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The Influence of Message Type, Environmental Attitude, and Political Ideology on Perceptions of Aquaculture in the United States

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An Abstract of the Thesis Presented
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In the United States, aquaculture receives varying degrees of support based on individuals' perceptions of the industry. This study analyzes the factors that contribute to those perceptions; namely, message type, affect, political orientation, and environmental attitude. We collected data through a nationwide survey, distributed by Qualtrics, which recruited a representative sample of U.S. residents. The survey included multiple choice, Likert scale, and open-ended questions regarding individual characteristics (e.g., age, income, political orientation, etc.) and opinions on aquaculture. In order to study message type, we employed four experimental conditions (narrative video, narrative text, infographic video, and text) and one control group with no message. Affect was measured using the Linguistic Inquiry and Word Count (LIWC) software program. Finally, environmental attitude was determined using the Dunlap et al.'s (2000) 15-item version of the New Environmental Paradigm (NEP).

Results from this study suggest that the infographic and narrative video were most effective in eliciting responses regarding perceived benefits of aquaculture. We found that the control group had the lowest rates of aquaculture benefit responses, indicating that it is better to

use some sort of stimuli than none at all. Mirroring findings from previous research on aquaculture perceptions (Feucht & Zander, 2015; Freeman et al., 2012; Rickard et al., 2018; Rickard et al., 2020; Schlag & Ystgaard, 2013; Vanhonacker et al., 2011), we also found these results to be an indicator of individuals' generally low level of awareness and knowledge surrounding aquaculture. Additionally, findings suggest that the narrative video was somewhat off-putting to participants, as there were increased rates of negative emotion among those who watched the narrative video. Lastly, results showed that an individual's environmental attitude is associated with a greater likelihood of mentioning general aquaculture benefits, as well as environmental benefits. Alternatively, findings indicate that political ideology does not predict an individual's views on aquaculture– which we speculate might be due to aquaculture not yet having gained the same degree of politicization as other environmental issues in the public sphere within the U.S. (e.g., climate change).

Looking forward, these findings could encourage aquaculture advocates to gear outreach efforts toward individuals with higher environmental-consciousness and be further encouraged in their efforts, as perceptions do not appear to be politically saturated. Researchers might further investigate the influence of message type by employing more conditions with varying length, message, and speaker. Future research might also employ path analysis to explore how perceptions of aquaculture are influenced by different message types, political orientation, and environmental attitude, in both direct and indirect ways. Overall, this work contributes to a more holistic understanding of the public's perceptions of aquaculture and in turn, informs more effective communication efforts with increased information salience and ideally, support for sustainable aquaculture.

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CHAPTER 1

INTRODUCTION

1.1. Aquaculture overview

Aquaculture is often understood as fish farming, but the practice actually involves much more than simply producing fish. In reality, it pertains to a diverse "production and culturing of hundreds of aquatic animal and plant species in fresh, brackish, marine, and hypersaline waters" (Lucas, 2015, p. 1064). Additionally, aquaculture differs from traditional fishing in that there is ownership of stock and manipulation of production. With a rapidly increasing global population and demand for fish products, fisheries have reached their saturation point in seafood production. In answer, the aquaculture industry has exponentially increased its production to offset reliance on fisheries. In fact, aquaculture surpassed the fisheries industry as the major source of worldwide seafood in 2012 with the production of 90 million tons of fish (Lucas, 2015). According to the National Oceanic and Atmospheric Administration (NOAA), aquaculture industries supply more than 50% of human-consumed seafood– and at an expected increasing rate (NOAA, 2019).

This upsurge in attention to and development of aquaculture over the past 20 years has been coined the "blue revolution" (Lucas, 2015). According to Lackovic (2019), residents of the United States began practicing aquaculture as early as the mid-1800s. The American demand for oysters in the eighteen- sixties, seventies, and eighties propelled both aquaculture seafood production and development. Maine and Connecticut "sea farmers," as they were called, led this development. By the 1950's, there were research efforts in place to bolster oyster populations in Maine coastal waters. In 1970, the University of Maine (UMaine) hired Dr. Herb Hibu, a shellfish biologist, to revitalize the oyster industry in Maine. Shortly after, UMaine's Darling

Marine Center received the state's first sea grant for "projects related to the culture of resources in the cold water environment" (Lackovic, 2019, p. 39). Today, Maine boasts a healthy and expanding industry of oyster aquaculture farming.

Over time, a growing sense of environmental stewardship has begun to accompany the burgeoning industry of aquaculture. However, sustainable efforts have not always come to fruition. During the infancy of this agricultural sector, the U.S. was struggling to "meet the environmental expectations and create universally-accepted industry standards" (Lucas, 2015, p. 1065). For instance, ecological issues associated with commercial net-pen salmon farming were, in some cases, leading to pollution, genetic contamination, and habitat destruction (Braaten, 1992). Further, the release of antibiotics and chemicals during production processes were considered a serious environmental threat to both fish populations and bottom fauna. Over time, these environmental ramifications have garnered considerable attention from scientists, environmental organizations, and mainstream media. While these issues vary depending on geographical, topographical, and physical conditions, measures can be taken to prevent such harms.

Fortunately, today's increased awareness of these dangers has led to stricter environmental regulations, reduced fish density, and improved agricultural practices (Lackovic, 2019). Although certain aquaculture practices can pose drawbacks, in general, aquaculture can also confer a wide range of benefits. For instance, diversifying seafood products through aquaculture allows for crucial species to thrive and sustain in all seasons (NOAA, 2019). Aquaculture can also boost economies in isolated coastal regions by creating employment, generating income, and improving access to food (D'Anna & Murray, 2015). Considering the range of risks and benefits, the topic of aquaculture proves itself complex and unique– presenting

a situation where both environmental and human health are at stake, while simultaneously creating an opportunity for a more sustainable approach toward seafood production.

