number of responses (N) to each question is noted throughout the presentation of the results below.

After proceeding through the initial screening, respondents were asked to identify themselves as members of the Falmouth community, given the options to report as a resident, homeowner, or both. A total of 238 individuals responded as such. Those who did not identify as residents or homeowners were redirected to a "thank you" page and were not permitted to continue the survey.

Survey results have been grouped into seven categories: 4.1 Demographics, 4.2 Coastal Change, 4.3 Coastal Access and Activity, 4.4 Marine Conservation and Seafood Preferences, 4.5 Marine Economy and Sectoral Influence, 4.6 Ocean Literacy, and 4.7 Coastal Values. The responses to multiple choice, ranking, and rating questions are displayed as histograms generated by the Opinio survey software. The responses to open-ended questions were categorized thematically. A representative quotation was chosen to illustrate the concept(s) present in each theme. Since a response could encompass more than one theme, multiple codes were assigned to some responses, as appropriate.

4.1. Demographics

Of 226 responses, only 10 percent (N=23) claimed Falmouth as their birthplace. The remaining 90 percent of respondents were born outside of the town (N=203). A majority reported living in Falmouth 8-12 months of the year (N=183); the rest spend between two and seven months in the town (N=28). Most respondents stated they were full-time workers (N=157; 69%), and the remainder were retirees (N=32; 14%), part-time workers (N=29; 13%), or seasonal workers (N=3; 1%). Others were unemployed (N=2; 1%) or preferred not to answer the question (N=3;

1%) (Figure 4.0). Respondents who work in science, research, education, or education-affiliated jobs (N=75) made up the largest employment group (Table 4.0). Other occupations included health and medicine (N=30), management and administration (N=27), hospitality and service (N=22), professional services (N=12), creative or communications (N=10), sales and retail (N=8), student (N=8), law (N=6), financial services (N=3), and "Other" (N=6) (Table 4.0). Nearly all respondents use a personal automobile as their primary mode of transportation (N=210); others travel by bicycle or on foot (N=21), or on public transit (N=3).

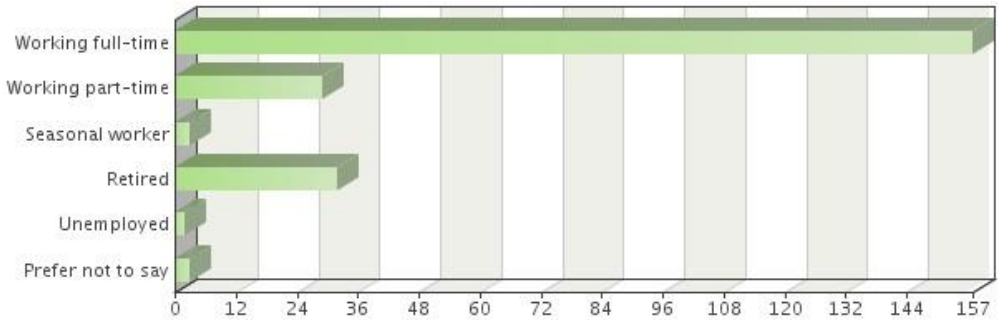

Figure 4.0. Employment Status of Participants (N=226).

Table 4.0. Participants by Employment Sector (N=219).

Employment Sector	Number of Participants
Science/research/education	75
Health/medicine	30
Administration/management	27
Tourism/services/hospitality	22
Other professional services	12
Creative/communications	10
Sales/retail	8
Student	8
Other	8
Law	6
Financial services	3

Respondents aged 50-64 accounted for 39 percent (N=59), followed by ages 34-49 (N=39; 26%), ages 18-33 (N= 28; 9%), and ages 65 and older (N= 25; 17%) (Figure 4.1). Residents below the age of 18 were not represented in this study.

Of the respondents who completed a question about the value of their homes, the largest group (N=84; 56%) stated their homes were valued between $200,000 and $500,000. Eighteen (12%) reported their homes as valued at $500,000 or higher, and six (4%) reported their homes as valued at $200,000 or less. Some respondents were renting (N=24; 16%) or preferred not to comment (N=18; 12%). Of the respondents who reported their annual household income, the largest grouping (N=74; 50%) claimed incomes were between $75,001 and $200,000 (Figure 4.2). Other groupings reported annual household incomes between $15,001 and 75,000 (N=49; 32%), or $200,000-plus (N=6; 4%). One respondent claimed an annual household income of less than $15,000, and several preferred not to comment (N=20; 13%). Households of three to five people were most common amongst the participants' living arrangements (N=60; 39%) (Figure 4.3).

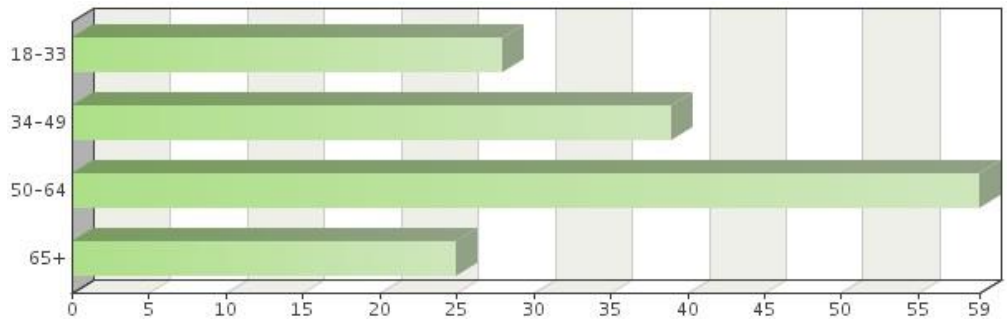

Figure 4.1. Age Range of Participants (N=151).

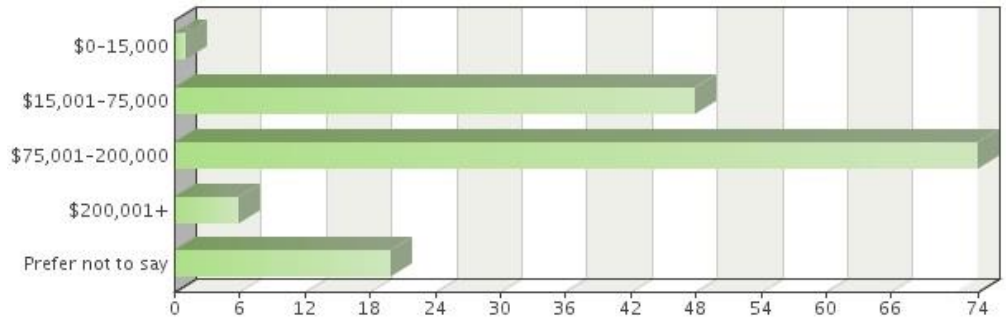

Figure 4.2. Participant Annual Household Income Range (N=149).

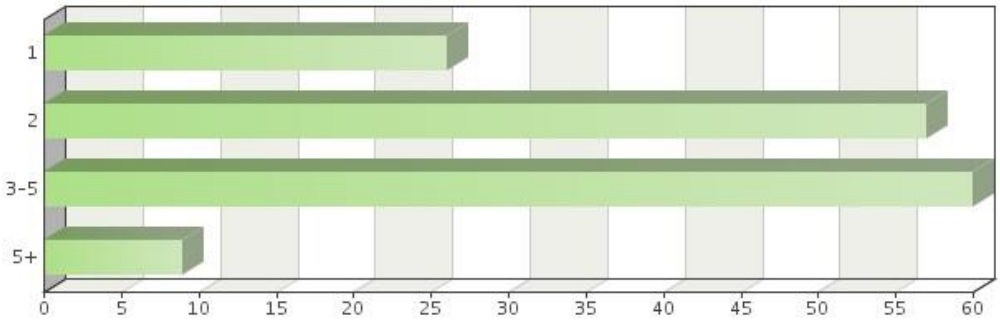

Figure 4.3. Participant Household Size (N=151).

Twenty-six respondents self-identified as male, versus 112 who self-identified as female (Table 4.1). Fifty-one reported as religiously-affiliated, and N=61 reported as politically-affiliated (N=41 Liberal or Democrat, N=8 Independent, N=7 Conservative or Republican) (Table 4.1). Some respondents opted not to answer the above questions.

Table 4.1. Participant Sexual Identity, Political Affiliation, and Religious Affiliation.

Sexual Identity (N=138)	Number of Participants
Male	26
Female	112
Religiously Affiliated (N=147)	
Yes	51
No	80
Prefer not to say	16
Politically Affiliated (N=147)	
Yes	61*
Liberal/Democrat	(41)
Conservative/Republican	(7)
Independent	(8)
No	72
Prefer not to say	14

*Not all the respondents who claimed political affiliation chose to report their party of choice.

4.2. Coastal Change: Flood Risk and Protection

The Coastal Change section relates to the changing nature of the coastline at Falmouth, testing for perceptions about the safety of individual homes and community from flood risk. The ocean

buffers Falmouth in easterly, westerly, and southerly directions. Of 218 respondents, only one claimed to live more than 10 miles from the coastline. More than 42 percent (N=89) reported living less than a mile from the coast with another third between one and two miles away (N=70). Altogether, over 75 percent (N=167) of respondents reside within two miles of the ocean (Table 4.2). The respondents were asked a variety of questions to gauge their views about government action aimed at mitigating against or adapting to changing conditions, and to probe for public policy ideas common among residents. The respondents were then asked whether they felt their home was adequately protected from coastal flood risk, and to explain why or why not. Those who felt their homes were not adequately protected were asked whether they would consider moving from their home, and if not, why. Finally, all respondents were asked about what they would like policymakers do to further protect their homes from flood risk.

Table 4.2. Distance of Participants' Homes from the Coast (N=218).

Distance from the Coast	Number of Participants
Living on oceanfront property	8
Not on oceanfront, but within 1 mile of coast	89
1-2 miles from coast	70
2-10 mile from coast	50
10+ miles from coast	1

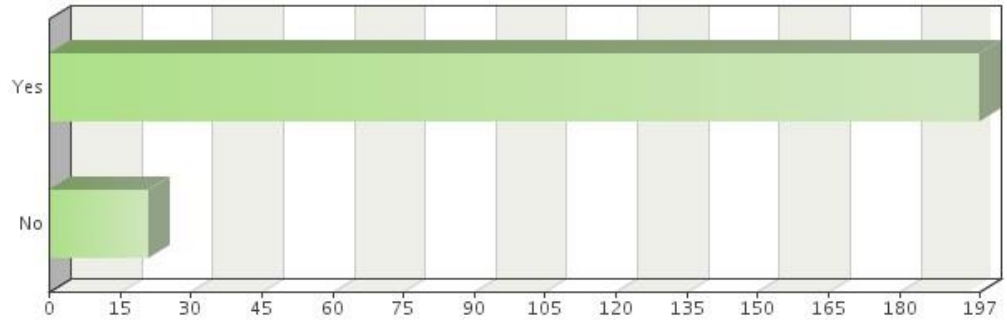

Figure 4.4. Homes Adequately Protected from Coastal Flooding? (N=218).

Table 4.3. Reasons for Perceptions of Safety (Individual Homes) (N=153).

Why Participants Feel Homes Are Adequately Protected	Frequency
High up (elevation) or far away *"We live [about] 1.5 miles from the coast and up on a small hill."*	152
Uncertain *"I used to feel protected. With sea level rise it feels much more uncertain."*	29
Reliant on flood maps, insurance information *"Well, the flood map shows my home is not in danger. If they aren't increasing my insurance premiums to cover potential flooding, I feel pretty secure that my home won't flood."*	27
Previous experience or historical evidence *"I know that flooding is possible, but our street hasn't flooded in the 45 years that we've owned the property."*	20
Affirmative response (home not adequately protected) *"The land between our house and the ocean is relatively flat. Even though there are many obstacles and a mile or so, there is nothing to truly stop a flood."*	13

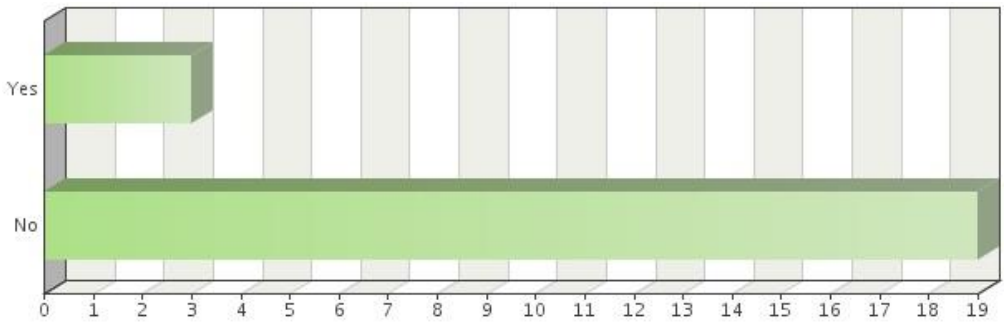

Figure 4.5. Willingness to Relocate Due to Perceived Flood Risk (Individual Homes) (N=22).

Table 4.4. Why Participants Would Not Consider Relocation from Homes (N=18).

Would Not Consider Relocation (Individual Homes)	Frequency
Attached to community; family ties; home *"I would not leave at this time because I love living here. This property has been in my family for more than 100 years."*	13
Benefits of staying outweigh the costs; risk is remote *"I know there is some risk, but I believe it is remote."*	6
Financial reasons *"Money concerns."*	3
Renting *"Renting, will move anyway."*	2

In total, only 10 percent felt their homes were *not* adequately protected from coastal flooding (Figure 4.4). Among the 90 percent (N=197) of respondents who did feel their homes were adequately protected, a variety of themes emerged to explain why (Table 4.3). Here, most reported living at a safe distance from the coast, or on sufficiently high ground to avoid flooding (N=152). Alternatively, 29 respondents alluded to some measure of doubt, using phrases such as "I think," "I feel," "probably," "for now," or "unsure," despite reporting that they felt adequately protected. Twenty-seven respondents stated a reliance on flood maps or flood insurance premiums to understand flood risk, while 20 others referenced previous experience, or past storm events to validate their reasoning. Thirteen reported reasons why they felt their home was *not* adequately protected, related to location within flood plains or previous flooding.

The 22 respondents who reported feeling that their home was *not* safe from coastal flooding were then asked to indicate whether they would consider moving from their homes in response to risk (Figure 4.5; Table 4.4). In total, 85 percent (N=19) said they would not consider moving from their current residence, despite acknowledging inadequate flood protection. Most explanations referred to family ties or alluded to a love for home or community (N=13). Other respondents cite bearable risk (N=6), financial inability to move (N=3), or renting (N=2).

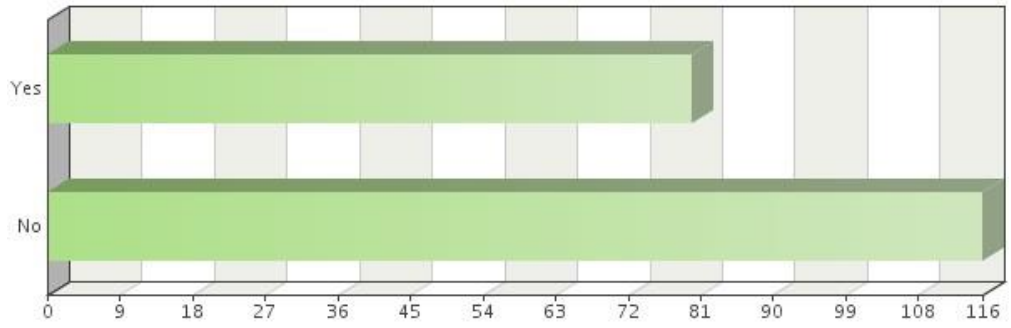

Figure 4.6. Community Adequately Protected from Coastal Flooding? (N=196).

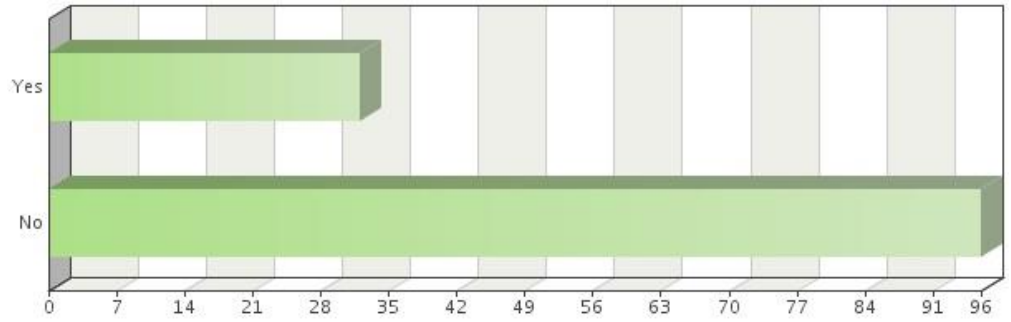

Figure 4.7. Willingness to Relocate from Community Due to Perceived Flood Risk (N=128).