To that end, environmental communication concerning this controversial topic is important for several reasons. First, aquaculture has suffered from "image problems" in past years. Amberg and Hall (2010) conducted a study around U.S. media coverage of two scientific studies about cases of contaminated farmed salmon, with results revealing more risk-focused information than benefit-focused information. Further, individuals have been shown to associate aquaculture with environmental risk (D'Anna & Murray, 2015; Freeman et al., 2012; Mazur & Curtis, 2006; Whitmarsh & Palmieri, 2011). Due to citizens' negative perceptions, as well as risk-oriented narratives in the media, it is imperative that producers, policymakers, and communicators practice effective messaging methods to impart aquaculture information. Further, it is important to practice attention and care with the use of communication tools when considering the fragility of aquaculture's reputation in the public sphere. If communicators can increase information salience through appropriate messaging techniques, there will be a higher chance of audience's attitudes and perceptions shifting– and ideally, this shift will facilitate increased support for sustainable aquaculture.

In tandem with the current study's goal, the Food and Agriculture Organization of the United Nations ([FAO], 2019) claim that the ability to exchange reliable and accurate information is a key component in the responsible management of aquaculture. The focus of this work– to examine message type and perceptions of aquaculture– supports the Human Dimensions theme ("Theme 4") of a recent (2014 - 2019) National Science Foundation (NSF)-funded project at the University of Maine, also known as the Sustainable Ecological Aquaculture Network (SEANET), outlined further in the following section. This work is geared toward

creating a better understanding of how message type and other select factors influence aquaculture perception and behavioral intentions among public audiences.

1.2. SEANET review

SEANET's Human Dimensions team's primary goal is to investigate the current structure, function, and socio-economic infrastructure of Maine's aquaculture industry, while simultaneously observing the related opportunities and challenges (SEANET, 2017). Specifically, this research addresses the following operational goal of SEANET's strategic plan: (5.3) "to advance our understanding of how science communication influences adoption of sustainable ecological aquaculture (SEA)." This study will apply narrative theory to demonstrate how and when stories (either in the video or text form)— in comparison to a traditional information-based textual message, information-based infographic video, or no message at all— have the potential to influence perceptions of and behavioral intentions related to aquaculture. Further, this study will investigate how political orientation and environmental attitude may relate to these outcome variables.

1.3. Chapter summaries

As discussed above, I approach this work from several different angles in order to fully understand the nuances of people's views on aquaculture. In this section, I briefly describe each chapter of this thesis, highlighting central themes and findings to outline the progression of the study. Beginning in the second chapter, I embark on a literature review to explore past and current academic work on aquaculture. In this review, I piece together conversations surrounding the aquaculture controversy, narrative as a form of communication, environmental attitude, and political orientation. This constellation of information provides an opportunity to "stand on the shoulders of giants" and begin approaching my research questions, which are as follows: (RQ1)

How does message type influence an individual's perception of risks and benefits regarding human health, environmental health, and the economy? (RQ2) How does message type influence an individual's engagement in the experimental stimuli? (RQ3) How does message type influence a person's expressed affect toward aquaculture? and (RQ4) How does a person's political ideology and environmental attitude relate to their views on aquaculture? Emerging from this chapter is the understanding of aquaculture as a means to feed a growing global population, but still an issue (and perhaps, an entire industry) that is rife with controversy and tension. As a means of communicating controversial information about aquaculture, I explore narrative and its potential to open people's minds to new ideas and perspectives. Finally, I consider the role of environmental attitude and political orientation as contributing factors to perceptions of aquaculture.

In the third chapter, I discuss the methodology, which includes a review of the procedure, sampling, and measures. After performing a pre-test using Amazon's Mechanical Turk (MTurk) platform, we conducted the main study which employed five conditions total. There were four experimental conditions (narrative text, narrative video, textual transcript, and infographic video) and one control condition (no message). We used Qualtrics to conduct a nationwide survey, which recruited a representative sample of U.S. residents with oversampling in coastal states. To measure the survey results, we developed a codebook for manual coding, as well as employed the Linguistic Inquiry and Word Count (LIWC) software program. The fourth chapter includes an analysis of the results. Overall, the narrative video and infographic proved the most effective in eliciting stimuli-consistent attitudes (i.e., communicating aquaculture benefits). We found little correlation between message type and reports of aquaculture risk. With regard to engagement, it appears that there is a significant relationship between message type and

explanatory engagement, as well as message type and minimal engagement. Affect results reveal a significant relationship between negative emotion and message type. Lastly, findings do not indicate a relationship between political ideology and perceptions of aquaculture; however, there is a relationship between environmental attitude and the odds of reporting both a) general aquaculture benefits and b) human health benefits related to aquaculture.

In the fifth chapter, I discuss results, study limitations, and avenues for future research. Notably, I explore the reasoning that, because people's aquaculture knowledge is generally low (Feucht & Zander 2015; Freeman et al., 2012; Schlag & Ystgaard, 2013; Rickard et al., 2018; Rickard et al., 2020; Vanhonacker et al., 2011), the issue may not yet be politicized like other environmental issues (e.g., climate change); however, environmentalists seem to be increasingly supportive of this industry. Further, I discuss the counter-intuitive finding that the narrative video was less successful in eliciting positive, story-consistent attitudes, which may be due to the message, the speaker, or a combination of both. That said, I encourage future researchers to exercise stimulus sampling by employing more conditions with a range of messages, settings, speakers, and length. Future work might also expand on the current analysis of narrative transportation, engagement, political orientation, and environmental attitude. Finally, the sixth chapter offers a conclusion which encompasses final thoughts on the results and overarching patterns discovered in this study. Here, I pay homage to more traditional message types that utilize simple, information-based communication, such as the infographic video. I also recognize the power of narrative, but emphasize the importance of using it with diligence and careful consideration. Lastly, I reflect on findings regarding a lack of significant relationship between political orientation and perceptions of aquaculture. Here, I offer hope for aquaculture producers, scientists, and advocates, as they might have space to more freely communicate the benefits of

sustainable aquaculture without being entangled in people's political affiliation. This can be viewed as a temporal opportunity to proactively communicate with audiences before aquaculture becomes intensely politicized, as has been the case with climate change, GMO foods, and other emerging environmental issues as technologies.

CHAPTER 2

LITERATURE REVIEW

2.1. Perceptions of aquaculture

Over time, aquaculture has proven to be a highly contested topic in the realm of conservation and resource management. The conversation encompasses a widespread population, including environmentalists, scientists, indigenous and local communities, farmers, and chefs (Osmundsen & Olsen, 2017). In many ways, this tension makes sense when considering the wide range of actors engaged in the aquaculture arena. Beyond differences in stakeholder interests, the controversy might also reflect a deeper divide in fundamental beliefs regarding the relationship between human beings and the environment. Aquaculture is complex and multifaceted in nature, wherein environmental, social, economic, and political factors strive for legitimacy and attention (Ahsan & Roth, 2010).

Aquaculture is often portrayed as a two-sided debate between advocates and opposers; however, the situation is actually more nuanced. In reality, it is "a constellation of linked problems embedded in the fabric of the communities in which they occur" (Kreuter et al., 2004, p. 441). Issues of this nature have also been characterized as *wicked problems*, wherein "stakeholders may have conflicting interpretation of [a] problem and the science behind it, as well as different values, goals, and life experiences" (Kreuter et al., 2004, p. 441). Rittel and Webber (1973) describe wicked problems in contrast to *tame* or *benign* ones that can be solved by technical and expert-driven approaches (e.g., problems in mathematics, engineering, chemistry, etc.). Wicked problems, however, are multidimensional, complex, and often found in social situations or planning efforts. These types of issues are not considered "wicked" due to a lack of morality or ethics, but instead in "a meaning akin to that of 'malignant' (in contrast to

‘benign’) or ‘vicious’ (like a circle) or ‘tricky’ (like a leprechaun) or ‘aggressive’ (like a lion, in contrast to the docility of a lamb)” (Rittel & Webber, 1973, p. 160). Wicked problems are iterative as there is no definitive solution, or clear path to it; therefore, solving these types of problems is somewhat elusive because each is unique and with no immediate or ultimate solution (Rittel & Webber, 1973).

The notion of wicked problems resonates with the topic of aquaculture– an issue rife with social and political components. These types of problems are likely to have varying perspectives depending on the position of the stakeholder. For instance, while some see aquaculture as a thriving industry with means to feed the growing global population, others view the industry as a potentially irreversible detriment to aquatic ecosystems (Lucas, 2015). Opposition to the industry raises questions about the ethics of mass food production, specifically surrounding health and environmental standards. In this domain, certain aquaculture practices have received more attention than others. For instance, raising salmon in ocean net pens has been represented, and widely circulated as, a story about environmental and human health concerns (Amberg & Hall, 2010). Issues associated with this narrative include fish disease, unsustainable fish feeding practices (Hixon, 2014), and increased chemicals in runoff water and harvested fish (Diana, 2009; Hites et al., 2004; Schlag, 2010). Alternatively, supporters tell a different story, claiming that aquaculture can actually benefit the environment. For example, the industry can reduce pressure on wild fisheries, improve water quality for shellfish species, and provide people with a reliable source of protein (Hixon, 2014).

The risks and benefits of aquaculture have resonated differently in varying geographic and cultural communities, leading to divergence in diffusion of the industry. While countries like China contributed more than 60% of the global aquaculture production in 2014 (FAO, 2016), the

United States aquaculture industry has lagged far behind. In fact, the U.S. imports approximately 90% of its seafood (NOAA, 2016). To address this discrepancy, the U.S. National Oceanic and Atmospheric Administration (NOAA) released a marine aquaculture strategic plan seeking to promote and expand sustainable aquaculture production by 50% by 2020 (NOAA, 2016). According to NOAA, sustainable aquaculture is defined as the "triple bottom line of environmental, economic, and social sustainability" (2016, p. 6). The plan highlights four main goals: regulatory efficiency, science-oriented tools for sustainable management practices, technology development, and an informed public. In order to achieve these goals, NOAA employs strategies such as strengthening partnerships, improving communication, using appropriate infrastructure, and practicing reliable program management.

2.2. Aquaculture media studies

In response to heightened political and social attention to aquaculture development, scholars have begun exploring individuals' perceptions surrounding the industry, measured both directly through public opinion research, and indirectly through media content analyses. Through a two-part study, Rickard et al., (2018) conducted focus group discussions and a media content analysis of news articles over a 15-year period to analyze aquaculture perceptions in New England. The content analysis covered three regional newspapers, while the focus groups consisted of Maine and Massachusetts residents. Newspaper findings suggested "overall widespread attention to environmental risk, as well as some regional differences in attention to risk/benefit information" (Rickard et al., 2018, p. 1). Additionally, focus group results revealed that residents developed risk and benefit perceptions based on direct and mediated experiences, while lacking general awareness of the issue. The varying results drawn from this study point to

the increasing need to understand how people make sense of and create value surrounding aquaculture industry development.

In a similar study, Rickard and Feldpausch-Parker (2016) examined newspaper coverage of aquaculture over a 10-year period (2005-2015). To complete this comparative analysis of regional and national papers, the scholars borrowed Luhmann's (1989) *social function system* to tease out themes of risk, benefit, science, economics, political/legal issues, and sustainability. *Social systems* are thought to obtain their own operational structure, maintaining a simultaneous autonomous and interrelated framework for understanding an issue (Luhmann, 1989). Overall, Rickard and Feldpausch-Parker's (2016) findings showed more discussion of risk than benefit, with dialogue resorting to the "well-worn territory in the aquaculture debate" (p. 10) on pollution issues. When observing this overall tendency toward risk-oriented information, it is important to remember the *agenda-setting* (Boykoff & Boykoff, 2004) function of the media. In this practice, news outlets select specific issues to direct the mass audience's attention and in effect, can greatly influence people's perceptions, opinions, and future thinking, albeit indirectly (Nisbet, 2014; Scheufele, 1999).

In the same study, Rickard and Feldpausch-Parker (2016) also discovered an emerging focus on aquaculture benefits and sustainability over the past three years. The scholars attributed this increased coverage to the growing popularity of shellfish aquaculture in Northeastern states, as well as local food movements (e.g., farmer's markets, locally-sourced food). Conclusively, findings suggest that the aquaculture conversation in the U.S. is "multidimensional and involves frequent co-occurrence of risk/benefit and social systems" (Rickard & Feldpausch-Parker, 2016, p. 1). These results speak to the complex nature of this topic and justify grounds to further explore the meaning-making processes behind perceptions of aquaculture.