Table 4.5. Why Participants Would Not Consider Relocation from Community (N=87).

Would Not Consider Relocation (Community)	Frequency
Attached to community; family ties; home *"I've lived next to the ocean my entire life, including 30 years on Martha's Vineyard. Not leaving. It's important to my feeling of happiness."*	37
No threat, no personal risk or risk to personal property *"It wouldn't impact my home directly."*	29
Benefits of staying outweigh the costs; risk is remote *"I'm willing to take the risk. The benefits outweigh the costs."*	16
Not yet; may be open to moving if risk increases *"My home is not currently in a floodplain, but that certainly could change. I would consider moving if the flood risk increased."*	11

The respondents were then asked to comment on whether they felt the community was adequately protected from coastal flooding (Figure 4.6), and if not, whether they would consider moving away from Falmouth due to flood risk (Figure 4.7). Of the respondents who were not open to the idea of moving (N=96; 75%), several referenced timescale, suggesting that although they would not move now, they may be open to the possibility in the future (N=11) (Table 4.5). Other themes explaining why the remaining respondents were not open to relocation involved a love for community, family ties, professional opportunity, or references to "home" (N=37). Twenty-nine felt there was no threat, or that they would not be personally affected by coastal flooding. Sixteen felt that the risk was remote, or that it did not outweigh the benefits to staying in Falmouth.

Table 4.6. Aversion to Publicly Funded Flood Protection (Individual Homes) (N=4).

Reasons for Not Supporting Increased Expenditure to Further Protect Home from Coastal Flooding	Frequency
Bad use of public funds *"Waste of money. You can't stop the erosion and shifting sands/coastlines."*	3
More information required *"I would need more information before I could make that decision."*	1

Table 4.7. Aversion to Publicly Funded Flood Protection (Community) (N=49).

Reasons for Not Supporting Increased Expenditure to Further Protect Community from Coastal Flooding	References
Not government's responsibility to protect private property *"I don't think we should subsidize personal risk with public funds...."*	13
More information required *"It's complicated – expenditure for protecting and restoring marsh systems I would be in favor of, but spending money on erosion control does not seem to work – or it sends the erosion problem somewhere else."*	10
Pointless to spend money on combatting sea level rise; defenses may harm wildlife *"I refuse to waste money on trying to control the natural world. Save your money and move to higher ground."*	10
Unnecessary, no threat to neighborhood *"I don't see it as a threat. The primary reason we see flooding is hurricane/tropical storms – doesn't happen that often."*	10
Keep structures away from the coastline, spend on retreat or other adaptations *"Because we should be planning for the future instead of just trying to stave it off."*	6

The survey respondents were asked to report whether they would be willing to support increased public infrastructure spending to protect their homes from flood risk, as well as whether they would extend the same support to protect the community writ-large. Here, 54 percent (N=116)

supported the idea of increased infrastructure spending to protect their homes, while 73 percent (N=145) supported the idea if aimed toward protecting the community.

Of the 46 percent (N=97) respondents who would *not* support increased public infrastructure spending to protect their homes, only four chose to explain their reasoning (Table 4.6). Three suggested that it would be a bad use of public funds, and one suggested that more information was needed prior to selecting yes or no.

Of the 27 percent (N=54) who would *not* support increased spending to protect the community, 13 felt it is not the responsibility of government to protect privately owned homes that may be at risk of flooding (Table 4.7). Several mentioned that they would not be comfortable making a supportive claim for increased spending without being presented with a suite of available options or more information, or labelled the question "vague" (N=10). Others reported feeling that it is "pointless" to spend money on trying to defend against a natural (or possibly unstoppable) process like sea level rise or climate change; this category also included those who felt that protective structures would only exacerbate the problem or harm wildlife (N=10). Ten others felt no threat existed, and six called for policymakers to keep people and structures away from the coastline and instead spend money on solutions or adaptations to climate change.

Table 4.8. Preferred Flood Risk Protection Policies (Individual Homes) (N=90).

Policy Ideas (Individual Homes)	Frequency
Support climate change policies; take climate change more seriously; limit GHGs, invest in green energy *"Start to use renewable energy… Develop solar and wind power everywhere…. Educate public on urgency, learn from what other towns are doing..."*	32
Limit hard structures along the coastline and/or restore/protect natural barriers/buffer zones *"Limiting hard structures in the coastal zone and adjacent areas and increased reliance on natural storm protection (plants, dunes, marsh, estuary, river restoration)."*	31
Collaborate with/participate in federal programs, update flood insurance policies *"Falmouth has recently formed a Coastal Resiliency Action Committee and has asked the Board of Selectmen to join a federal government program designed to mitigate flooding and lower insurance premiums."*	12
Uncertain; unsure of options *"Not sure. Need to explore options first."*	11
Redirecting/upgrading/fixing local infrastructure *"The street drainage around Falmouth ranges between nonexistent and abysmal. Even repaving roads so that they weren't pitched in ways that makes pools of water in heavy rains would be an improvement."*	11
More research, outreach, or public education; develop a local action plan *"We have amazing researchers and scientists right down the street in Woods Hole. I wish the town would work more collaboratively to find innovative and cost-effective solutions."*	11
Leave us alone; not the government's responsibility to deal with private homes *"Living near the coast is a risk we take, others should not be responsible for this."*	7
Not a risk; other *"My home inland and located at approximately 80 [feet] above sea level..."*	7

Table 4.9. Preferred Flood Risk Protection Policies (Community) (N=107).

Policy Ideas (Community)	Frequency
Limit hard structures along the coastline and/or restore/protect natural barriers/buffer zones *"Beach and dune enrichment. After zoning and building codes to discourage coastal development. Continue to maintain and improve tidal and storm flow to salt ponds. Create greenways in low lying areas that can provide undeveloped locations for storm surges to overflow to."*	55
More research, outreach, or public education; develop a local action plan *"Educate the public about importance of wetlands and dunes in protecting Falmouth and create policies to do this..."*	24
Support climate change policies; take climate change more seriously; limit GHGs, invest in green energy *"I would like to see better investment in long-term strategies that reduce CO2 emissions, such as solar energy, residential and corporate compost pickup, better year-round public transportation, etc."*	18
Uncertain; unsure of options *"I am not sure what they can do."*	15
Redirecting/upgrading/fixing local infrastructure; erosion measures *"Homeowners must build to hurricane standards."*	13
Other *"Repetitive…"*	6
Collaborate with/participate in federal programs, update flood insurance policies *"Make flood insurance less outrageous."*	5

On matters of flood risk and protection, respondents were asked to indicate whether they would like to see policy action to further protect their homes from flood risk. Here, 42 percent responded affirmatively (N=79), while 58 percent (N=111) indicated that they did not feel policy action was necessary. The same question was then posed to include the broader community. In this case, 57 percent (N=99) responded affirmatively, to support policy action improving coastal flood protection in Falmouth generally, while 43 percent (N=54) did not. In both cases, those who responded affirmatively were asked to describe what action they would like policymakers to take (Table 4.8; Table 4.9).

Of the 42 percent who wished for policy action to further protect individual homes, many respondents expressed support for initiatives aimed at reducing greenhouse gases, taking climate

change “seriously,” or called for action otherwise related to mitigating climate change (N=32). Other responses called for a restoration of natural coastal barriers, removal of jetties or built structures along the coast, limitations on building in flood-prone areas, or related changes to zoning laws (N=31). Twelve suggested solutions involving federal programs or updated flood insurance policies. Many expressed uncertainty about available policy options (N=11), or referenced the necessity for further education on climate change or flood risk; also in this category were calls for more research in association with local mitigation or adaptation plans (N=11). Eleven hoped to see updates to existing local infrastructure, roadways, or drainage pathways. Others felt the government should refrain from financing protections for personal property and that this burden should fall to the homeowner (N=7), or that there was no imminent risk (N=7).

The respondents who were supportive of policy action to further protect the community from flood risk (57%; N=99) were asked to describe what they would like to see from policymakers. Most responses recommended the protection or restoration of natural storm surge buffers, a removal of hard structures along the coastline, limits to coastal construction, or retreat (N=55). Others noted further education on the topic of climate change or sea level rise, or for further study or local planning (N=24). Some referenced support for general measures to mitigate climate change or engage in initiatives aimed at carbon emissions reductions (N=18). Some expressed an uncertainty regarding policy options available (N=15). Respondents also called for local infrastructure projects like new roads, drainage pathways, or protective structures; also in this category were suggestions to address erosion (N=13). Five suggested that the municipality partake in federal initiatives, or update flood insurance policies, and six did not fall within any of the above categories (“Other”).

4.3. Coastal Access and Activity

This section deals with coastal accessibility and common coastal activity in Falmouth. From May to September, nearly half of all respondents reported accessing the coast 16-30 times per month (N=97), followed by 35 percent at 5-15 times per month (N=69), and 14 percent at least once per month (N=28). Only two respondents (1%) stated that they did not access the coast during the summer (Figure 4.8).

From October to April, 26 percent of respondents reported accessing the coast 16-30 times per month (N=51), followed by 36 percent at 5-15 times per month (N=70), and 36 percent at least once per month (N=70). Five respondents (3%) reported no coastal access during late fall through to the spring (Figure 4.9).

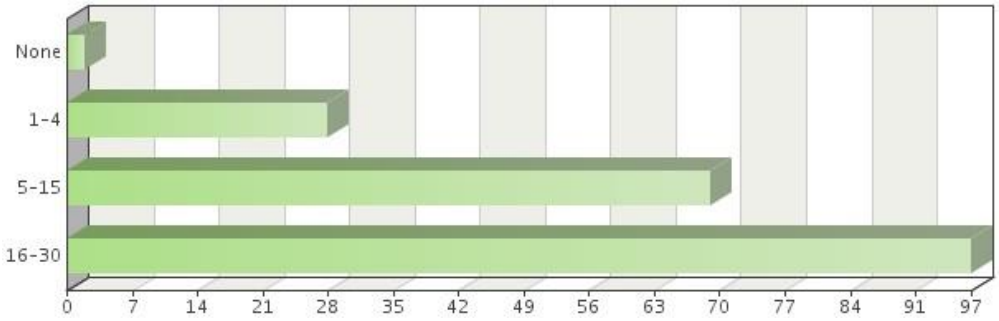

Figure 4.8. Participants' Monthly Coastal Use, May through September by number of times per month (N=196).

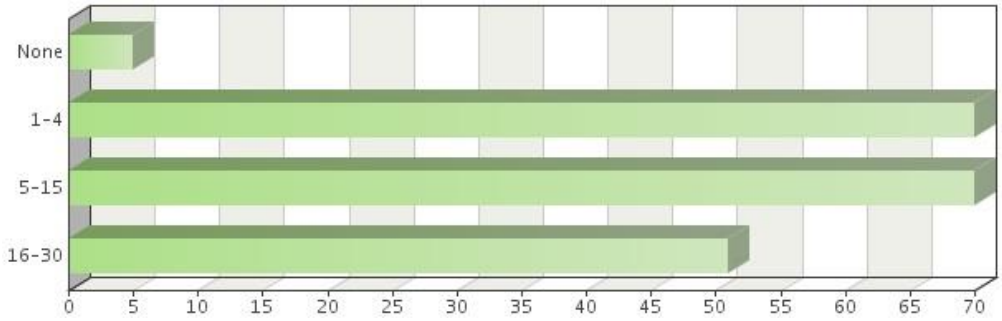

Figure 4.9. Participants' Monthly Coastal Use, October through April by number of times per month (N=196).

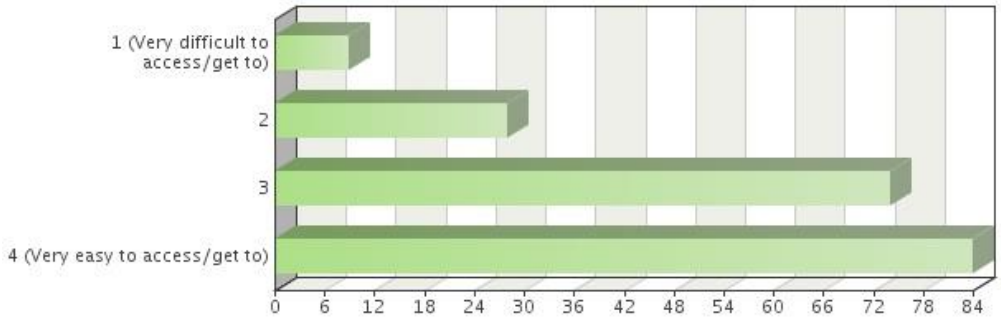

Figure 4.10. Ease of Coastal Access in Falmouth (N=195).

Table 4.10. Barriers to Easy Coastal Access (N=35).

Barriers to Easy Coastal Access	Frequency
Private beaches, private homes blocking access *"[There are] private homes lining the beach. Due to the lack of public access points, as a coastal homeowner, we have constant trespassers crushing our dune grass to get access to the coast by foot."*	22
Prohibitive parking costs, difficulty obtaining parking "sticker"; lack of public transit and/or walking trails to coast *"If I don't get a parking pass, [it's] hard to go to Falmouth beaches if not physically able (i.e., my significant other has a mobility disability, which means biking/walking to beach isn't an option)…"*	19
Insufficient parking space *"Parking gets tight in the summer. I'm not saying we should increase parking, though…"*	15
Traffic or overcrowding *"It depends on the season. In the summertime I often can't compete with the amount of visitors to gain access to our beaches."*	6

The respondents were asked to rank ease of coastal access in Falmouth on a sliding scale from one (*very difficult to access/get to*) to four (*very easy to access/get to*) (Figure 4.10). Most responses rated ease of access at four – very easy (N=84; 43%). Thirty-eight percent of respondents rated ease of access at three (N=74), followed by 14 percent at two (N=28), and 5 percent at one (N=9). Those who rated ease of access as two or lower (N=37; 19%) were asked to explain why (Table 4.10). Most identified "private beaches," or private homes lining the coastline (N=22) as problematic, followed by parking costs, difficulty obtaining "parking stickers" necessary for residents to park at beaches, a lack of public transit servicing the coast, or a lack public walking trails to the beach (N=19). Others listed insufficient parking space (N=15), traffic, or overcrowding (N=6) especially during the summer months.

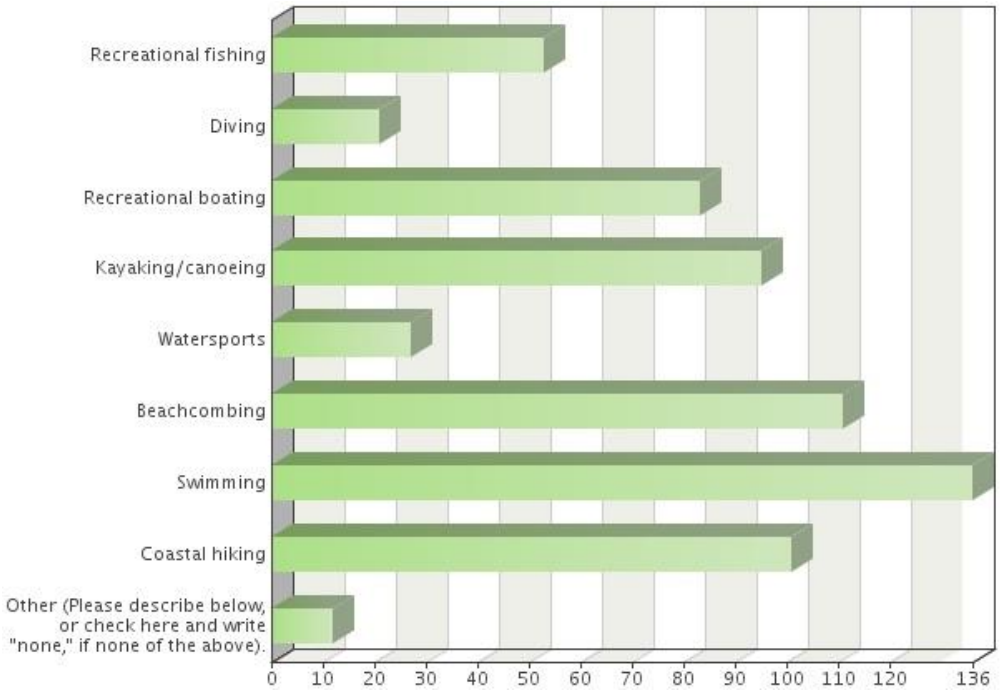

Figure 4.11. Participants' Coastal Activities (N=157).

The respondents were next asked to identify marine or coastal activities in which they partake. Among the available choices, most common was swimming, selected by more than 86 percent of responses (N=136; Figure 4.11). Close behind were beachcombing (N=111; 70%) and coastal hiking (N=101; 64%). Other choices included kayaking or canoeing (N=95; 61%), recreational boating (N=83; 53%), recreational fishing (N=53; 34%), watersports (N=27; 17%) and diving (N=21; 13%). "Other" activities included photography, clamming or crabbing, meditation, sunbathing, camping, and sailing (N=12; 8%).