Froehlich et al. (2017) also investigated media coverage of aquaculture, specifically focusing on sentiment and opinion. This study collected data across the world using two methods: (1) an analysis of newspaper headlines and (2) collection of government-gathered public comments with respect to both general (i.e., regulating all types of marine-based aquaculture in the U.S.) and specific (i.e., policies regarding open-ocean finishing farming in the Gulf of Mexico) U.S. aquaculture issues. Results suggest that internationally, aquaculture coverage has increased and maintains an overall positive tone. In regard to public comments, specific marine policy tended to receive more negative comments, as opposed to general marine policy which garnered more positive comments (Froehlich et al., 2017). Further, more citizens and environmentalists commented on the specific marine aquaculture project and often wrote negatively. These findings imply that offshore aquaculture perceptions might be different than other types of aquaculture, which also calls attention to people's varying attitudes depending on the type and location of aquaculture farming. This information prompted Froelich et al. (2017) to call for "better development and communication of the distinctions between types of aquaculture" (p. 13), and more generally, an acute awareness of audience followed by deliberate use of messaging to appropriately communicate this information.

2.3. General aquaculture studies

In another study regarding attitudes toward the aquaculture industry, D'Anna and Murray (2015) observed individuals' perceptions of shellfish aquaculture through a survey and semi-structured interviews. Results demonstrated that individuals and communities are generally affected in multiple dimensions: environment, economic, and lived-experiences. For example, individuals who expressed opinions related to the environmental theme were described as "attuned to the scenes, systems, and species of the landscapes in which they live" and assessed

aquaculture impact based on changes to their ecological surroundings (D'Anna & Murray, 2015, p. 56). The economic dimension largely consisted of discussion regarding sustainable jobs and local taxes. Lastly, the experience dimension was centered around access, views, aesthetic, livelihood, social interaction, and psychological attachment. While most industry interviewees focused on environmental and economic benefits, non-industry participants brought attention to environmental effects, economic benefits, and negative lived experience (e.g., debris on beaches, obstruction of views, limited public access to shoreland). This study points to the nuanced processes of meaning-making surrounding aquaculture perception.

Research surrounding perceptions of aquaculture reveal a diverse range of opinion, as well as a plethora of influencing factors. In order to best understand how and why individuals maintain their distinct viewpoints, it is important to consider the mode through which information is communicated. Over time, communicating contentious information through the narrative format has proved effective and increasingly popular (Cooper & Nisbet, 2016; Green & Clark, 2013; Moyer-Gusé et al., 2019); as a result, this study will analyze how the role of narrative format may influence perceptions of aquaculture.

2.4. Narrative

Storytelling is one of the most fundamental components of human communication. Although there is yet to be a single determining factor to explain the utility of the communicative form, it is generally accepted that people are naturally "wired" to be sensitive to information presented in the narrative format (Green & Brock, 2002). According to Schank and Abelson (1995), "stories about one's experiences and the experiences of others are the fundamental constituents of human memory, knowledge, and social communication… when it comes to interaction in language, all of our knowledge is contained in stories and mechanisms to construct

and retrieve them" (pp. 1-2). For the purpose of this review, I am defining *narrative* as "a representation of connected events and characters that has an identifiable structure . . . bounded in space and time, and contain[ing] implicit or explicit messages about the topic being addressed" (Kreuter et al., 2007, p. 222). The spectrum of narrative type is broad and including, but not limited to, literature, reporting and journalism, entertainment education (Moyer-Gusé, 2008), personal testimonials (Braverman, 2008), exemplification (Brosius, 1999), and storytelling (Kreuter et al., 2007).

To begin, "narrative is the basic mode of human interaction and a fundamental way of acquiring knowledge" (Hinyard & Kreuter, 2007, p. 777). By studying the factors that contribute to people's meaning-making processes, we can have a more holistic understanding of people's perceptions and better communicate information. The increased interest in narrative is largely due to "the belief that stories can be an especially potent means of creating opinion change" (Braddock & Dillard, 2016, p. 1). Narrative as a form of communication has been linked to, among many topics, generating support for controversial political parties (Igartua & Barrios, 2012), the end of slavery (Strange, 2002), and improved health (Hinyard & Kreuter, 2007).

Narrative has a powerful impact on the human psyche, and preceding research in multiple disciplines speaks to its persuasive affordances. In order to better conceptualize and theorize narrative, Green and Brock (2002) created the Transportation-Imagery Model (TIM). The TIM consists of five postulates which seek to analyze the sensation of being "lost in a book" (Nell, 1988), or being so engulfed in a story that the surrounding physical world seems to fade away. This experience is referred to as *transportation*, a process that brings about high cognitive and emotional involvement. The model's postulates are as follows: (1) narrative evokes images and impacts readers' beliefs, (2) belief change occurs and reader becomes absorbed in the narrative,

(3) degree of transportation is influenced by the readers' personal attributes, (4) degree of transportation is impacted by attributes of the text, and finally, (5) degree of transportation is affected by attributes of the medium used (Green & Brock, 2002). In light of recent attention and use of narrative in a persuasive manner, the TIM helps to analyze how narratives influence individuals' perceptions and real-world beliefs.

The ideal transportation experience is facilitated by highly involving, descriptive, and imagery-rich narratives (Green & Brock, 2000). However, the TIM pays particular attention to the role of imagery. For instance, Green and Brock (2002) use *Uncle Tom's Cabin* to address the importance of visual imagery, said to be both startling and absorbing in the novel. Another example of a transportive narrative is seen in a story called "Murder at the Mall," which uses vivid detail and language that describes "a killer's knife repeatedly stabbing Katie, and the child's glassy stare as she lays dying" (Green & Brock, 2002, p. 318). In stories that evoke high rates of transportation, individuals also reveal increased belief change, empathy toward major characters, and an overall greater acceptance of story content (Green & Brock, 2002). With regard to the creation process, a high level of craftsmanship and artistry are also important components of an effective narrative (Green & Brock, 2002). For readers, the ability to engage in cognitive processes that create vivid images and thus, be more easily transported, is another factor that can influence message salience.

The persuasive and influential components of a narrative materialize differently depending on the recipient. While the TIM analyzes the degree of transportation, there are a number of methods that have attempted to conceptualize this type of engagement, such as *identification* (Cohen, 2001), *presence* (Biocca, 2002; Lee, 2004), and *flow* (Csikszentmihalyi, 1997; Sherry, 2004). All of these concepts are related, but play a different role in the narrative

experience. As previously mentioned, individuals transported by narrative often experience high levels of cognitive and emotional engagement. In response, participants also experience enjoyment and notably, story-consistent attitudes (Busselle & Bilandzic, 2009). The relationship between narrative engagement and strong story-consistent attitudes is attributed to two phenomena: first, decreased counterarguing capacity with the premise of the story (Green & Brock, 2002), and second, higher elaboration of story content (Slater, 2002; Slater et al., 2006).

The primary mechanism that attracts interest to the field of narrative persuasion is the tendency to adopt story-consistent attitudes. Green and Clark (2013) investigated this phenomenon in a study on the psychological mechanisms behind transportation within the context of entertainment media and tobacco use. By applying narrative transportation theory, scholars attempted to persuade participants and modify attitudes, both explicitly (e.g., characters that glamorize smoking may create positive smoking attitudes) and implicitly (e.g., activating unconscious smoking-related associations). Results suggest that individuals who experience higher rates of transportation were more apt to change attitudes, beliefs, and behaviors. Further, the effects of transportation worked largely through connections with characters, emotional involvement, and reduced capacity to counterargue.

Critical to ensuring that individuals experience cognitive processes contributing to narrative transportation is narrative construction. Narrative format has been analyzed on three levels: content, form, and context (De Graaf et al., 2016). Content refers to the story's characters, events, and setting. Form is the way that information is presented in the narrative (e.g., point of view or events presented in chronological vs. non-chronologically) (Brewer & Liechtenstein, 1982). Lastly, the context of a narrative refers to the framework in which information is presented. For instance, the context could be entertainment (e.g., radio-based drama),

advertisement (e.g., story in a magazine ad), or health education (e.g., message on colorectal cancer screening) (e.g., Chang, 2008; Dillard et al., 2010; Shen & Han, 2014;). Research surrounding narrative content suggests that narratives portraying healthy activity are more likely to influence behavior versus narratives presenting unhealthy behavior (De Graaf et al., 2016). Shen et al. (2015) assessed 25 studies comparing narrative to non-narrative messages and also found type of advocated behavior to be a moderator. Additionally, the use of both overtly and subtly persuasive messages produced effective results. In regard to narrative format, De Graaf et al. (2016) found that first-person perspective, compared to third-person, is advantageous. Shen et al. (2015) found that narratives delivered via audio and video produced significantly more impact than print-based stimuli. Finally, Braddock and Dillard (2016) reported fictionality and medium to be indicators of response variation. Despite this array of findings, a meta-analysis by Zebregs et al. (2015) did not reveal a significant correlation between format and persuasive effects.

These inconsistent results point to the importance of detail-oriented work that considers all dimensions of the stimuli. Echoing this notion, Dahlstrom et al. (2017) call attention to defining the conceptualization and operationalization of narrative in both health- and non-health-related contexts. Narrative is a complex communicative structure and process, with broad application and no standard form (Dahlstrom et al., 2017). In their meta-analysis, Dahlstrom et al. (2017) also found a general lack of narrative stimuli that represent externally valid formats frequently consumed by individuals. Further, nearly half the studies described their narrative stimuli in vague terms unrelated to defined, external formats, such as “short story” or “video.” As a result, scholars suggest that researchers seeking to explore generalizable effects of narrative should lean toward ensuring external validity, as well as clearly describing their stimuli to account for a broader range of results.

To date, most work performed in the narrative field has addressed health-related contexts (Green, 2006; Kreuter et al., 2007; Moyer-Gusé & Nabi, 2011; Murphy et al., 2013). However, increasingly, researchers have begun to explore the role of narratives within an environmental context. Numerous studies have found that narratives have the potential to increase people's motivation to engage in environmentally-friendly actions either by reducing message resistance (Moyer-Gusé et al., 2019), tapping into personal norms to inspire in environmental action (Bilandzic & Sukalla, 2019), or increasing the complexity of perceptions surrounding controversial issues such as GMOs (Rhodes et al., 2016). Other variables such as risk perception (Cooper & Nisbet, 2016) and moral emotion such as guilt (Bilandzic & Sukalla, 2019) have also been shown to influence environmental behavior.

While narrative communication research focusing on human health topics has been considerable and attention within environmental contexts is growing, little work has been done to investigate the impact of fundamental values such as environmental attitude and political ideology on individuals' response to narrative persuasion. Moreover, there is a lack of conversation about how these components might influence narrative response to controversial matters such as aquaculture, an issue with both environmental and human health implications.

2.5. Environmental attitude

As the Earth's temperature rises and problems begin to mount, there is an increasing awareness of and concern for environmental issues. Since the 1970s, primary issues in the public sphere have included air and water pollution, loss of aesthetic values, and resource conservation (Dunlap et al., 2000). More recent discussions about climate change, ozone depletion, deforestation, and loss of biodiversity have continued to prove the complex and multi-dimensional nature of environmental issues (Stern et al., 1992). As a result of these increasingly

pressing matters, there has been an interest in measuring the public's concern for environmental health. Numerous traditional approaches have measured environmental concern through analyzing ecological consciousness (Ellis & Thompson, 1997), anthropocentrism (Chandler & Dreger, 1993), and anthropocentrism versus ecocentrism (Thompson & Barton, 1994). However, for the purposes of this research, I will use the revised New Environmental Paradigm (NEP) scale (Dunlap et al., 2000) to measure ecological worldview, a decision I justify below.

To date, the NEP scale remains one of the most widely used methods of measuring environmental attitude. The original NEP scale was published in 1978 by Dunlap and Van Leire, during which the scholars argued that "...implicit within environmentalism was a challenge to our fundamental views about nature and humans' relationship to it" (Dunlap et al., 2000, p. 427). The NEP focuses on concepts such as humanity's influence on the balance of nature, limitations to human expansion, and society's belief in an inherent right to dominate nature. Using a 12-item Likert-type scale (i.e., strongly agree, agree, somewhat agree), the NEP addresses three major themes: (1) the existence of ecological limitations to growth; (2) the importance of sustaining the balance of nature; (3) the rejection of the anthropogenic idea that nature exists primarily to serve humans (Dunlap, 2008; Dunlap & Van Liere, 2008).