4.4. Marine Conservation and Seafood Preferences

This section presents the results to questions about which marine conservation initiatives Falmouth residents perceive as most important, and also accounts for their preferences and considerations in purchasing seafood. The respondents were first asked to choose the three conservation activities they perceive as most important (Figure 4.12), followed by one they would most like local policymakers to focus on (Figure 4.13).

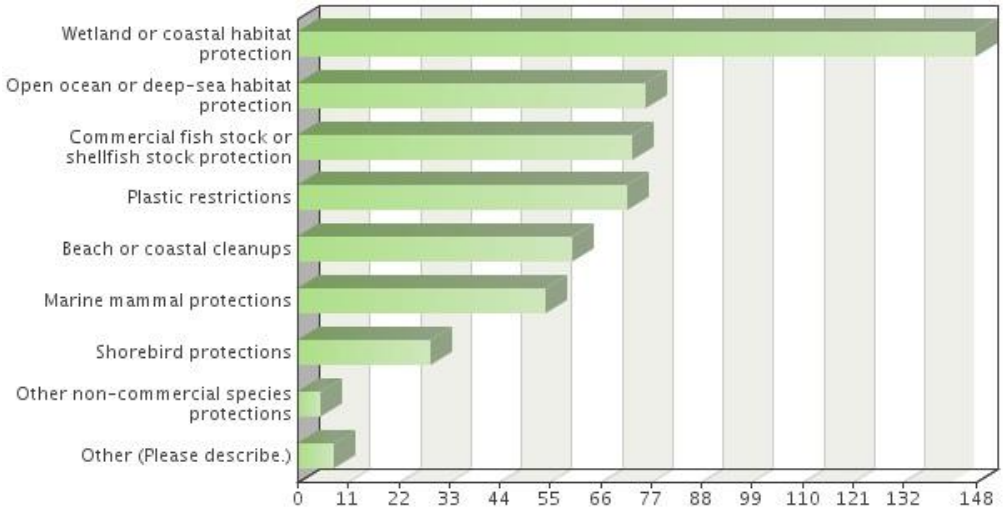

Figure 4.12. Top-three Most Important Conservation Initiatives (N=188).

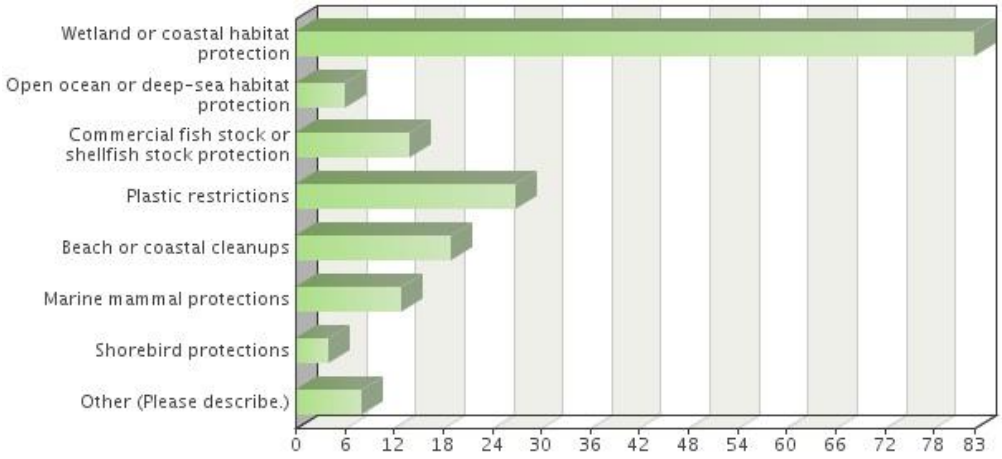

Figure 4.13. Preferred Conservation Initiative (N=174).

Wetland and coastal protection was chosen as one of the top-three conservation initiatives in 79 percent of responses (N=148) (Figure 4.12). Three choices vied closely for the second and third positions, with 40 percent or respondents (N=76) selecting open ocean or deep-sea habitat protection, 39 percent (N=73) choosing commercial fish stock or shellfish stock protections, and 38 percent (N=72) selecting plastic restrictions. Thirty-two percent (N=60) chose beach or coastal cleanups, followed by 29 percent for marine mammal protections (N=54), and 15 percent for shorebird protections (N=29). Three percent (N=5) selected protections for non-commercial species. Responses in the "Other" category included water quality, sewage discharge, education, acidification prevention, or "all of the above" (N=8; 4%).

Asked to select only one marine conservation initiative for targeted focus by policymakers, 47 percent (N=84) of respondents chose wetland and coastal habitat protections (Figure 4.13). Plastic restrictions were selected by 16 percent (N=27) of respondents, followed by beach or coastal cleanups at 11 percent (N=19). Eight percent selected commercial fish stock or shellfish stock protections (N=14), followed by seven percent for marine mammal protection (N=13), three percent for open ocean or deep-sea habitat protections (N=6), two percent for shorebird protections (N=4), and four percent for "Other" (N=8).

The respondents were also asked a series of questions related to seafood preference. Those who stated they were seafood consumers (N=145) were asked to rate the importance of several potential factors during the purchasing process on a scale from one (*Not important*) to four (*Very important*). To determine which purchasing factors were most important in aggregate, the responses were given scores from zero to 1.5, with a rating of four (*Very important*) valued at 1.5 points, and a rating of one (*Not important*) valued at zero. The scores were then totalled to determine "total importance" for each factor (see Table 4.11 for scoring system) and the scores were then compared across purchasing considerations (Table 4.12).

Table 4.11. Importance of Seafood Purchasing Considerations (Scoring System).

Importance of purchasing consideration (1 – *Not important*; 4 – *Very important*)	Score (points)
1	0
2	0.5
3	1
4	1.5
Total Importance (Sum of scores)	3

Table 4.12. Importance of Seafood Purchasing Considerations in Falmouth.

Purchasing consideration	1/Unsure (0 points)	2 (0.5 points)	3 (1 point)	4 (1.5 points)	Total importance
Taste (N=145)	0	1	17	127	**208.0**
Potential health risks (N=144)	4	13	21	106	**186.5**
Product appearance (N=145)	3	8	43	91	**183.5**
Sustainably sourced (N=146)	6	8	55	77	**174.5**
Locally caught/raised (N=146)	7	17	56	66	**163.5**
Affordability (N=145)	3	23	69	50	**155.5**
Other (N=5)	1	0	0	4	**6**

Taste was rated most commonly as "very important" (N=127; 88%), and this factor also scored the highest in aggregate importance in purchasing decisions. Potential health risk (N=106; 74%) and appearance (N=91; 63%) were next in the "very important" ratings and also second and third in total score, respectively. Sustainable sourcing (N=77; 53%) and local produce (N=69; 45%) fell fourth and fifth in the "very important" ranking, which aligned with the total importance scores. Affordability was rated as the least important element – rated as "very important" by only 34 percent (N=50) of respondents. Other considerations included seasonality or "time to market" and freshness (N=5).

Finally, seafood consumers were asked to identify whether they preferred wild-caught or farm-raised products (Figure 4.14). Eighty-three respondents preferred wild-caught seafood (59%), in contrast to only three who favored farm-raised seafood (2%), while 54 stated no preference (39%). Those who stated a preference were asked to explain why. Because of the low number who reported a preference for farmed products, only the reasons for wild-caught preferences are presented (Table 4.13).

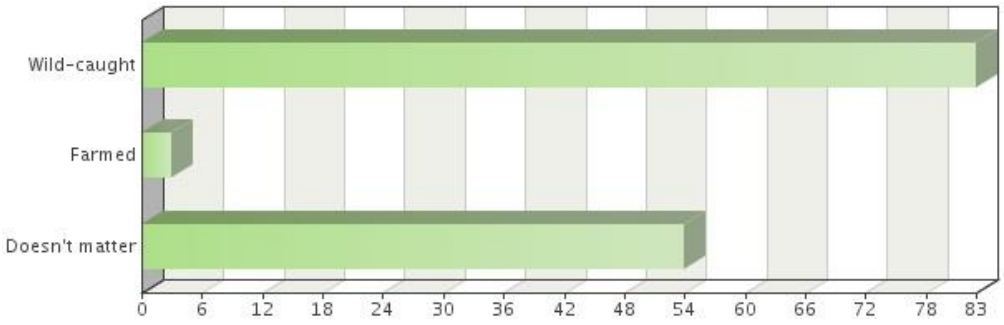

Figure 4.14. Wild-caught vs. Farmed Seafood Preference (N=140).

Table 4.13. Why Participants Prefer Wild-caught Seafood (N=48).

Reasons for Wild-caught Preferences	Frequency
Depends on species, harvesting technique, aquaculture methods *"Some farmed seafood is fine (oysters). Others not so much (salmon)."*	19
Wild-caught is more natural, healthier, or more nutritious; concern for chemicals or unnatural diets fed to farm-raised fish *"Wild-caught seafood just seems 'right'… The fish was swimming and was caught and now I'm eating it. A farmed fish never lived and was probably fed some weird stuff that it wouldn't normally have eaten in the wild."*	18
Sustainability/environmental concerns surrounding aquaculture; fish farms may cause harm to local ecosystems/fish populations "I only prefer wild shellfish. Otherwise, wild-caught. I don't like the idea of farmed species escaping and negatively affecting local genetic diversity."	17
Wild-caught fish taste better *"Taste."*	4
Other *"I feel badly for farmed food. They only exist to be eaten."*	4
Sustainable aquaculture is not available *"What I'd REALLY prefer is 'sustainably farmed', but that doesn't seem to be a thing."*	3

Here, 19 respondents reported that their preference depends on either the species or techniques used during the aquaculture or fishing processes. Most who preferred wild-caught seafood felt that wild products are "more natural," stating a comparative lack in nutritional value in farmed seafood, or they were wary of chemical or dietary inputs (N=18). Seventeen respondents expressed concerns about environmental harm induced by aquaculture, through biotoxin loading or the spreading of disease to wild fish populations. Others thought that wild-caught fish simply taste better (N=4), or that "sustainable" aquaculture was not available (N=3). Other reasons for wild-caught preferences included "feeling bad for farmed animals," and support for local fishers (N=4).

4.5. Marine Economy and Sectoral Influence

This section asked respondents a series of questions about the influence of various marine-related industries or sectors in Falmouth. They were asked to identify whether anyone in their household was employed in the sectors listed below (Table 4.14).

Table 4.14. Members of Household in Marine-related Occupations.

Marine-related sector	Number employed
Marine research/education	62
Coastal or marine conservation	12
Coastal tourism	10
Marine shipping	9
Navy or Coast Guard	6
Commercial fishing	6
Coastal construction	3
Aquaculture	2
None	43

The respondents were then asked to rate the degree of influence that each marine-related sector had in their personal lives, using a scale of one (*No influence*) to four (*High degree of influence*). To accurately determine which marine sectors were most important in aggregate, each response was scored from zero to 1.5, with the rating of four (*High degree of influence*) assigned 1.5 points, and a rating of one (*No influence*) assigned zero points. The scores were then totalled to

determine the "total influence" for each marine sector (Table 4.15 for scoring system), and then compared across all sectors (Table 4.16).

Table 4.15. Perceived Influence of Marine Sectors in Respondents' Personal Lives (Scoring System).

Perceived degree of marine-sectoral influence (1 – *No influence*; 4 – *High degree of influence*)	Score (points)
1	0
2	0.5
3	1
4	1.5
Total Influence (Sum of scores)	**3**

Table 4.16. Perceived Influence of Marine Sectors in Respondents' Personal Lives.

Marine-related sector	1/Unsure (0 points)	2 (0.5 points)	3 (1 point)	4 (1.5 points)	Total influence
Coastal tourism (N=173)	23	35	58	57	**161.0**
Marine research (N=173)	34	31	40	68	**157.5**
Marine conservation (N=172)	33	30	53	56	**152.0**
Navy or Coast Guard (N=173)	70	49	31	23	**90.0**
Commercial fishing (N=172)	70	50	36	16	**85.0**
Coastal construction (N=172)	77	46	30	19	**81.5**
Aquaculture (N=173)	81	53	29	10	**70.5**
Marine shipping (N=173)	98	45	17	13	**59.0**
Other (N=11)	7	0	1	3	**5.5**

The same set of questions was then repeated with a focus on perceived marine-sectoral influence within the community itself. The respondents were asked to rate the degree of influence they felt each marine-related sector had in Falmouth generally from one (*No influence*) to four (*High degree of influence*). To determine which marine sectors were most important in aggregate, each response was given a score from zero to 1.5, with four (*High degree of influence*) assigned 1.5 points, and a rating of one (*No influence*) assigned zero points. The scores were then totalled to determine the "total influence" for each marine sector (Table 4.17 for scoring system) and then compared across all sectors (Table 4.18).

Table 4.17. Perceived Influence of Marine Sectors in Falmouth (Scoring System).

Perceived degree of marine-sectoral influence in Falmouth (1 – *No influence*; 4 – *High degree of influence*)	Score (points)
1	0
2	0.5
3	1
4	1.5
Total Influence (Sum of scores)	**3**

Table 4.18. Perceived Influence of Marine Sectors in Falmouth.

Marine-related sector	1/Unsure (0 points)	2 (0.5 points)	3 (1 point)	4 (1.5 points)	Total influence
Coastal tourism (N=164)	8	4	17	139	**227.5**
Marine research (N=164)	9	12	28	115	**206.5**
Marine conservation (N=163)	11	15	52	85	**187**
Navy or Coast Guard (N=164)	15	41	61	47	**159.5**
Coastal construction (N=164)	21	39	41	63	**155**
Commercial fishing (N=162)	16	34	61	51	**142.5**
Aquaculture (N=164)	35	44	50	35	**124.5**
Marine shipping (N=162)	53	60	32	17	**87.5**
Other (N=5)	3	0	0	2	**3**

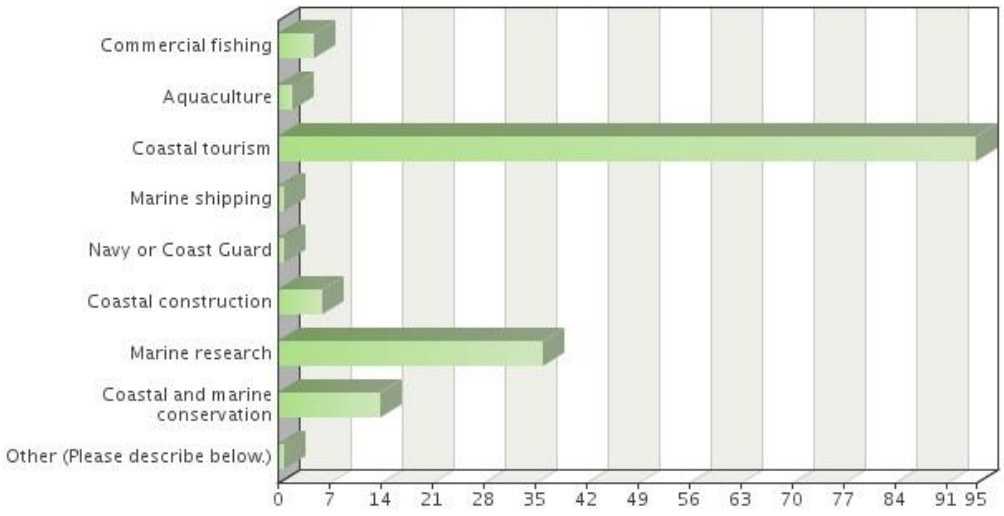

Figure 4.15. Most Influential Marine Sector in Falmouth (N=161).

The respondents were then asked to indicate which of the marine sectors they perceived as most influential relative to the others (Figure 4.15). Coastal tourism was perceived to have the greatest influence in Falmouth (N=95; 59%). Marine research was selected in 22 percent (N=36) of the responses, followed by coastal and marine conservation (N=14; 9%), coastal construction (N=6; 4%), and commercial fishing (N=5; 3%). Other responses included aquaculture (N=2), marine shipping (N=1), Navy or Coast Guard (N=1), or "Other" (N=1), each below one percent.

To complement questions related to influence, the respondents were asked to select the three marine-related sectors they perceived as most important for the creation or protection of jobs in Falmouth (Figure 4.16). The three top selections for "most important" were marine research (N=95; 61%), coastal tourism (N=87; 56%), and coastal or marine conservation (N=61; 39%). Least common were coastal construction (N=8; 5%) and marine shipping (N=4; 3%).