Soon after its creation, the NEP scale became widely used as a measure of environmental or ecological worldview. The 1978 scale, using a set of 12 Likert items, revealed good internal consistency and a strong ability to distinguish between environmentalists and the general public. This scale was developed as a challenge to society's Dominant Social Paradigm (DSP), or a worldview "through which individuals or, collectively, a society interprets the meaning of the external world… [and]… a mental image of social reality that guides expectations in a society" (Pirages & Erlich, 1974, pp. 43-44). According to Schwartz (1999), the contrast between the

DSP and the NEP projects humankind's fateful decision moving forward: "either to fit harmoniously into the world, trying to preserve it (*harmony* values, or the NEP worldview), or to exploit and change the world (*mastery* values, or the DSP worldview)" (Hawcroft & Milfont, 2010, p. 332). In creating the original NEP, Dunlap and Van Liere (1978) attempted to gauge the public's acceptance of content within the scale (e.g., issues of limits to growth, steady-state economy, etc.), and further, to establish a means to measure environmental attitude. Since its development, the scale has been used in a variety of contexts, by a diverse pool of academics, including psychologists (Stern, 2000), sociologists (Albrecht et al., 1982), political scientists (Dalton et al., 1999), communication scholars (Hart & Feldman, 2018) and geographers (Lalonde & Jackson, 2002).

The scale's popularity, however, has become somewhat problematic. The NEP casts a wide net which has been used to measure an array of related– but not necessarily equivalent– constructs, including environmental attitude, environmental belief, and environmental values. Indeed, the breadth of use and ambiguity in purpose has been criticized (Hawcroft & Milfont, 2010). Some attribute shortcomings to a failure to ground the work in social-psychological theories of attitude formation or attitude-behavior relationships (Stern et al., 1995). Most notably criticized is the significant inconsistency in the number of dimensions. A range of studies have found all 12 items to load on a single factor (Edgell & Nowell, 1989; Lefcourt, 1996; Noe & Snow, 1990) while others have found two dimensions in their samples (Bechtel et al., 1999; Gooch, 1995; Noe & Snow, 1989-90, 1990; Noe & Hammitt, 1992; Scott & Willits, 1994). That said, numerous studies have also found three dimensions (Edgell & Nowell, 1989; Noe & Snow, 1989-90; Shetzer et al, 1991), four dimensions (Furman, 1998; Roberts & Bacon, 1997), or even five dimensions (Albrecht et al., 1982; Bechtel et al., 1999; Noe & Snow, 1990; Shetzer et al.,

1991). Regardless of how its component items load, this body of literature provides evidence to suggest that "the NEP can still be fruitfully employed to examine the structure and coherence of ecological worldviews and the relationships between these worldviews and a range of more specific environmental attitudes, beliefs, and behaviors" (Dunlap et al., 2000, p. 431).

In order to address the original NEP's lack of dimensional balance, as well as update and improve its content, Dunlap, Van Liere, Mertig, and Jones revised the scale in 2000. In an effort to broaden the scale's reach, scholars renamed the instrument the "New *Ecological* Paradigm Scale." One of the primary goals of the revised material was to provide more balance between pro- and anti-NEP items. The new content was also modified to: include the idea of *human exemptionalism*, or the notion that humans are an exception to the limitations of nature (Dunlap & Catton, 1994); emphasize the potential for catastrophic environmental changes that would impact humans; and eliminate sexist terminology such as "mankind." As described in Dunlap et al. (2000), the 15-item scale demonstrated more balanced content and modified language (six items originated from the original NEP scale, four of which were slightly altered). Ultimately, the scale serves to evaluate five components of an individual's worldview: the reality of limits to growth, fragility of nature's balance, possibility of eco-crisis, anti-anthropocentrism, and rejection of exemptionalism (Dunlap et al., 2000).

Since the Dunlap et al. (2000) revision, there have been many additional iterations of the NEP. Adapting material from both the original and revised NEP scales, scholars have taken liberties with the number of items used, the content of those items, and the number of response categories on the Likert scale, in order to measure environmental attitude within their own frame of research. Each "customized" application of the NEP scale has resulted in varying success. Studies have ranged from surveying countries in Eastern Europe in order to gauge risk

perceptions from a nearby petrochemical plant (Bostrom, 2006) to examining the relationship between post-material values and environmental attitudes in Japan and the U.S. (Pierce et al., 1987). One of the most widely-used popular reduced versions of the NEP scale is a 6-item version (Arcury et al., 1986; Gooch, 1995; Knight, 2008; Nistor, 2012). Perhaps due to general convenience, reduced participant burden, and widespread acceptance in the research community, many scholars appear to be drawn to some version of the 6-item scale.

These modified scales display a patchwork of the Dunlap et al. (2000) revised NEP scale items– e.g., some items are eliminated, some slightly modified, and others constructed entirely from scratch. For instance, in the revised NEP, the seventh item states, "Plants and animals have as much right as humans to exist" (Dunlap et al., 2000). Pierce et al. (1987) and Gooch (1995), however, invert this statement and use the phrase, "Plants and animals do not exist primarily to be used by humans." In another case, Dunlap et al. (2000) use the item, "The earth has plenty of natural resources if we just learn how to develop them." Feldman and Hart (2018) drastically alter this item, instead using: "Ecological, rather than economic, factors must guide our use of natural resources" in their study on the effect of visual messaging on climate change engagement, which used a 7-item subset of the NEP. The truncated scale proved reliable, as findings resulted in a Cronbach's alpha coefficient of .84. In this case, the scholars reported measuring "ecological belief," which is said to be an important predictor of climate change attitudes (Stedman, 2004). Feldman and Hart's (2018) variation of the NEP scale is yet another example of researchers tailoring components of the NEP to match their individual purpose and desired outcome.

Unlike the previous studies noted, Schultz (1999) used the revised NEP scale and all 15 original items in a cross-cultural study on environmental attitudes and values. Despite

interpretation and translation issues, the revised NEP scale proved reliable. This work points to cautionary issues with NEP scale items. Although the present study will involve a national (U.S.) rather than international sample, there is still potential for varying or mis-interpretation depending on the participant's region.