The final question in this series asked respondents to identify a single employment sector that they wished to see developed by policymakers (Figure 4.17). Coastal or marine conservation emerged as the top sector of choice for focus (N=65; 44%), followed by marine research (N=31; 21%), aquaculture (N=19; 13%), commercial fishing (N=10; 7%), coastal tourism (N=10; 7%), coastal construction (N=5; 3%), "other" (N=5; 1%), and marine shipping (N=1; 1%).

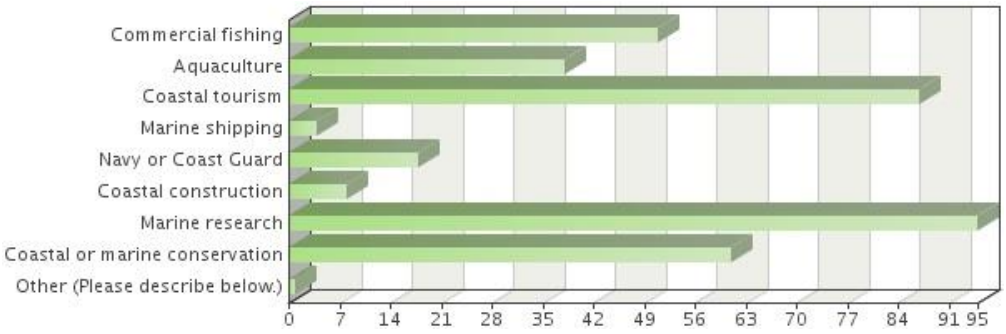

Figure 4.16. Identifying Three Important Marine Sectors for Development (N=155).

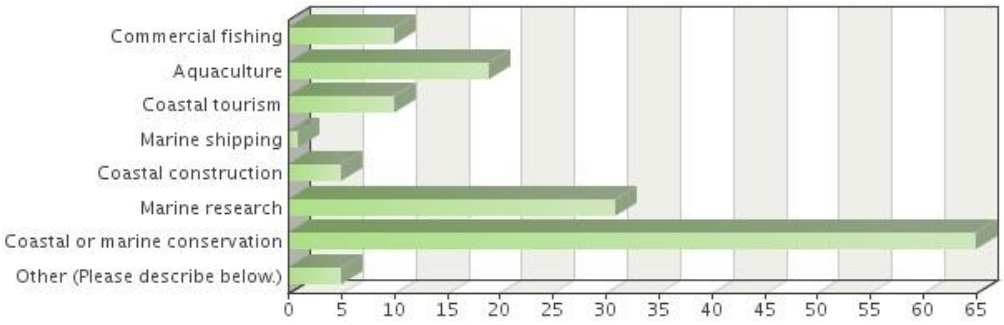

Figure 4.17. Choosing One Marine Sector for Focused Development (N=146).

4.6. Ocean Literacy: Knowledge, Available Resources, and Informational Preferences

This section presents the results regarding the participants' level of ocean-related knowledge, and how they consume – or would like to consume – ocean-related information. The respondents were asked to rate their level of knowledge about the ocean, identify the information sources they draw upon to develop an understanding of the ocean, describe any further informational sources they would like to see, and discuss how current informational sources could be made more accessible. Furthermore, the respondents were asked to report whether they had observed any changes to the ocean in their lifetime – as well as which change they perceived as most concerning – and about the issues they would most like coastal or marine policymakers to consider.

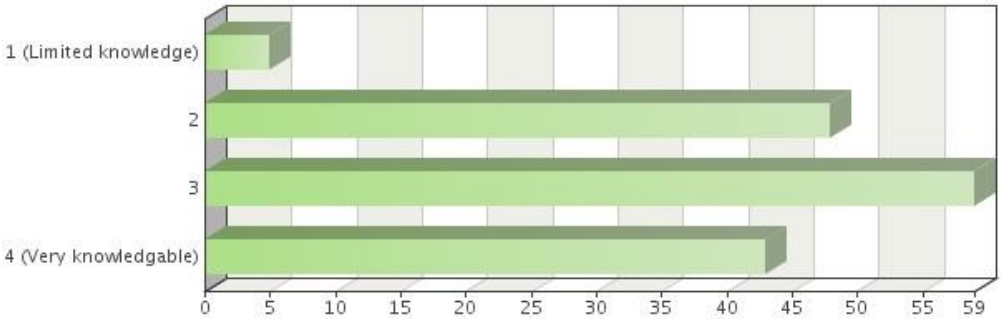

Figure 4.18. Ocean Knowledge of Participants (N=155).

Asked to report their knowledge of the ocean on a sliding scale from one (*Limited knowledge*) to four (*Very knowledgeable*), 35 percent (N=59) of respondents reported as a three, 31 percent (N=45) reported as a two, and 28 percent (N=43) rated their knowledge at four. Only two percent (N=5) of respondents reported "limited knowledge," at a one (Figure 4.18).

Table 4.19. Identifying Common Sources of Ocean Information in Falmouth (N=123).

Sources Used for Ocean Knowledge	Frequency
Standard print or informational source; books, magazines, traditional media *"Variety of journals, newsletters and blogs on policy, industry and research. National and international newspaper coverage."*	56
Marine science institutions *"WHOI, NOAA, National Seashore Program (NEED Academy), Deb Coulombe's 'The Seashore Naturalist', Waquoit Bay Estuary, [Woods Hole] lectures, presentations and professional development."*	39
Personal communications; interactions with scientists/researchers *"Local experts."*	33
Online sources; social media *"I follow WHOI and other scientific institutions on social media...."*	26
TV, documentary film, radio. *"Reading National Geographic and watching documentaries."*	20
Past educational experience *"My scientific training and research…"*	17
Public lectures *"Presentations at WHOI and reading."*	12
Experience and observation *"Research cruises… hands on experience."*	7

The respondents were asked to indicate the sources of information they typically rely upon to understand the ocean or ocean-related issues. A variety of categories emerged (Table 4.19). Many respondents mentioned traditional media, local news, magazines, or books as informational sources commonly drawn upon (N=56). Second most common were references to local marine science institutions such as WHOI, MBL, Buzzards Bay Coalition, or NOAA (N=39). Thirty-three referenced personal communications or private interactions. Internet or social media resources were mentioned 26 times. Other sources of ocean information included

documentary programs, television, or radio (N=20), past education (N=17), public lectures (N=12), and experience or observation (N=7).

Table 4.20. Making Ocean Information More Accessible (N=86).

Ideas for More Accessible Ocean Information	Frequency
Gear information towards a general audience; train scientists to develop communication skills, interact with community more often "Develop better public communication skills among scientists, policy researchers, and military. All of them struggle to explain things outside of their fields."	33
More open-access information/online journals; remove paywalls; more social media "It could be more readily accessible without having paywalls, especially for new scientific knowledge. Lots of this knowledge isn't necessarily readily accessible unless you know the community and know where to look…"	29
Unsure/already accessible "I'm not actually sure. There is a wealth of knowledge out there. I feel the onus is on the individual to take advantage of the sources."	20
More ocean-related news/science-journalism partnerships "WHOI, MBL, NOAA could highlight their work with [a] guest column in [the Falmouth] Enterprise…"	19
Informational material available at high-traffic public areas – beaches, schools, etc. "Good question. More educational resources at docks frequented by recreational boaters and at public beaches. Easy to read and understand signage about things like the harms of plastic in the water, looking out for sea turtles, disposing carefully of fishing line and trash."	14
TV/radio programs focused on local issues "Put a local show on FCTV. Falmouth Community Television."	8

The respondents were next asked how informational sources could be made more "accessible" (Table 4.20). Many responses recommended that scientific information (particularly that produced locally) be designed for a general audience. The suggestions included references to "translation," or to relate science to issues of public importance. This category also included training scientists in communication or encouraging scientists to interact more with the community in public talks, symposiums, or about the town (N=33). Other responses included more open-access information online or via social media, free of paywalls or other institutional

barriers (N=29). Several respondents felt that informational sources are already accessible or they were unsure how to answer (N=20). Some also suggested more partnerships between journalists and scientists, or more ocean-related coverage – particularly regarding local issues (N=19). Others called for a more information in available public places, (e.g., signage on the beach explaining natural coastal processes or ocean-related issues), or a greater focus on schools (N=14). References to more local television or radio content rounded out the responses (N=8).

Table 4.21. Informational Sources for Development (N=69).

Sources for Further Development	Frequency
Much information already available *"Already a lot available here in Falmouth."*	15
More media coverage of locally produced marine science; more easily digestible information made for general audiences. *"More news articles. I think there are a lot of resources available, especially in Falmouth. I need to take advantage of those resources."*	13
Free lectures, seminars, or courses available to the public *"Educational programs for kids and adults that actually take place along Falmouth waters."*	12
Educational resources at high-traffic public areas *"Set up pop-up museums at beaches during the summer or at the grocery stores or shopping destinations… bring the education from the aquarium or WHOI to where the people are… [In] snackable bites… Make a statement with the garbage cans at the beaches with education about the impact of recycling one plastic water bottle here, instead of there on the beach…"*	9
Social media; apps; interactive online resources *"Text/phone alerts of cool new local ocean news; information along with warnings/status of algal blooms for communities…"*	9
Information on seafood sustainability guidelines *"An app re: Cape Cod sustainable seafood (spinoff of Monterey Bay Aquarium's?)…"*	5

The respondents also reported on the types of information they would like to see developed to further their understanding about the ocean or ocean-related issues (Table 4.21). Here, many were unsure, felt that much information was already available, or that the onus was on the

consumer to seek out information (N=15). Suggestions for more media coverage or journal articles, or science translated into easily readable books or magazine articles also emerged often (N=13). Free lectures, seminars, or learning courses available to the public were referenced 12 times. Others called for educational resources at public places like beaches, schools, or tourist centers (N=9). Other responses included references to social media, apps, or interactive online resources (N=9), or more information on local sustainable seafood guidelines (N=5). Across these categories, requests for localized material occurred eleven times. “Kids” or “schools” were mentioned ten times, references to accessibility or connecting with audiences were made nine times.

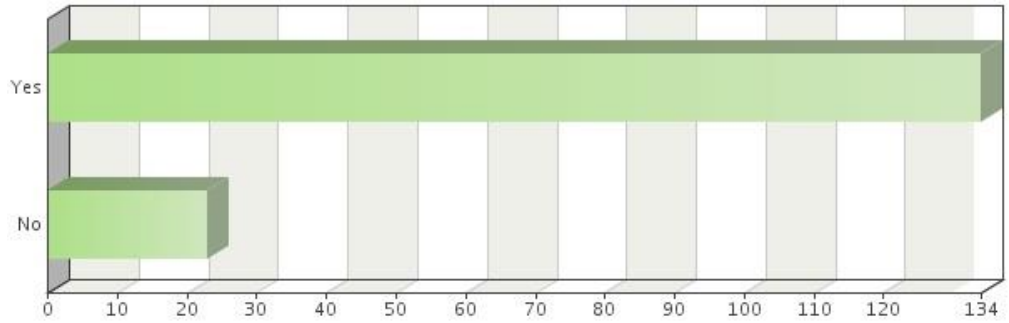

Figure 4.19. Tracking Perceived Changes to Ocean Environments in Falmouth (N=157).

Table 4.22. Most Concerning Ocean-related Changes for Participants (N=125).

Perceived Ocean-related Changes	Frequency
Erosion, shoreline loss, rising sea levels *"Coastal erosion/rising sea level."*	49
Ocean plastics, beach litter, marine pollution *"More litter and pollution."*	48
Changing ecosystems, biodiversity loss, overfishing *"Fewer of every animal I remember – starfish, horseshoe crabs, blue crabs, laughing gulls, whippoorwills, bobwhites… On the other hand, there are more ospreys, even eagles in [the] Boston area, but net loss."*	40
Rising ocean temperatures *"The ocean is getting warmer. Seems to be more toxic algal blooms, wildlife in trouble because food sources are changing, change in climate."*	23
Coastal building/decline in public access to coastal areas *"Building up of natural spaces. I have been here for 60 years and have seen multiple changes, sadly mostly construction over open spaces."*	16

Table 4.23. Participants' Marine Policy Focus Preferences (N=85).

Marine Policy Focus	Frequency
Restoration of coastal habitat/natural buffer zones *"We should be considering the construction of a barrier reef from Nobska light to Falmouth Harbour to slow the wave action and reduce erosion…"*	31
Cleaning beaches, addressing marine pollution *"Keeping the beaches clean (I am talking about trash, needles, nips)."*	19
Support broad-scale climate change adaptation policies, address sea level rise *"Developing a long-term strategy to protect the community and implementing it."*	18
Plan for coastal retreat, limit hard structures along coastline *"Less building right on the coast, cut back on building of revetments and other coastal structures, danger of letting affordable projects avoid compliance with regulations related to habitat."*	14
Overfishing/species conservation *"Conservation, climate change; pollution and overfishing."*	12
Address coastal access issues, manage overcrowding *"Too much tourism. Cape Cod is being loved to death. Stop promoting it so much, especially the Chamber of Commerce and state tourism bureaus. The inn is filled to capacity. Limit growth, especially hotels, resorts, restaurants, etc. No timeshares, AirBnBs."*	8
More education/research/marine science *"Science. Get it out there!"*	7
Update flood maps/insurance policies *"Making the national flood insurance program a much fairer program, changing for the risk where it is the greatest. Those that live in high risk areas should pay accordingly and not be subsidized by taxpayers who cannot afford to live in those same places and have no access, especially if the property is frequently flooded or damaged… If they chose to stay there it should be at their own risk and cost after the first loss."*	2

The respondents were next asked to note whether they had observed any changes to the ocean in their lifetime (Figure 4.19). Here, 85 percent (N=134) responded affirmatively. These respondents were then asked to comment on which change they perceived as most concerning (Table 4.22). Forty-nine responses mentioned erosion, shoreline loss, or rising sea levels.

Comments about increased pollution along the beaches, or plastics in the ocean emerged 48 times. Others mentioned declining rates of biodiversity, changes to local ecosystems, or overfishing (N=40). The remaining references included rising ocean temperatures (N=23), or decreased public access to natural coastal areas (N=16).

Rounding out the Ocean Literacy section, the respondents were asked which ocean-related issues they would most like policymakers to be aware of or focus on (Table 4.23). Thirty-one responses claimed the protection or restoration of coastal habitat or natural storm surge buffer zones as a priority. The respondents also recommended keeping the beaches clean or reducing ocean pollution (N=19). Some also made general references to sea level rise or climate change adaptation (N=18), or called for restrictions on coastal building (N=14). Others suggested that policymakers address overfishing (N=12), consider strategies to manage crowding and increasingly difficult coastal access (N=8), increase ocean-related research or education (N=7), or update flood zoning and insurance information (N=2).

4.7. Coastal Values: What Makes for a Good Life at the Coast?

This section outlines the intangible elements of coastal living most important to Falmouth residents. They were asked to identify their first thought when presented with the word “ocean”; what they most enjoy about living in a coastal community; and ultimately, what is most important to them about the ocean.

Table 4.24. First Thoughts in Reference to "Ocean" (N=151).

First Thought	Frequency
Intangible connections: peace, happiness, joy, freedom, love, mental health, etc. *"Essential for my mental health."*	57
Beauty, aesthetics, power, change, wonder, wild, etc. *"From flat calm to roaring waves in minutes."*	32
Marine life, ocean ecosystems/habitat, nature, etc. *"All the mysterious and wonderful creatures within."*	23
Sensory experience: sight, sound, smell, touch *"I think of the tides and wives, the smell of salt air, and the sound of a foghorn."*	16
Openness, vastness, references to size, etc. *"The ocean is expansive and strong."*	13
Beaches *"The sounds of the beach: waves, birds."*	9
Climate regulation/oxygen *"Oxygen producer, carbon sink."*	9
Recreational activity *"Diving into huge waves, refreshing and energizing."*	7
Food/resources *"One of our greatest natural resources."*	5
Conservation/protection *"Holistic system that needs to be protected."*	5

Table 4.25. Tracking the Best Features of Coastal Living (N=151).