While the NEP scale poses its challenges, numerous studies have claimed success in measuring environmental attitude with respect to a range of issues, and correlating this attitude with behavioral intentions or response. Scholars have employed the scale to measure environmental attitude in relation to environmental issues, some of which include urban planning (Kaltenborn et al., 2009), nature-based tourism (Luo & Deng, 2008), and low-carbon behaviors associated with pollution (Xu & Ou, 2019). Taking a broader approach, Hawcroft and Milfont (2010) performed a meta-analysis of studies that used the NEP in the past 30 years. Results suggest that varying scale length plays a significant role in an individual's NEP score. For instance, participant NEP scores are significantly higher for samples responding to the 6-item NEP scale, than for the original 15-item NEP scale. A content analysis also reveals that the 6-item scale might a) vary considerably across studies and b) have a significant effect on NEP scores. Additionally, results show that environmentalist and "white-collar participants" score noticeably higher than national or regional representative samples, while "blue-collar participants" score considerably lower. In response, scholars encourage future research to be cognizant of varying responses from samples of different socioeconomic backgrounds.

Hawcroft and Milfont (2010) also reported notable issues with the scale, including lack of necessary information (e.g., internal consistency of sample responses to the scale, standard deviation, average age, gender), problematic sample types, and variation in length and item content. To address these issues, researchers are encouraged to provide all the necessary

information to produce the most accurate results (e.g., NEP scale items used, mean, standard deviation, sample characteristics). This attention to detail "could increase understanding of the correlation between environmental attitude and other variables" (Hawcroft & Milfont, 2010, p. 151).

In this research, I acknowledge the importance of thorough data collection processes in order to gather the most accurate information possible. The preceding studies discussed in this section will serve as a reference point for my work in measuring environmental attitudes relating to aquaculture perceptions. Despite the considerable variation in size and content of the NEP scale, this study employs Dunlap et al.'s (2000) NEP scale and its originally-worded 15 items. This choice is justified by multiple reasons. To begin, the revised scale has been shown to demonstrate respectable internal reliability. Moreover, it is my goal to contribute to theory and knowledge creation. While using a shortened version of the scale reduces burden on participants and can be an appropriate choice, the inconsistent number of items and variant item wording makes it difficult to compare data across studies. Working with the 15-item scale will allow me to build upon a pre-established foundation of knowledge and further, extend the understanding of environmental attitude.

2.6. Political orientation

Another area worthy of exploration is the influence of political orientation on perceptions of environmental issues. Overlap between political orientation and environmental attitude is relevant in the public sphere, defined as "the forums and interactions in which different individuals engage each other about subjects of shared concern that affect a wider community" (Pezzullo & Cox, 2018, p. 20). These public spheres create circles of influence that impact how individuals interpret the environment, their relationship to it, and surrounding interactions.

Further, the environment is a central topic in many political discussions, therefore associated with a wide range of political opinions.

One of the most pressing and widespread environmental topics is climate change. According to a report conducted by the Yale Program on Climate Change Communication and the George Mason University Center for Climate Change Communication (Leiserowitz et al., 2019a), seven in ten registered voters think global warming is real. This 70% includes almost all liberal Democrats (95%), the majority of moderate/conservative Democrats (87%), and most liberal/moderate Republicans (63%). Conversely, less than four in ten conservative Republicans (38%) think global warming is real (Leiserowitz et al., 2019a). Although a substantial proportion of individuals display belief in climate change, those who do not are disproportionately distributed on the conservative end of the political spectrum. This imbalance points to a fundamental division in attitude and ideology, ultimately leading to polarization among citizens.

In another nationally representative survey, Leiserowitz et al. (2019b) asked citizens how they conceptualized global warming, finding that 58% of Americans think global warming is a political issue, 54% believe it to be an economic issue, and 75% see it as an environmental issue. Additionally, discourse surrounding climate change is often couched in human health concerns (McMichael, 2013; McMichael et al., 2006; Patz et al., 2005). Overall, this study reveals that some environmental issues, like climate change, can be highly polarizing, at least in the context of the U.S. Thus, other environmental issues which have a similar composition of human and environmental health implications– such as aquaculture– may also result in divergent opinions by political leaning. However, with respect to the lack of research on the relationship between political orientation and aquaculture, it is difficult to say whether the correlation exists within this particular environmental issue.

According to Tognacci et al. (1972), environmental concern varies significantly depending on political orientation. A substantial number of surveys— conducted at community, state, and national levels— have shown a relationship between demographic characteristics and environmental concern (Dillman & Christenson, 1972; Mcevoy, 1972; Munton & Brady, 1970). Mirroring findings in the Yale and George Mason studies (Leiserowitz et al., 2019a), Tognacci et al. (1972) found that those who identify as Democrat and Liberal rank significantly higher than Republicans and Conservatives on matters of environmental concern. Both studies, although nearly 50 years apart, show similar trends between political orientation and concern for environmental matters.

In more recent work, Longo and Baker (2016) examined the relationship between political characteristics and environmental issues with regard to individuals' cognition for potential of an eco-catastrophe. Scholars argued that "economic ideology is the strongest predictor of attitudes about eco-catastrophe, and its influence is conditioned by political identity" (Longo & Baker, 2016, p. 341). These results indicate that political identity conditions economic views and further, is more impactful on conservative views (i.e., compared to liberal views). This work reiterates the increasing awareness that "environmental concerns and efforts to address them are inextricably bound to political-economic realities" (Longo & Baker, 2016, p. 356). Rickard et al. (2020) zero in on political orientation and environmental values in a study measuring U.S. support for aquaculture as a food technology. Findings showed no significant relationship between support for aquaculture and political ideology; however, stronger environmental values were associated with more support for aquaculture policy. Witzling et al. (2020) also analyzed the factors associated with people's perceptions of aquaculture. Specifically, they studied public opinion about inland aquaculture, as well as predictors of

environmental policy support. Results revealed that individuals generally viewed aquaculture as favorable and further, that risk/benefit perceptions were strong predictors of regulation-focused policy.

Because ecological issues are related to economic and social issues (Carter, 2018), environmental matters are often situated in the political sphere. This dynamic allows for a range of issues to surface, including conflicts between stakeholders, public and private regulations, communication types, and knowledge forms (Carter, 2018). Aquaculture encompasses environmental, political, and human-health matters– making the industry an ideal candidate for exploration. These types of environmental issues are challenging, and adding political pressure creates further layers of complexity. Studying aquaculture perceptions will enhance efforts to effectively communicate contentious information, foster productive dialogue, facilitate new perspectives, and potentially increase support for sustainable aquaculture. Carter (2018) echoes this notion and urges "abandoning the polemic discussions of fish farming and opening up new ways for debating its past, present, and future" (p. 2).