Feature Most Enjoyable about the Coastal Community	Frequency
Access: proximity, closeness to coast/beach/ocean *"Access to salt water and sandy beaches."*	57
Sight and aesthetics: beauty, view, vista, sunset, etc. *"The beauty of the ocean and the coast. The resilience and closeness of the community. The wonders of nature."*	56
Intangible connections: peace, happiness, rejuvenation, connection, home, community, etc. *"Being in touch with nature and the ocean, relaxation and peace from being on or near the waves. It's part of who I am."*	46
Activity and recreation *"Seeing the ocean as much as possible. Walking and rail trails, beaches, driving on roads by it, dining in restaurants near it."*	34
Physical feeling; touch, climate, weather, etc. *"An almost continuous salty breeze, and being able to [easily] go to the beach. Digging my toes into the sand, and being with my family at the beaches collecting shells, swimming, or just spending time together…"*	25
Ocean ecosystems, marine biodiversity *"The connection with the sea and it's biodiversity."*	18
Sound *"Swimming in the summer and fall and the beauty of the water. I also love that I can hear the foghorn at my house 3 miles from the water!"*	11
Smell *"The smell of the tides, the feel of salt water drying on your skin, and the sunset over the water."*	10
Taste: food/resources *"… delicious, freshly caught dinner, powerful atmosphere, home."*	10

Table 4.26. What is Most Important about the Ocean in Falmouth? (N=85)

Most Important Feature about the Ocean	Frequency
Responsible for all life; caretaking for future generations; power/climate regulation *"Without the ocean, there is no life on Earth."*	41
Nature, biodiversity, sustainability; protection/preservation/conservation *"That we respect the creatures in it, and we protect them."*	40
Cleanliness *"Keeping beaches and harbors clean and safe."*	22
Access *"Public access, and environmentally sound everything."*	16
Intangible or psychological value, sensory experience *"The ocean means peace to me."*	16
Economy/food/resources *"All of its tasty edible creatures."*	10

With regard to the first thing that came to mind when considering the word "ocean," most respondents referred to a series of fundamental concepts like peace, joy, happiness, freedom, love, or mental health (N=57) (Table 4.24). The participants mentioned terms related to beauty, power, change, wonder, aesthetics, or "wild" in 32 instances. Others commented on life, biodiversity, nature, or habitat (N=23), or sensory experience such as seeing, hearing, or smelling (N=16). Responses using terms such as "open" or "vast," or vistas or size also emerged (N=13), as did references to beaches (N=9), climate or oxygen (N=9), activity, (N=7), food or resources (N=5), and conservation (N=5).

The respondents were asked to indicate what they most enjoyed about living in a coastal community (Table 4.25). Here, the array of sensory-related responses was categorized to separate sight, sound, smell, and physical feeling. Many respondents stated the ability to access the coast, "get to," or be "close" to the ocean or beaches as the feature they enjoyed most

(N=57). Others noted a variety of sight-related phenomena, using terms such as “see,” “view,” “beauty,” “vista,” or “sunset” listed in 56 instances. Non-physical attributes such as peace, happiness, joy, health, or connection to the world or the community were also common (N=46). Coastal recreation or specific coastal activities were mentioned in 34 responses. Twenty-five responses commented on touch or physical feel, “salt air,” “ocean breezes,” pleasurable climatic characteristics, weather or temperature. Others referenced nature, habitat, or themes related to marine biodiversity (N=18), or other sensory experiences including sound (N=11), smell (N=10), and taste (e.g., “seafood”) (N=10).

Finally, the respondents were asked to identify what they felt was most important to them about the ocean, and any additional comments (Table 4.26). In this case references to power, climate regulation, future generations, “life” (e.g., “all life” – references specific to marine life were placed in a separate category), or responsibility as “caretakers” or “custodians” were included in one group (N=41). Others mentioned marine life specifically, nature, preservation, protection, conservation, sustainability or ocean health (N=40). Many also used words like “clean” or “cleanliness,” or called for reduced pollution (N=22). Access and recreation-related themes emerged in 16 responses, as did references to psychological, sensory, or place-based benefits like happiness, personal health, connection, rejuvenation, community (N=16). Rounding out the responses were comments involving the economy or resources generally (N=10).

5. Discussion

This section provides suggestions on how local policymakers or communicators could further incorporate public perception data as part of decision-making processes, or in building community support for proposed initiatives. Suggestions are drawn from key elements identified within survey results. During the analysis process, a variety of themes emerged as indicative of several values and perceptions held commonly amongst the survey respondents.

Findings showed: 1) a strong connection to intangible connections or place-based values in Falmouth, 2) uncertainty related to the adequate protection of the community regarding flood risk, 3) a significant importance for the protection of wetland and coastal habitats, 4) a call to limit human-made coastal structures and restore natural barriers, and 5) a desire for more public-scientist interaction, and accessibly communicated ocean science.

The first of two discussion sections examines town bylaws and marine planning initiatives in Falmouth, showing that many of these espoused values are already reflected within the town's Local Comprehensive Plan (LCP). Also included here are national and state policies or programs which could aid in the development of coastal planning strategies pursuant to the views of Falmouth residents. The following section will focus on communication, information and coastal values. Additionally, the concept of relational values (Chan et al., 2016) is proposed as a frame for incorporating perceptions related to more abstract, intangible connections and place-based values in discussions of ocean citizenship and coastal conservation. Finally, this section will outline how the evidence from the survey could be considered in the construction of an Ocean Connectivity Index, particularly the challenge of adapting intangible benefits and relational values for use in scientific and policy contexts. Representative quotations have been placed at the beginning of each discussion sub-chapter to provide additional context to the themes addressed within.

5.1. Adopting Public Perceptions into Policy

5.1.1. Floods and Flood Insurance: Navigating a Shifting Landscape

> "I have no idea if my home is adequately protected. What I do know… we pay A LOT for flood insurance, and yet, just seven houses up the street from us, homeowners aren't required to pay any flood insurance… Makes no sense."

Major perceptual differences are evident when comparing how residents felt about the safety of their homes versus the safety of the community emerged. Ninety percent of respondents felt their homes were adequately protected from flood risk (Figure 4.4). This view was in stark contrast to only 40 percent of respondents who felt that the community itself was adequately protected (Figure 4.6). More research may be necessary to understand the full meaning of this discrepancy, but a preliminary understanding can be gleaned by examining responses explaining why such a large majority of survey respondents felt their homes were safe (Table 4.3).

Most respondents cited elevation or distance as responsible for their views about the safety of their homes. A significant proportion also reported uncertainty or a reliance on flood maps or insurance premiums. Alternatively, significant concern pertaining to the potential for coastal flooding in the community was displayed throughout the survey responses, with calls for enhanced natural buffer zones and coastal retreat among the more common policy ideas. This could help to explain why so many felt their homes were safe, despite perceiving the community as inadequately protected from coastal flooding. To mitigate uncertainty related to coastal flood risk, policymakers and communicators can play a role in the dissemination of risk-related information for residents. Furthermore, these responses call for an examination of local flood zoning maps (a resource that many were dependent upon), their level of reliability, and their relationship to insurance premiums used to determine the measure of flood risk associated with neighborhoods and individual homes in Falmouth. This review could be incorporated as part of the municipality's LCP mandate to contract an independent, town-wide environmental risk assessment within the next two years (LCP, 2016).

Over the course of the next several decades, hurricane intensity is expected to increase globally, as are the number of category four and five hurricanes in the Atlantic basin (Bender et al., 2010; Knutson et al., 2013). Debate still exists as to exactly how storm frequency will be affected by climate change over time, but recent NOAA estimates suggest an increase in major hurricanes on the order of 39-45 percent by 2050 (Knutson et al., 2013). Precipitation rates are also expected to increase by an average of 10-30 percent per storm (Knutson et. al, 2013). Warmer temperatures induced by human activities are already leading to substantial increases in rainfall and flash flood events (Pall et al., 2017). In New England's coastal waters, sea surface temperatures have seen some of the fastest increases on the planet (Thomas et al., 2017). These factors combined put Falmouth and other Cape Cod coastal towns at significant risk of flooding going forward.

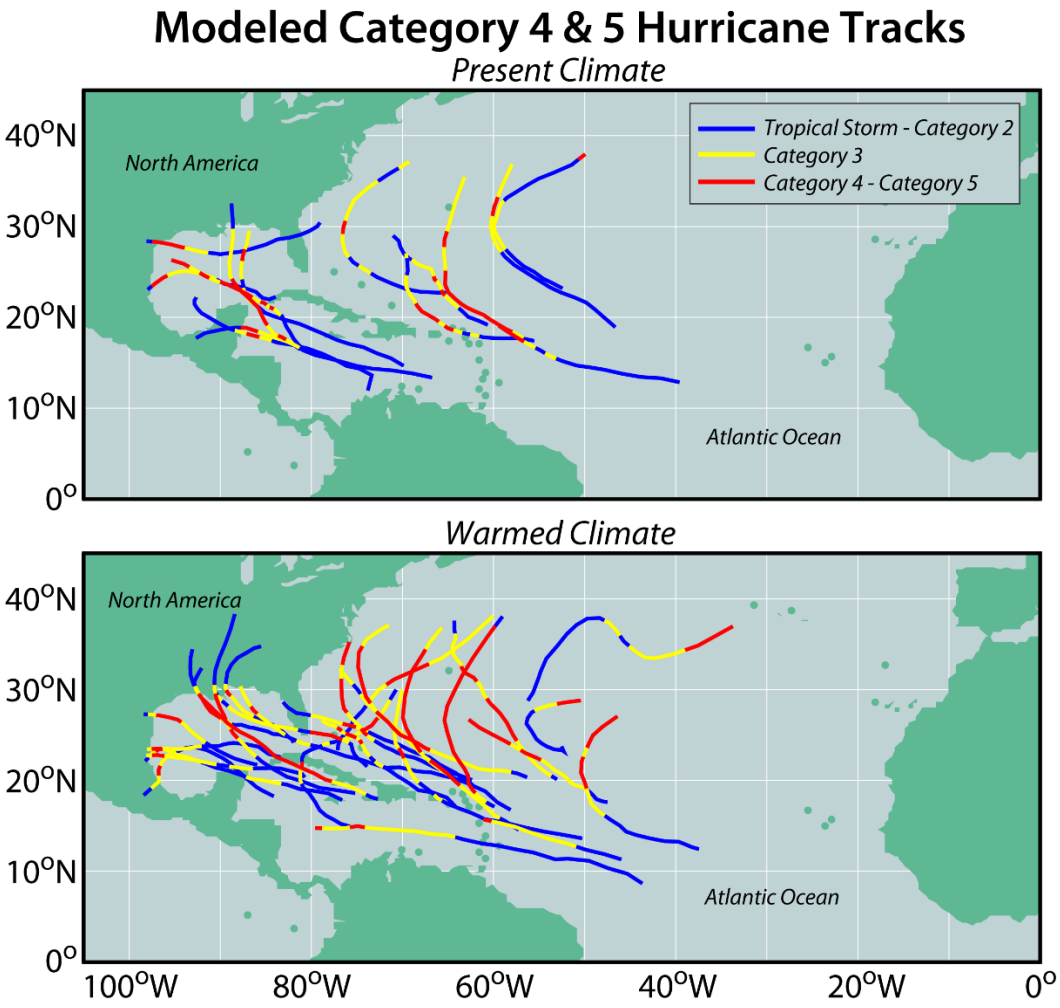

Figure 5.0. Expected Increase in Atlantic Hurricane Frequency Over Time (Bender et al., 2010).

Flood insurance claims in the United States cost an average of $20,000 per home (Division of Insurance, 2017). Yearly premiums typically cost about $550 (Division of Insurance, 2017). Still, each year, American homeowners forgo flood insurance, and many experience unexpected flood events (Division of Insurance, 2017). With policies and premium rates in flux due to the severity of the 2017 storm season and proposed changes to federal flood insurance policy (21st Century Flood Reform Act, 2017), a climate of uncertainty has emerged in understanding how property owners will be affected. For this reason, it is imperative that coastal residents have access to information required to make safe decisions regarding the protection of their homes.

In the United States, the Federal Emergency Management Agency (FEMA) is the primary provider of flood zoning information. FEMA most recently updated flood zoning maps for

Falmouth and the rest of Barnstable County as part of its 2014 Flood Insurance Study (FIS) (FEMA, 2014). The FIS distributes information on the likelihood and severity of flood hazards in the area. However, updating information can be expensive, especially if new surveys are required, and the wide range of variability in forecasting sea level rise, and subsequent effects on storm surge or rainfall (Church et al., 2013) make estimates fundamentally challenging (Pralle, 2017). FEMA's FIS maps are based primarily on historical data, and do not account for future vulnerabilities predicted in climate modelling (Pralle, 2017). In past instances – including in New York City during Hurricane Sandy, and in large parts of Houston during Hurricane Harvey – zones outside of designated floodplains have seen major flood events (Pralle, 2017; Skibba, 2017).

In Falmouth, residents identified FEMA's flood maps as a tool for understanding whether their homes are at risk. This suggests the need for local agencies to communicate the inherent margin for error embedded in these maps to Falmouth homeowners. It is also worth noting that the June 2014 FIS map for Falmouth is included in the town's Local Comprehensive Plan, and referenced for guidance on planning matters (LCP, 2016).

The FIS is also intended to assist Falmouth and other coastal communities in establishing appropriate actuarial rates and flood management policies as part of the National Flood Insurance Program (NFIP). NFIP provides standardized flood insurance to residents of over 20,000 U.S. communities that agree to adopt flood management policies aimed at mitigating risk and limiting the potential for incurred flood damages. NFIP has been the subject of significant political debate in 2017, as the program is due for renewal at the end of its most recent five-year extension imposed by the Obama Administration. Associated with the renewal process, a Congressional Bill passed in November 2017 adds a variety of amendments to NFIP as part of the 21st Century Flood Reform Act (H.R. 2874). Here, the Bill offers a national framework to assist Falmouth planners in updating local bylaws and floodplain policies to address the concerns of residents as they see fit.

5.1.2. Uncertainty: Disseminating Information and Collaborating with Local Institutions

> "I don't think anything can ever be fully prepared. You take measures and steps to protect your property, but… you can never really predict the impact a storm will have until it hits."

In alignment with the current federal administration policies aimed at market deregulation, provisions within H.R. 2874 are expected to reduce government-backed insurance policies and attract private lenders to flood insurance markets. This signals a shift away from widespread public coverage provided by FEMA through NFIP, but amendments to the FEMA mandate in H.R. 2874 also deliver an opportunity for municipalities to take the lead in helping citizens to understand risk and navigate the flood insurance landscape. Several of the following changes are related to questions and ideas raised by survey respondents and could carry important meaning for Falmouth town planners and property owners.

First are changes related to transparency and the distribution of information. Section 103 of the 21st Century Flood Reform Act requires FEMA to hold public meetings and publish an annual explanation of actuarial rates. FEMA must now also make any historical information about previous claims, coverages, or damages available to property owners within 30 days of the request (21st Century Flood Reform Act, 2017). Planners and communicators in Falmouth could begin to mitigate public uncertainty simply by making these changes widely known, advertising dates on which public meetings are to be held, and assisting residents through the process of obtaining flood insurance information for personal properties.

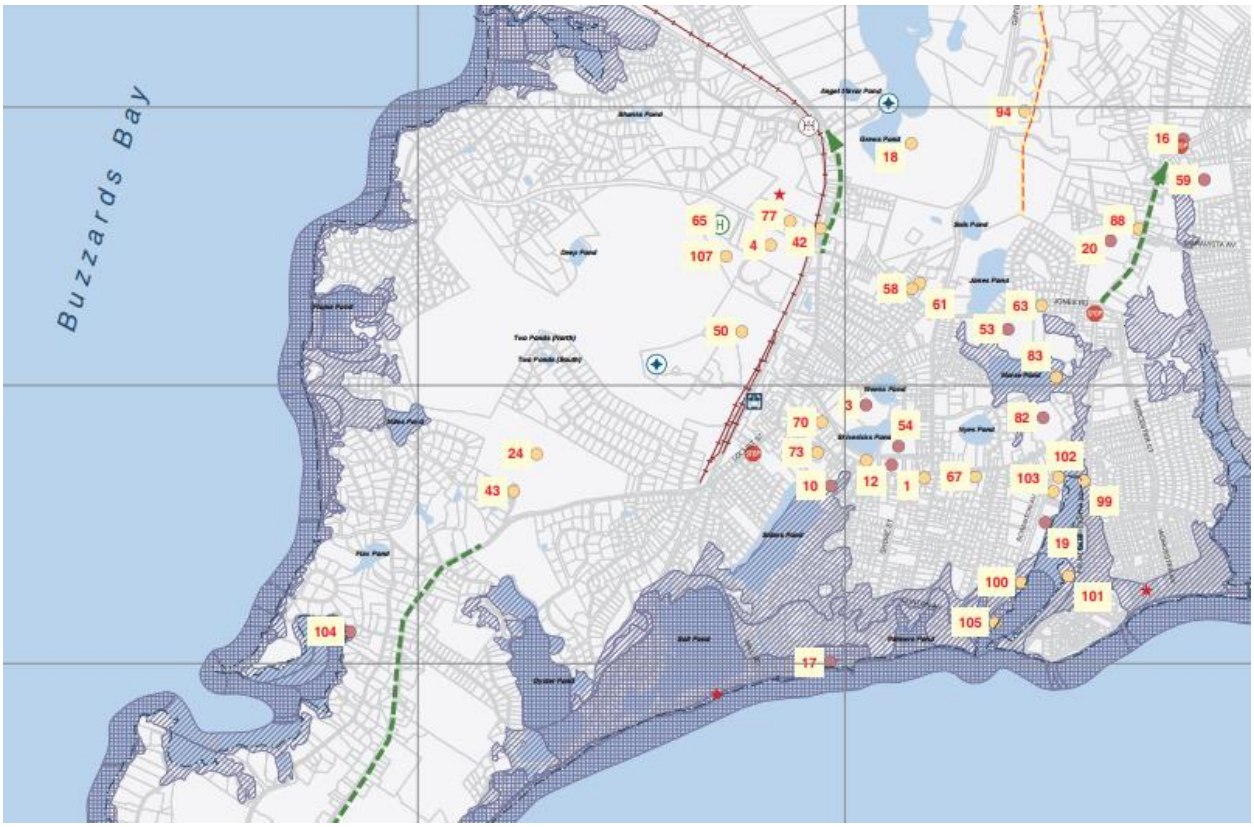

Figure 5.1. Sample Falmouth Flood Risk Vulnerability Assessment Map (Cape Cod Commission, 2004). Showing 100-year Floodplain.

The Act also provides opportunity for towns and private insurance lenders to mandate the purchasing of flood insurance in areas that have not been identified by FEMA as special hazard areas (21st Century Reform Act, 2017). This clause allows municipal policymakers to exert more authority in designating areas of risk best known within the local community, or locations subject to future climate-related liability, which may not be fully reflected by FEMA flood maps. FEMA is also required to consult with the Department of Defense, USGS, and NOAA in obtaining relevant flood insurance mapping information (21st Century Flood Act, 2017). The latter two organizations have offices and research facilities located in Woods Hole. This infrastructure makes Falmouth an ideal location for the development of adaptive flood risk principles capable of providing the surety and protection necessary to keep people and property safe as the frequency and intensity of storms continue to rise over the course of the century (Bender, et al., 2010; Knutson et al., 2013; Pall et al., 2017). Continued collaborations of this type would also help to satisfy calls from survey respondents for the municipal government to

work in concert with local scientists in the design of a long-term plan for climate change adaptation (Table 4.8; Table 4.9).

5.1.3. Mitigating Conflict: Equitable Insurance and Limiting Coastal Development

> "Everybody should be responsible for their own property, we pay more to live closer to the ocean and that also includes risks…"

With new FEMA regulations, Falmouth also has an opportunity to address challenges associated with repetitive loss properties – properties to which NFIP has made at least four payouts of greater than $5,000 in damages or recovery costs. While many survey respondents were open to the idea of government spending in the interest of protecting the community, others felt that it is not appropriate for public monies to be spent on the protection of private homes (Table 4.7), as well as some who felt that future coastal building should be limited, if not entirely restricted (Table 4.8; Table 4.9). Because of the significant extent of private ownership along the Falmouth coastline, private homeowners are likely to be hit hardest by increasing flood risk. Large payouts to private homeowners, especially in areas of frequent loss, could further exacerbate the frustration of other citizens in low risk areas whose payments are used to front costs.

These inequities could represent potential source of conflict between coastal property owners and citizens who do not wish to see public funds distributed to cover private losses. The 21st Century Flood Act requires FEMA to raise premiums on multiple loss properties by 15% annually, if rates do not reflect full risk, and limit the availability of coverage for properties built within special hazard zones. Theoretically, these measures should provide a major economic incentive for high risk property owners to ensure their buildings are floodproofed, and for developers to avoid building in the floodplain. Current regulations stated in Falmouth's municipal code related to the Floodplain Zone (Falmouth Home Rule Charter, 2017) include requirements to ensure structural integrity and mitigate flood damages for coastal developments, but do not in any case restrict coastal building for reasons specifically related to flood risk. Falmouth's Local Comprehensive Plan includes a provision to ensure that local codes are reviewed to increase the resilience of construction projects. Indeed, town planners could go a step further, and seize upon

H.R. 2874 provisions to de-incentivize building in flood zones and update local development codes to satisfy residents' requests to limit coastal structures by adjusting zoning laws as necessary, until long-term adaptation strategies can be agreed upon in public discourse.

5.1.4. Protecting Wetlands and Restoring Natural Buffer Zones

"Wetlands… are the filter for air pollution, they are the nurseries for baby animals, they are the resting place for migrating birds, and they shelter houses from hurricanes."

Figure 5.2. Coastal Wetlands on Cape Cod. (Simon Ryder-Burbidge)

Further changes to H.R. 2874 also reflect public calls for the restoration of coastal habitat and natural buffer zones (Table 4.8; Table 4.9). The Bill now "requires" (as opposed to "allows" – as was formerly written) FEMA to provide premium credits to communities that protect "natural and beneficial floodplain functions" (21st Century Flood Reform Act, 2017, S.410). Falmouth

already demonstrates a strong dedication to wetland conservation and the preservation of coastal habitat – represented both by survey responses (Figure 4.11; Figure 4.12) and by stringent municipal bylaws related to wetlands, dunes, and coastal estuaries (Falmouth Home Rule Charter, 2017). In the fall of 2016, several wetland protection violations made headlines, as nine Falmouth property owners faced fines for illegal clearing and filling in designated wetland areas (Feldott, 2016). The Conservation Commission also unanimously moved to suggest that the town counsel write a "strongly-worded letter" to the construction company that carried out the violations under contract (Feldott, 2016). Legal notices involving wetlands protection violations or permitting requests appear frequently in weekly legal announcements issued by the local media, suggesting the seriousness with which Falmouth's wetland-governing Conservation Commission administers protection laws (Legal Notices – Sept. 22, 2017, 2017).

The town's Local Comprehensive Plan also states a variety of goals involving the restoration of natural coastal systems in relation to resiliency mandates. Relevant policies and action items include the development of a wetlands restoration plan, the integration of multiple adaptation projects into the town budget and the establishment of a fund for the acquisition of vulnerable shoreline properties (LCP, 2016). Each of these measures reflect a range of survey responses and policy ideas provided by respondents (LCP, 2016). To move restoration projects forward, planners and proponents could leverage residents' views on the importance of coastal habitat in combination with H.R. 2874, reaffirming this dedication to wetlands, while simultaneously communicating financial benefits in the form of reduced flood insurance costs for citizens and fewer public payouts to private homeowners.

Further economic opportunity in the restoration of natural coastal spaces may be available in the form of eco-tourism. Tourism was identified by the survey respondents as Falmouth's most influential industry (Figure 4.13). The economic opportunity associated with the continued growth of global tourism industries is well-documented. In 2015, the travel industry accounted for about 10 percent of total international GDP (approximately $7.2 trillion) and is expected to grow by another 4 percent per annum over the course of the next decade (WTTC, 2016). Nature-based travel currently accounts for about 20 percent of global travel and is also on the rise (WTTC, 2016). However, wetland ecosystems like those characterising the Falmouth area can be susceptible to harm from overuse if access and activities are not managed sustainably (Kotios et

al., 2009). Here, coastal restoration projects can reflect the economic importance of the tourism industry in Falmouth by providing eco-tourism options, while also providing natural public space for residents and visitors, creating jobs in coastal and marine conservation (Figure 4.15) and expanding wildlife habitat.

Some efforts in wetland restoration have already begun in Falmouth. The Coonamessett River Restoration Project, a joint effort between the Conservation Commission, several Falmouth environmental organizations, and public works departments, can act as an early model in bringing together the social and financial capital necessary to restore degraded natural spaces (Coonamessett River Park Coalition, 2005). Project leaders have recorded improved water quality, recovering cranberry bogs, and a modest rejuvenation of local fish populations. Historical harvest records suggest that the Coonamessett was once home to about one million herring, down to an estimated 75,000 today (Feldott, 2016). The restoration effort is expected to culminate in a system of trails and kiosks for public use by its anticipated conclusion date in 2019 (Feldott, 2016).

In future restoration programs, state bodies, such as the Massachusetts Division of Ecological Restoration (DER), and federal support can also help to identify areas appropriate for ecological restoration or the establishment of living shorelines. Living shorelines are an erosion control management practice relying on the use of natural coastal habitats to buffer against storm surge (DER, 2017; NOAA, 2015). The DER's Priority Project program, and NOAA's *Guidance for Considering the Use of Living Shorelines* document provide guidelines to assist with the acquisition of funding or technical assistance, the establishment of partnerships, and in navigating regulatory and permitting landscapes in association with relevant community initiatives (DER, 2017; NOAA, 2015). Earlier in 2017, the Falmouth Coastal Resiliency Action Committee and the governing Board of Selectmen discussed options to de-armor (i.e., remove concrete structures) certain coastal areas and removes jetties – a popular initiative amongst survey respondents (Table 4.9). The Committee meeting referenced previous studies on coastal erosion and sea level rise (Walter et al., 2017), and the healthy, well-nourished beaches along the National Seashore to the east of Cape Cod – which represent about 40 miles of near-contiguous living shoreline – as potential models (Feldott, 2017).

5.1.5. Considering Coastal Access

"I love being able to access the power and the beauty of the ocean. It has so many manifestations, it's always different…"

A series of survey questions related to coastal access and activities was deployed to gauge how often Falmouth residents access the coast, how they perceive ease of access, and how they use coastal or ocean spaces in recreation. Perhaps the most telling statistics were the extremely high use rates associated with coastal areas (Figure 4.8; Figure 4.9). In the summer months, almost half of respondents reported accessing the coast more than every second day, and about 85 percent accessed the coast at a rate of at least 5-15 days per month. High coastal access rates emerged during the winter months as well, with more than 60 percent of respondents reporting coastal attendance at a rate of at least once per week, and 26 percent still visiting at least every second day. This high use rate speaks to the importance of access to Falmouth's coast and aligns with the more than one third of respondents who referenced "closeness," or the ability to get to the coast as the thing they most enjoyed about living in a coastal community (Table 4.25). An examination of these use rates in tandem with responses to other questions about the preferred recreational activities of Falmouth residents proves it is possible to build a general understanding of what the term "access" generally refers to, and the benefits that residents draw from coastal proximity.

The importance of the beaches at Falmouth is well known within the community, both as a major driver for tourism and for a variety of intangible properties reported by respondents. From an activity-based standpoint, for most respondents, coastal access translates primarily to swimming, beachcombing or walking coastal trails (Figure 4.11). It is worth noting that none of these activities require the use of gear, equipment, or vessels. The recreational activities important to the greatest number of respondents were those that simply require a usable, accessible space.

Despite high coastal use rates and Falmouth's geographical proximity to the ocean, several respondents cited challenges associated with coastal access (Table 4.10). One of the issues most commonly raised was the extent of private property along the coastline, limiting space for public

coastal use. While private residences do dominate the majority of the town's shoreline, this problem is not unique to Falmouth. Massachusetts has a series of unique laws related to public coastal use. In most U.S. states, the land between the high and low water marks, known as "tidelands," are open for public access (Energy and Environmental Affairs, 2005). In Massachusetts, however, shoreline property owners retain almost all the rights to the space, and only citizens wishing to engage in a distinct set of coastal activities – including fishing, fowling (sport-hunting), and vessel navigation – are allowed to utilize the area (Energy and Environmental Affairs, 2005). These laws are largely holdovers from colonial ordinances originating as far back as the 17th century in some cases (Energy and Environmental Affairs, 2005). Today, this collection of allowable public activities can, in certain instances, be legally extended to include pursuits like windsurfing, or birdwatching, under monikers of navigation or fowling, respectively. However, no provisions are made for more common activities like walking or sunbathing (Energy and Environmental Affairs, 2005). For all practical purposes the tidelands are subject to the ownership of the property holders in Massachusetts. If receding shorelines, coastal erosion, residential developments, or burgeoning rates of coastal tourism continue to cause access problems for citizens, it may be necessary to investigate whether these private ownership laws are still practical for Massachusetts residents.

In the interim, there are more attainable outcomes that local policymakers can strive for to make coastal areas more accessible. It is worth examining other issues raised by survey responses about prohibitive costs or undue challenges associated with parking space when attempting to get to the beach (Table 4.10). Enacting policies that incentivize citizens to walk, cycle, or take public transit to beaches could provide public benefits. These goals would also align well with a number of respondents who expressed support for initiatives aimed at emissions reductions and general action on climate change. Furthermore, investing in public transit to and from public beaches during summer months would assist residents with mobility challenges, and perhaps diminish the number of vehicles lined along coastal roadways or filling parking lots, as was mentioned several times in the survey. Falmouth currently has much of the infrastructure in place to accommodate this kind of program, as shuttle buses run regularly from lots near the town center to the ferry terminal in Woods Hole during the busy summer tourist season.

An opportunity may also exist in bylaws regarding marine districts, which carry a provision to consider public access in planning decisions (Falmouth Home Rule Charter, 2017). Here, spaces zoned for marine use allow for developments such as wharves, landings, coastal parks, and marine retail, among others. Charter guidelines include a clause requiring that "public amenities" (both physical and visual access to the waterfront) be considered in development proposals, so long as there are no imminent risks to public safety or unreasonable liability to the property owner (Falmouth Home Rule Charter, 2017, S.240-45). Perhaps a greater emphasis could be ascribed to these considerations in future developments, given the importance that Falmouth residents attribute to accessing the water.

As the majority of Falmouth's waterfront is already developed, another option might be for local planners to explore the possibility of collaboration with property owners to incentivize the allowance of access on selected areas of private land. In this option, decision-makers could benefit from more study related to the efficacy of different coastal spaces in providing the kind of "access" that residents seek, as well as how the values referenced in the survey manifest themselves across coastal or marine spaces. For instance, do the intrinsic benefits mentioned by the survey respondents (Table 4.25) require significantly-sized spaces, or can smaller points of access – e.g., repurposed parcels of privately-owned land – allow for the same activities, provide the same sensory experiences, or elicit the same feelings of connection?

5.1.6. On Ocean Knowledge and Access to Information

"More public outreach efforts by marine research institutions and coastal environmental-type groups – relayed in visually appealing ways and in simple language…"

"…also, people LOVE, LOVE, LOVE Shark Week…"

Knowledge and information give people the tools required to evaluate potential choices and make decisions. Critical assessment is especially important in addressing complex issues pertaining to coastal and marine planning (Jentoft & Chuenpagdee, 2009). In response to the

survey, Falmouth residents put forth a range of ideas to enable more functional informational exchanges and communication pathways between scientists, citizens, and mediators (journalists and environmental groups) alike.

First, common amongst respondents were calls for science-journalism partnerships, open-access data portals, more science-related social media content, and information made available at areas of high public traffic (Table 4.20). Several recent publications support the efficacy of these concepts (Connecting with climate science, 2017; Lowndes et al., 2017; Pearson et al., 2016). However, comments related to interpersonal interactions between local scientists and public citizens, and suggestions to ensure information is designed for lay audiences, were the most common themes across responses. Several residents suggested that ocean science information should be made more "accessible," or "digestible," while others wished to see scientists better trained in communications or encouraged to participate in community outreach activities.

The respondents' emphasis on the importance of public engagement programs and communications training for scientists echoes recommendations from many within the scientific community (Besley, Dudo, & Storksdieck, 2015; Kahan, 2010; Leshner, 2007; Wood-Charlson et al., 2015). Some respondents felt that ocean-related information was already largely accessible in Falmouth, and that public engagement represented the more significant challenge in this case (Table 4.21). This idea also represents the views of many scientists, who have advocated in the past for citizen science and outreach programs as fundamental components of marine research (Cigliano et al., 2015; Leshner, 2007; Schlappy et al., 2017). One way to achieve these goals is through scientist-community partnerships. Solving community problems – such as those involving coastal spaces – and building science literacy both constitute iterative processes requiring the participation of multiple stakeholders, and typically all parties involved can derive benefit from effective collaborations (CSD, 2015; Roth, 2002).

Falmouth has a variety of attributes which position the town as a place of exceptional opportunity for experiments in citizen science, science outreach, and ocean literacy. With a uniquely high scientist-citizen ratio, a robust collection of scientific technologies and infrastructure belonging to various Woods Hole science institutions, and science taking place year-round, Falmouth could take a leading role in strengthening ties between science and the public in Massachusetts.

Furthermore, there are several existing local initiatives, like the Broader Impacts Group (BIG) and the WHOI Sustainability Task Force that are also available to provide support, resources, local contacts, and communicative assistance to scientists who wish to engage in communication and outreach efforts. BIG is a joint effort between WHOI and the Massachusetts Institute of Technology aimed to assist graduate students in "extending the impact" of their research and working with the public (Broader Impacts Group, n.d.). The WHOI Sustainability Task Force leads WHOI students, scientists, and staff in workshops and community events related to sustainability. Examples include science communication tutorials for WHOI employees, collaborations with outside organizations on publicly-oriented environmental initiatives such as beach cleanups or renewable energy seminars.

Drawing on ideas presented by Falmouth residents, research institutions can aid policymakers by further investing in these groups, and in science communication more broadly. Trends identified in the literature suggest that communication and outreach are becoming more regular tasks for scientists, often incentivized by public grant requirements (Kintisch, 2013; Varner, 2014). Training programs designed to assist researchers in communication are now a widespread phenomenon within the scientific community (Besley, Dudo, & Storksdieck, 2015). Some include best practices models, incorporating the views of scientists as they relate to specific goals commonly encapsulated within communications training, to determine the most effective methods and framing devices to engage researchers (Besley, Dudo, & Storksdieck, 2015). A variety of tools for effective communication include using visual cues, writing more actively e.g., moving away from the passive voice, reducing jargon, describing the experience of scientific practice, humanizing storylines, and incorporating non-scientific concepts to illustrate research (Wood-Charlson et al., 2015). Others advocate for a move away from the "measured scientist" doctrine, calling for researchers to rely more on the passion they have for their work when discussing why their science is necessary (Bickford et al., 2015).

Scientific institutions and professional organizations can play a role in helping researchers consider the value of communication past a traditional focus on message comprehension (Besley, Dudo, & Storksdieck, 2015). Beyond simply translating research for the layperson, scientists are now asked to consider the values of the audience they are addressing, and remain cognizant of the sociopolitical implications of their work. Supporting and encouraging scientists and students

to interact with residents more often, and in non-expert terms, could provide an ideal starting point in addressing science-public communication concerns raised by Falmouth residents (Table 4.20).

In addition, a combination of digitally accessible information and channels for interpersonal communication would serve the widest range of informational needs in Falmouth (Table 4.20). Several ideas provided by Falmouth residents in the survey could aid information transmission in both directions, leading to a more robust knowledge exchange. Some of these ideas included "pop-up museums" at local beaches, with local marine species on display and education material; a mobile app to help consumers navigate the sustainable seafood market on Cape Cod; and a proposal for a marine-related community "movie night" or other outdoor educational events held on a monthly basis, to name just a few.

Several concepts that could be incorporated into communications planning also emerged in the survey results, highlighting the importance of targeted content related to place-based values. For instance, a range of responses referencing notions of community, family, or sensory experience arose when respondents were asked about their ocean-related thoughts (Table 4.24). Survey responses suggest that integrating these ideas into science or policy communications plans could resonate well with audiences.

5.2. Considering Coastal Values and Intangible Connections

5.2.1. Place-based Values and the Relational Values Framework

> "The ocean is my happy place."

Figure 5.3. Place-based Values and Sensory Experience at the Coast in Falmouth. (Simon Ryder-Burbidge)

References to intangible connections related to coastal environments emerged as a consistent theme in the survey results. Falmouth residents repeatedly used words like peace, happiness, joy, love, home, rejuvenation, and relaxation to describe how they thought of the ocean (Table 4.24). Other common themes involved sensory experience like touch, feel, smell, sound, and sight, accompanied by descriptive terms in relation to these experiences: access, beauty, power, open, wild, strong, etc. Asked what they most enjoyed about living in a coastal community, respondents referred to proximity, access, or closeness in 57 cases (Table 4.25); visual or aesthetic themes like beauty, views, or concepts related to sight or seeing appeared in 56 instances; and emotional or interpersonal references (happiness, connection, community, etc.) emerged 46 times. These frequent intangible, place-based responses contrasted with less common references related to specific activities or recreational capacities, which appeared in 34 instances, or refences to resources or economic benefits which occurred a total of ten times.

Without more detailed information related to independent responses, it can be difficult to tease out the specific elements of ocean or coastal environments that elicit these responses, or to assign

spatial components for use in planning. However, these themes can act as useful framing devices for policymakers and science communicators to adjust communication styles for more resonance with local citizens. Furthermore, coastal planners can encourage the public to think about meaningful features of ocean spaces during consultations, to gain a better understanding of how people experience place-based values across spatial boundaries.

In Falmouth, the survey results suggest that tailoring communication plans to involve concepts like home, peace, or beauty at the coast could be of value in connecting with residents. Similarly, framing the communication of marine projects to align with perceptions and commonly held ocean values could be effective in garnering support for proposals (Bennett, 2016). Future research could examine potential avenues to measure the effects of community specific communication styles, e.g., looking for increased engagement or support for projects pitched as wetland-friendly, publicly accessible, and rich with opportunity for sensory experience (Figure 4.12; Table 4.25).

Beyond communication, understanding *why* citizens value certain place-based elements of the coastal zone also represents an important goal. Intangible benefits derived from ocean ecosystems can be more difficult to characterize or quantify than others with ascribed monetary value. However, the range of survey responses referencing intangibles suggests that careful consideration should be given to their inclusion in the development of ocean policy. Contemporary literature used to guide ocean planning initiatives tends to focus attention on valuing marine ecosystems using ecosystem services frameworks. Examples include describing the financial benefits of protective natural barriers in cost-savings or direct monetary benefits accrued by marine-related industries such as commercial fisheries or tourism (Hoegh-Guldberg et al., 2015; Moffit & Cajas-Cano, 2014). Likewise, marine biophysical features (e.g., important species, Ecologically or Biologically Sensitive Areas, etc.) tend to be the dominant features used in modern coastal planning and ocean policy contexts (Klain & Chan, 2012).

Existing planning processes often do not explicitly assess non-monetary values tied to ecosystems (Klain & Chan, 2012). Klain and Chan (2012) show that representing intangible or social values in a spatial context can be challenging for some coastal residents. This finding is supported by other marine spatial planning research suggesting that without prompting, people are unlikely to "map" these values, or associate them with specific locations (Brown, Raymond,

& Corcoran, 2015). Researchers propose using various place-related behaviors (e.g., *would proposed changes to a specific area inspire citizens to protect the space?*), or explicitly-drawn connections to personal identity as conceptual prompts (Brown, Raymond, & Corcoran, 2015). These results suggest that concerted efforts should be made by spatial planners to encourage local citizens to think about the intangible benefits of ocean environments in explicitly spatial terms.

Furthermore, Chan et al. (2016) offer relational values as a new way of framing issues surrounding conservation. Fundamentally, relational values are those that organize and guide people in relationships. In an environmental context, relational values are tied to decision-making processes involving the interplay between natural environments and others within the community (Chan et al., 2016). A concept borrowed from philosophical paradigms, relational values provide an alternative to the two frames generally employed in understanding socio-ecological connections, namely intrinsic values (the space has inherent value independent of values assigned by people) and instrumental values (values assigned to the space by its users) (Chan et al., 2016). Relational values reflect an instinctual compulsion towards the collective good (Sen, 1977). In philosophical terms, this concept is known as eudaimonia, roughly translating to "human flourishing" (Wolbert, de Ruyter, & Schinkel, 2015); e.g., striving for collective good is the only way to "be your best self." In the context of the coastal zone, relational values suggest that meaningful relationships and other elements of "the good life" or one's "best self" cannot be separated from the space in which they take place. Here, coastal habitats emerge as "the collective," the enabling space that allows for positive interpersonal relationships among individuals and the natural world that underpins human flourishing. This frame suggests that caring for coastal habitats represents an act of "collective good" – making decisions in the interest of the shared space, and therefore in the interest of neighbors (both human and non-human), while simultaneously allowing for the individual to reach their potential for existential satisfaction and fulfillment. These principles appear in the survey responses that reference the importance of community, home, family, and other representations of "the good life," as understood within coastal regions.

Policymakers and communicators could adopt relational values principles as an engagement tool – one potentially capable of transcending individual experience by appealing to pro-social human

tendencies. Two trains of philosophical thought attempt to describe the nature of these tendencies, using "commitment" and "capabilities," respectively. Sen (1977) uses commitment – such that an individual might be committed to family, and therefore regard familial interests in higher standing than self-interest – as a fundamental feature of human flourishing. Nussbaum (2011) considers "the good life" in terms of "capabilities," e.g., for play, or for the use of imagination. For the purposes of public discourse, relational values can be described in terms of the collective (Chan et al., 2016). For example: social cohesion, social responsibility, or cultural identity (*this is who we are* – a coastal community); or in terms of the individual, e.g., stewardship (*coastal protection is the right thing to do*) or personal identity (*this is who I am* – a professional fisher). These notions of commitment, capability, and collective good can be applied to the relationships between people and coastal zones by adding a spatial component, e.g., considering commitments to coastal stewardship, the freedom of capability that living near the ocean provides, and the community benefits involved in keeping marine ecosystems healthy.

5.2.2. Further *Research and the Ocean Connectivity Index*

In the future, research could investigate methods to incorporate relational values and other intangible connections described by coastal residents into ocean policy planning. Next steps could include the development of an Ocean Connectivity Index (OCI). An OCI could be used to characterize public perceptions and represent coastal values of all kinds in spatial terms for policy use. Previous publications that could provide guidance include the Ocean Health Index (Halpern et al. 2012), social vulnerability and resilience indicators produced by NOAA (Colburn & Jepson, 2012), and the USGS Coastal Change Hazards Portal (Doran, Long, and Overbeck, 2015). Each of these works quantify elements of coastal and ocean change, and the effect of these changes on coastal communities at varied spatial scales. This information is used by coastal managers to understand where policy change is required, and how new policies might affect communities at the local level. An Ocean Connectivity Index could provide important additional knowledge in this effort, by identifying public perceptions and coastal values across similar spatial boundaries.

Furthermore, the construction of an Ocean Connectivity Index could offer a valuable opportunity for community engagement. Current literature suggests that many researchers in ecological or adjacent fields are awash with data. Instead, aggregation and distillation for use of data within

policy contexts are now of considerable importance (Lowndes et al., 2017), and many have called for a greater emphasis on science outreach (Besley, Dudo, & Storksdieck, 2015; Kahan, 2010; Leshner, 2007; Wood-Charlson et al., 2015). Building an OCI would represent an opportunity for both data collection and engagement, and would require significant levels of participation from residents of coastal communities. Community input is now universally recognized as a critical component of marine governance (Ferse et al., 2010; Gilmour, Coffey, & O'Toole, 2015). A participatory data collection process could help to introduce coastal citizens to the idea of relational values, and give further insight into the relationships between people and marine environments. The experience in Falmouth suggests that people are interested and willing to partake in such initiatives.

Similarly, the OCI product could be made available for public use after its development. Much like the Ocean Health Index, or the Coastal Change Hazards Portal, an OCI could employ data visualization features allowing for open-access online, helping citizens understand how people connect with the ocean in different places, and enable more informed marine policy and spatial planning discussions. Lack of knowledge and scientific literacy have been identified as barriers to effective public participation (MacDonald, Soomai, De Santo & Wells, 2016; Donati, Rossi, & Brebbia, 2004). Given the importance of public engagement in developing policy (CSD, 2015; Mckinley & Fletcher, 2012), enabling accessible sources of coastal and ocean-related information should be an imperative consideration.

6. Conclusion

"Ever since I was tiny, I had the feeling that I was related to the creatures in the salt marshes here. I actually thought that the horseshoe crabs and the fiddler crabs and the sea lettuce were part of my family… What I love the most is that feeling of relationship – to the ocean and to the other people who love it. It is almost a religious or spiritual connection that we share."

Figure 6.0. Empty Horseshoe Crab Shell, near the Shining Sea Bikeway in Falmouth. (Simon Ryder-Burbidge)

Results from the survey data gathered in Falmouth show there is a crucial need for greater understanding of intangible placed-based values related to marine spaces (Table 4.25; Table 4.26). Many marine planning efforts typically rely upon economic indicators to describe the value of marine environments (Arkema et al., 2015; Lubchenco et al., 2016). However, Falmouth residents identified non-monetary features like aesthetics, emotion, and sensory experience more

frequently than other categories to define their connection to the sea. This suggests that there could be a significant disconnect in the way that coastal residents perceive value in the ocean, and the way that marine environments are valued in policy decision-making. Other research supports this notion, and calls for new and innovative approaches for management to consider a wider range of coastal values (Chan et al., 2016; Voyer et al., 2015).

The study of public perceptions provides a method to identify these values (Jefferson et al., 2015). Human behavior can affect the ocean in myriad ways, and understanding the psychologies and perceptions driving this behavior is important for marine management (Beyerl, Putz, & Breckwoldt, 2017). In Falmouth, residents identified a variety of perceptions related to the marine environment that could be used in local planning. Many expressed a need for greater measures to ensure the adequacy of flood protection, and advocated for the restoration of natural protective barriers as well as limits on the building of coastal structures. Furthermore, the importance of conserving wetland and coastal habitat was frequently evident in the survey results. Respondents recognized the importance of the tourism industry in Falmouth, but also called for policymakers to create opportunities for work in marine and coastal conservation.

Many of these concepts are already incorporated into Falmouth planning documents (LCP, 2016), and emerging shifts in national flood policy could allow a framework for local policymakers to take a more central role in the determination of flood safety measures and habitat restoration in the community (21st Century Flood Reform Act, 2017).

Perhaps most importantly, Falmouth residents identified a suite of intangible and social values that could help communicators and planners integrate local values into science communication strategies and coastal policy. Comments referring to peace, family and happiness; touch and feel; beauty, power, home, and community dominated open-ended responses related to coastal values and perceptions. Philosophical concepts such as relational values (Chan et al., 2016) can help to provide a frame for incorporating these themes into discussions surrounding ocean conservation. Research suggests that relational values can be used to help coastal citizens conceptualize stewardship as essential to a meaningful life, by enabling an understanding of personal relationships and the collective good as inherently linked to the ocean (Chan et al., 2016).

Alternatively, relating ocean themes to even clearer terms like community, home, or family, as identified in the survey, could also prove useful for policymakers, as could encouraging public

citizens to consider relational values in understanding their connection to the ocean. Early evidence suggests that these concepts resonate broadly across cultures (Klain, Olmsted, Chan, & Satterfield, 2017). In plain terms, the coastal planner can ask community members how they envision their "best self," and then consider how coastal policies can help them to achieve individual and collective goals.

While informative results emerged during the course of this study, further research should address several limitations. Future data investigation could link particular respondent demographic characteristics to response patterns; e.g., how do fishers perceive the value of coastal habitat conservation relative to teachers, or bartenders, or scientists. Other academic efforts have attempted to measure these perceptions across demographic variables and suggest that correlations can be found in some cases (Hamilton & Safford 2015; Trenouth et al., 2012). More study in this regard could prove helpful in the continued quest of science communicators to "understand audiences" in citizen engagement plans.

In the community context, there may be a bias towards the views of already ocean-engaged respondents in this study. While numerous steps were taken to mitigate this bias by inviting participation from a variety of non-ocean-related online discussion groups and public library attendees, a survey of this nature is likely to attract citizens already involved in ocean issues. However, although these views may not necessarily be representative of the entire community, the interested public are often some of the most vocal on ocean issues; this is a group whose perceptual understanding could provide insight to decision-makers and better inform policy (Soomai, MacDonald, & Wells 2013). Because of its engaged citizenry and marine science infrastructure, in many ways Falmouth provided an appropriate setting in which to test the method of study and gather input from a variety of ocean science professionals.

The methodology tested here could be applied in other contexts to extend understanding of connections between people and ocean spaces. Future community comparisons (e.g., how do citizens in nearby Chatham, or Boston, or New Bedford express their connections to marine environments in relation to Falmouth) could provide context in the development of an Ocean Connectivity Index. This index could help to characterize values associated with marine environments such as those identified by Falmouth residents. Explicitly drawing connections between the coastal zone and community values would give policymakers a better understanding

of how citizens relate to ocean spaces affected by coastal and marine planning efforts (Brown, Raymond, & Corcoran, 2015; Klain & Chan, 2012).

Furthermore, an Ocean Connectivity Index could help to foster engagement and connect residents to ongoing coastal and marine science in their region – something widely called for by Falmouth survey respondents. Many suggested an increased engagement effort in ocean governance (Besley, 2015; Kahan, 2010; Leshner, 2007; Wood-Charlson et al., 2015). The necessity for public participation in marine planning is well-recognized (Ferse et al., 2010; Gilmour, Coffey, & O'Toole, 2015). It is important to note that the process of surveying ocean connectivity within a community can act as an engagement program in and of itself. In Falmouth, the survey process provided a foundational structure to collect public perceptions data, while simultaneously engaging residents, and eliciting a wide range of ideas for potential inclusion into local coastal governance plans.

Ultimately, respondents who completed the survey gave informative responses, and the community showed an enthusiasm for the project. Interactions with residents in Falmouth led to conversations about local and regional ocean issues, or scientific efforts to address them, which may not have otherwise emerged. These discussions relate to findings suggesting that science and science literacy are products of an idea-trading process between individuals who experience or understand the same information in different ways; that is, science as collective praxis (CSD, 2015; Roth, 2002). Thus, any effort to characterize how communities connect with ocean environments has an inherent community engagement value entirely separate from its product. Increased engagement and improved ocean literacy often leads to a greater capacity for ocean citizenship and pro-ocean behavior (Fletcher & Potts, 2007; Mckinley & Fletcher, 2012).

In conclusion, marine science and conservation may continue to unlock key components in understanding the intangible connections between people and oceans. For now, relational values and philosophical language seem to be the parameters most capable of encapsulating the wide array of ocean-related experiences from which Falmouth residents draw meaning: peace, beauty, power; touch, sight, sound, taste and smell; happiness, rejuvenation, love; home.

One Falmouth resident deftly sums these principles in describing what they most enjoy about living in a coastal community:

> "Ever since I was tiny, I had the feeling that I was related to the creatures in the salt marshes here. I actually thought that the horseshoe crabs and the fiddler crabs and the sea lettuce were part of my family… What I love the most is that feeling of relationship – to the ocean and to the other people who love it. It is almost a religious or spiritual connection that we share."

This message defines notions of space, familial relationships, and marine ecosystems as highly interconnected aspects of coastal life. Beyond traditional ocean conservation ideas of protection and co-existence, shifting the frame of reference in this way could lead towards a broader engagement in sustainable behavior as it pertains to relationships, personal and collective identity, and the capacity to lead a meaningful and fulfilling life (Chan et al., 2016). For coastal citizens, this shift could manifest in bringing community members together around shared projects of ecosystem enhancement, or more simply in enabling a holistic understanding of lived experience in relation to, and within the context of, natural spaces – e.g., being at the coast with loved ones. In this understanding, the essence of connection between people and marine environments becomes an extension of interpersonal relationships; a connection deeply intertwined with the intellectual, sensory, and emotional elements of the human experience that make for a worthy and rewarding life.

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Appendix A: Survey Instrument

Understanding Public Perception: Ocean Connectivity in Falmouth, Massachusetts

This survey is being conducted as part of a research study to understand how members of the Falmouth community perceive their connection to the ocean.

This project is led by Simon Ryder-Burbidge, a graduate student with the Marine Affairs Program (MAP) at Dalhousie University, Halifax, Nova Scotia, and supervised by Dr. Bertrum MacDonald of Environmental Information: Use and Influence (EIUI) with Dalhousie University's Faculty of Management, and by Dr. Porter Hoagland at the Woods Hole Oceanographic Institution's Marine Policy Center (MPC). Your participation is voluntary and you may withdraw from the survey at any time prior to completion. **No personally identifying information will be collected, and all responses will be treated as confidential.**

The survey should take about 15 minutes to complete. The first and the last sections ask demographic questions. The second section is dedicated to questions involving your relationship and experience with the coast. The third section will ask about your interest in the Falmouth "marine economy," and how it affects your day-to-day life. The fourth section is a space to provide ideas or comments or concerns that you may have about your connection to the ocean, what kind of ocean policies you would like to see in Falmouth. If at any time you feel you can't answer a particular question, or if a question makes you uncomfortable, **just skip it!** This is not a test! We just want to know how you connect with the sea. You'll see that most questions are multiple choice, but some also allow for written response. We understand your time is valuable. Short, one-sentence answers are welcome, but if you have more to say, please do!

Do you have a story you'd like to share involving your connection to the sea? Tell us about it for **a chance to be featured live on WCAI's Living Lab Radio show with Heather Goldstone**, public radio for the Cape and Islands. Once you've completed the survey, **send an email message to Simon** at s.ryder-burbidge@dal.ca, or call 508-289-2846 (ex. 2373) with your story and contact information, or return the other page provided with the survey via mail. Looking forward to hearing from you!

For any questions, concerns, or more information about the study, please contact Simon, Dr. MacDonald (bertrum.macdonald@dal.ca; 902-494-2472) or Dr. Hoagland (phoagland@whoi.edu; 508-289-2867). If you have any difficulties with, or wish to voice concern about, any aspect of your participation in this study, you may contact Ashley Doyle, Faculty of Management (FoM) Research Ethics Officer at Dalhousie University, for assistance (ashley.doyle@dal.ca).

1. **I have read the explanation about this study or it has been read to me. I understand what I am being asked to do and my questions about the study have been answered. I know that participating is my choice and that I can leave this survey at any time prior to completion. I understand that by completing this survey, informed consent is assumed.**
2. I agree to use of direct quotations from my interview in reports and publications arising from this research. I understand that these quotations cannot be attributed to me and will be treated anonymously.
3. This is the first time I have completed this survey in-person, or online.

Thanks for your time! Let's get started.

DEMOGRAPHICS PART I

1. Are you a resident or a homeowner in Falmouth, MA?
   Resident / **Homeowner** / **Resident and homeowner** / **Just visiting** (Circle one.)

a. Approximately how many months do you typically spend in Falmouth in a year?

---

2. Were you born in Falmouth? **Yes** / **No** (Circle one.)

3. Which of the following best describes your employment situation?
1. Working full-time
2. Working part-time
3. Seasonal worker
4. Retired
5. Unemployed
6. Prefer not to say

4. What is your current or most recent occupation?

---

5. What is your primary mode of transportation? (Please describe.)

COASTAL CONNECTIVITY

1. Do you own oceanfront property? **Yes** / **No** (Circle one.)

2. Do you currently live on oceanfront property? **Yes** / **No** (Circle one.)
    1. If no, have you lived on oceanfront property previously? **Yes** / **No** (Circle one.)
    2. If yes, for how long? a) 0-10 years b) 10+ years (Circle one.)

3. If you have ever lived on oceanfront property, what did you/do you like most about the experience?

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4. If you have ever lived on oceanfront property, what did you/do you like least about the experience?

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5. If you do not currently own oceanfront property, approximately how far do you live from the coast?
1. Less than a mile b) 1-2 miles c) 2-10 miles d) 10 or more miles

2. Do you feel your home is adequately protected from coastal flooding? **Yes** / **No** / **Unsure** (Please circle one.)
    1. If yes, please indicate why.

---

    2. If no, would you consider moving from your home because of coastal flood risk? **Yes** / **No** (Please circle one.) If no, please indicate why.

---

3. Would you support increased public infrastructure expenditure to further protect your home from coastal flooding? **Yes** / **No** (Please circle one.)
4. If no, why?

---

5. What would you like to see policymakers do to improve coastal flood protection for your home?

---

3. Do you feel your community is adequately protected from coastal flooding? **Yes** / **No** / **Unsure** (Please circle one.)
   1. If yes, please indicate why.

---

2. If no, would you consider moving from your community because of coastal flood risk? **Yes** / **No** (Please circle one.) If no, please indicate why.

---

3. Would you support increased public infrastructure expenditure to further protect your community from coastal flooding? **Yes** / **No** (Please circle one.)
4. If no, why?

---

4. What would you like to see policymakers do to improve coastal flood protection for your community?

---

5. When in Falmouth, how many days per month do you typically access the ocean from the beginning of May through the end of September (i.e., public/private beach, coastal trail, fishing, boating, etc.)?

1. None b) 1-4 c) 5-15 d) 16-30

2. When in Falmouth, how many days per month do you typically access the ocean from the beginning of October through the end of April (i.e., public/private beach, coastal trail, fishing, boating, etc.)?

3. None b) 1-4 c) 5-15 d) 16-30

4. On a scale of 1-4, how would you rate public access to the coast in your community? **1** - *very difficult to access/get to*; **4** - *very easy to access/get to* (Circle one.)
   a) 1 b) 2 c) 3 d) 4

5. If you selected 1 or 2, why is it difficult to access/get to the coast?

---

6. Please mark as many as three of the MOST important marine conservation initiatives with an “M.” Please mark as many as three of the LEAST important marine conservation initiatives with an “L.”

1. Wetland or coastal habitat protection ___
2. Open ocean or deep-sea habitat protection ___

3. Commercial fish or shellfish stock protections ___
4. Shorebird protections ___
5. Marine mammal protections ___
6. Other non-commercial species protections ___
7. Plastic restrictions ___
8. Beach cleanups ___

Of the options above, which do you believe is the most important, and why? (Please describe.)

MARINE ECONOMY CONNECTIVITY

1. Is anyone in your household employed in any of the following marine-related occupations? (Please select all that apply.)

1. Fishing b) Aquaculture c) Coastal tourism d) Marine shipping e) Navy or Coast Guard f) Coastal construction g) Marine research h) Coastal or marine conservation j) None/other (Please describe below.)

---

2. Please rate the amount of influence each of the following marine-related sectors have upon your day-to-day life. **1** - *no influence*; **2** – *minor influence*; **3** – *significant influence*; **4** - *extreme influence*

1. Fishing ___
2. Aquaculture ___
3. Coastal tourism ___
4. Marine shipping ___
5. Navy or Coast Guard ___
6. Coastal construction ___
7. Marine research ___
8. Coastal or marine conservation ___
9. Other (Please describe.) ___

---

1. Which of the above sectors do you feel has the most influence? (Please explain.)

---

10. Please rate the amount of influence each of the following marine-related sectors have upon your community. **1** - *no influence*; **2** – *minor influence*; **3** – *significant influence*; **4** - *extreme influence*

1. Fishing ___
2. Aquaculture ___
3. Coastal tourism ___
4. Marine shipping ___
5. Navy or Coast Guard ___
6. Coastal construction ___
7. Marine research ___
8. Coastal or marine conservation ___
9. Other (Please describe.) ___

1. Which of the above sectors do you feel has the most influence? (Please explain.)

Please mark **as many as three** of the marine-related sectors for which you feel it is MOST important to create or sustain jobs with an "M." Please mark **as many as three** of the marine-related sectors for which you feel it is LEAST important to create or sustain jobs with an "L."

1. Commercial fishing ___
2. Aquaculture ___
3. Coastal tourism ___
4. Marine shipping ___
5. Navy or Coast Guard ___
6. Coastal construction ___
7. Marine research ___
8. Coastal or marine conservation ___
9. Other (Please describe.) ___

Which of the above sectors would you most like to see policymakers develop further? (Please explain.)

10. In general, do you support the idea of deep-sea mining?
Yes / **No** / **Not sure** / **Depends** (Please explain below.)

11. Do you eat seafood? **Yes** / **No** (Circle one.)
    1. If yes, rate the importance of each of the following factors when purchasing seafood from 1-4: ***1*** *– least important;* ***4*** *– most important*

1. Taste ___
2. Appearance of the product ___
3. Affordability ___
4. Caught/raised in New England waters ___
5. Potential health risks ___
6. Sustainably-sourced ___
7. Other (please describe below). ___

8. Do you prefer wild-caught or farmed seafood? If you have a preference, please explain why below.
Wild-caught / **Farmed** / **Doesn't matter** / **N/A**

9. Do you participate in any of the following activities? (Please select all that apply.)

1. Fishing b) Diving c) Recreational boating d) Kayaking/canoeing e) Watersports f) Beachcombing g) Swimming h) Coastal hiking i) None/Other (Please describe.)

GENERAL OCEAN CONNECTIVITY

1. In one sentence, what is the first thought that comes to mind when you hear the word “ocean?”

2. What do you enjoy most about living in a coastal community?

1. From 1-4, how would you rate your level of ocean-knowledge? ***1*** *– Limited knowledge;* ***4*** *– Very knowledgeable:* a) **1** b) **2** c) **3** d) **4**

1. What information sources do you draw on for an understanding of the ocean or ocean-related issues?

2. How could ocean-related information be made more accessible?

3. What kind of additional information sources would you like to see to further your understanding about the ocean or ocean-related issues?

4. What ocean-related information/issues would you like policymakers to be aware of/focus on?

5. Which of the following do you feel represents the greatest “connection” to the Falmouth community? Please rank the following elements of ocean connectivity from 1-4; ***4*** *– Greatest connection;* ***1*** *– Least connection*.

1. Coastal change and coastal property protection ___
2. Commercial and recreational fisheries ___
3. Coastal tourism and recreation ___
4. Other marine economy (i.e., marine shipping, non-fisheries resource development, ocean research, etc.) ___
5. Something else (please describe below). ___

6. Have you observed any changes to the ocean in lifetime? If so, which of those change most concerns you and why? (Please describe.)

7. What is most important about the ocean to you? Any further comments?

DEMOGRAPHICS PART II (FINAL SECTION)

1. Please select your age range.
1. 18-33 b) 34-49 c) 50-64 d) 65+

2. Please describe your gender.

---

3. Please select the annual income range of your household.
1. $0-15,000 b) $15,001-75,000 c) $75,001-200,000 d) $200,001+ e) Prefer not to say

2. What is the approximate value of your home?
   a) $0-200,000 b) $200,001-500,000 c) $500,001+ d) I rent e) Prefer not to say

3. How many people currently live in your household? (Circle one.)
1. 1 b) 2 c) 3-5 d) 5+

2. Are you affiliated with any organized religion?
   Yes / **No** / **Prefer not to say** (Circle one.) If yes, please describe.

---

3. Are you affiliated with any organized political parties?
   Yes / **No** / **Prefer not to say** (Circle one.) If yes, please describe.

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1. We are happy to share our results with you. An executive summary report of the findings will be posted to the EIUI website (www.eiui.ca) at the completion of the study in December, 2017. If you wish to receive a copy of the final report, please contact us after December 31, 2017.

On behalf of the research team, thank you for your help!

Appendix B: Ethics Approval from the Dalhousie Faculty of Management

DALHOUSIE UNIVERSITY
Inspiring Minds
Faculty of Management

Faculty of Management Graduate Student Ethics Approval for a Course-based Project

June 27, 2017

Simon Ryder-Burbidge,

I am pleased to inform you that I have reviewed your project **"Towards an Ocean Connectivity Index" (file no. 062117),** for the course MARA5002 (Graduate Project) under the supervision of Dr. Bertrum MacDonald, and have found the proposed research involving human participants to be in accordance with the *Faculty of Management Ethics Review Policy for Course-based Projects* and the *Tri- Council Policy Statement on Ethical Conduct for Research Involving Humans (TCPS2).* This project has received ethics approval.

This approval will be in effect until and not exceeding December 25, 2017|(fourteen days from the final date of classes for the 2017 Dalhousie Fall Semester). It is your responsibility to immediately report any adverse events involving participants to both your instructor and to the Research Ethics Officer. Please note that any significant changes to the research methodology, consent form or recruitment materials must be resubmitted to Research Ethics Officer for review and approval prior to their use.

Congratulations on your successful Faculty of Management Graduate Student Ethics Approval for your Course-based Project. I wish you all the best as you begin this next phase of your research. Should you have any questions regarding ethical issues at any point during your project, please do not hesitate to contact me.

Sincerely,

Ashley Doyle

Ashley Cummiskey (Doyle)
Faculty of Management Research Ethics Officer
Rowe 2029
Dalhousie University
PO Box 15000, Halifax, NS B3H 4R2

Appendix C: Ethics Exemption from the Massachusetts Institute of Technology Committee

MIT Committee On the Use of Humans as Experimental Subjects

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
77 Massachusetts Avenue
Cambridge, Massachusetts 02139
Building E 25-1439
(617) 253-6787

To:	Simon Ryder-Burbidge
From:	Leigh Firn, Chair COUHES
Date:	07/12/2017
Committee Action:	**Exemption Granted**
Committee Action Date:	07/12/2017
COUHES Protocol #:	1707019564
Study Title:	Towards an Ocean Connectivity Index

The above-referenced protocol is considered exempt after review by the Committee on the Use of Humans as Experimental Subjects pursuant to Federal regulations, 45 CFR Part 46.101(b)(2) .

This part of the federal regulations requires that the information be recorded by investigators in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. It is necessary that the information obtained not be such that if disclosed outside the research, it could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

If the research involves collaboration with another institution, then the research cannot commence until COUHES receives written notification of approval from the collaborating institution's IRB.

Unless informed consent is waived by the IRB, use only the most recent, IRB approved and stamped copies of the consent form(s).

Adverse Events: Any serious or unexpected adverse event must be reported to COUHES within 48 hours. All other adverse events should be reported in writing within 10 working days.

Amendments: Any changes to the protocol, including changes in experimental design, equipment, personnel or funding, must be approved by COUHES before they can be initiated, except when necessary to eliminate apparent immediate hazards to the subject.

Human subjects training is required for all study personnel and must be updated every 3 years.

You must maintain a research file for at least 3 years after completion of the study. This file should include all correspondence with COUHES, original signed consent forms, and study data.

Appendix D: Sample Online Invitation to Participate (Facebook Group)

Appendix E: Sample Survey Invitation Brief for Organizational Offices

Dear Falmouth,

What does the OCEAN mean to you?

A joint project between the Woods Hole Oceanographic Institution and Dalhousie University in Nova Scotia is conducting a survey to understand how the Falmouth community experiences "connection" to the ocean. If you are a resident or a homeowner here, **we're looking for your opinion**. You'll find a link to the survey at our online page:

www.lowlanderpress.com

In the meantime, please help yourself to one of our…

FREEPRINTS.

They're all from right here in Falmouth. If you have a family member or friend who you think might like to participate, help us spread the word. We want to build a model for community-based ocean policy, **and we need your help**. Thanks much!

DALHOUSIE UNIVERSITY
Inspiring Minds

Woods Hole Oceanographic INSTITUTION

Simon Ryder-Burbidge,

Dalhousie Marine Affairs Program, WHOI Guest Student