2.7. Summary

Ideally, findings from this study will facilitate a deeper and more nuanced understanding of people's perceptions– which will ultimately contribute to more effective communication strategies for disseminating aquaculture information. To date, there have been a handful of studies focusing on the perceptions of aquaculture and individual characteristics that contribute to these perceptions. As previously mentioned, Rickard et al. (2020) studied how sociodemographic characteristics, such as political ideology and environmental values, relate to support for aquaculture. In another case, Witzling et al. (2020) investigated the relationship between knowledge and aquaculture policy support, as well as the role of emotion on policy

support. The scholars found that emotions were strong predictors of support for pro-aquaculture policies and specifically, positive emotions predicted support for regulation. Results also indicated that emotion plays an important role in aquaculture policy support, thus validating further exploration.

The studies observed in this review paint a picture of aquaculture today and offer a roadmap for future approaches toward communication efforts. Researchers have already begun exploring the potential of narrative as a tool to communicate contentious information (Cooper & Nisbet, 2016; Green & Clark, 2013; Moyer-Gusé et al., 2019). In this study, I also investigate narrative as a communication tool and seek to further contribute to the emerging foundation of knowledge in the field. This work examines a realm of factors that may influence perceptions of aquaculture, including message type (e.g., narrative), environmental attitude, and political orientation. Overall, I strive to create a better understanding of how messaging and other select factors influence aquaculture perception– as outlined in the research questions below.

2.8. Research questions

RQ1: How does message type influence an individual's perception of risks and benefits regarding:

1a.) Human health?

1b.) Environment?

1c.) Economy?

RQ2: How does message type influence an individual's engagement in the experimental stimuli?

RQ3: How does message type influence a person's expressed affect toward aquaculture?

RQ4: How does a person's:

4a.) Political ideology relate to views on aquaculture?

4b.) Environmental attitude relate to views on aquaculture?

CHAPTER 3

METHODOLOGY

3.1. Overview

The methodology section reviews how this study was conducted, including participant sampling and survey distribution. Further, I discuss how variables respective to the research questions were measured, such as perception of risk and benefits, engagement, environmental attitude, and political orientation.

3.2. Institutional Review Board (IRB)

The study described was approved by the IRB at the University of Maine. The IRB number is 2019_05_02. The study was judged exempt.

3.3. Pre-test

We performed a pre-test using Amazon's Mechanical Turk (MTurk) platform to test the survey instrument and stimuli. Two rounds of data were collected in 2019, from June 12 to June 30 (Study 1) and from July 24 to August 1 (Study 2). We administered the online survey (using the Qualtrics platform) with an embedded messaging experiment to a sample of U.S. adult MTurk workers, who were compensated (between $0.50 and $0.75) for completing the questionnaire. After answering a series of questions about their knowledge of aquaculture and other individual characteristics (e.g., seafood consumption), participants were randomly assigned to one of three experimental conditions or a no-message control condition. Participants given one of the experimental conditions viewed the stimuli while participants in the control condition were automatically directed to a later section of the questionnaire.

There were four conditions, including a textual information sheet, infographic video, narrative video, and a no-message control group. (To view stimuli, see Appendix 1.) Each of the

experimental conditions (e.g., textual, infographic, and video) employed messages that highly supported the production and consumption of aquaculture. The first condition was a one-page information sheet that defined marine aquaculture, described its role in the United States, and encouraged readers to support the industry. This information about sustainable aquaculture was drawn from sources such as NOAA and, more locally, state-based Sea Grant offices. The second condition was an infographic video[1] narrated by Barton Seaver, celebrity seafood chef. This 3:07 minute video used the same language from the textual condition in an audio recording and featured still images, including photographs of seafood and direct quotations from the script.

Lastly, there was video featuring Barton Seaver telling a story that broadly incorporates aspects of three themes: (1) his biography/identity with respect to the ocean (e.g., searching for shellfish in the Chesapeake Bay as a child); (2) the status/history of working waterfronts (especially in the U.S.) (e.g., declining fisheries mean that aquaculture can supplement traditional fishing livelihoods); (3) the role of sustainable aquaculture in the food industry/food system (e.g., how chefs can feature farmed seafood in their restaurants). The video was filmed on the oceanside. Based on the data from Study 1, we modified the narrative video[2] used subsequently in Study 2 to include a more engaging narrative from Chef Seaver. In this case, Seaver was standing in his kitchen instead of at the waterfront and the video had been reduced to 3:10 minutes (from an initial 4:51 minutes), while the textual message and infographic video remained identical.

[1] Readers can access the infographic video here: https://www.youtube.com/watch?v=e2HqLOn7YU8&feature=youtu.be
[2] Readers can access Barton Seaver's narrative video here: https://www.youtube.com/watch?v=5cJLPOScNPw&feature=youtu.be

Following the experimental portion of the survey, participants answered additional questions about sociodemographic characteristics, (e.g., race/ethnicity, gender, environmental values), opinions about marine aquaculture, and behavioral intentions (e.g., to support aquaculture policy). Two sets of attention checks included: (1) a recall question regarding the topic discussed in the stimuli; and (2) a simple attention check that required participants to mark a specific response option for a multiple-choice question. After excluding participants who failed these attention checks, our final sample sizes for analysis were 368 in Study 1 (91.8% of the total sample) and 440 in Study 2 (85.1% of the total sample).

3.4. Main study

Prior to fielding the main study, we added a fifth experimental condition: a text-only transcript of the narrative video. (See Appendix 1). Adding this condition allowed for comparison between the video-based narrative and text-based narrative conditions, meaning we could explore the influence of communication medium. Ultimately, we ended up grouping the experimental conditions in two categories: a) the textual and infographic video and b) the narrative text and narrative video. In addition, we added a free-response question (directly following exposure to the stimuli) that asked participants to describe marine aquaculture to a family member or friend (also included for those in the control condition). Aside from adding the fifth condition and the free-response question, the experimental process stayed the same. After the survey content was finalized, we fielded the questionnaire (see Appendix 3) between October 11 and November 7, 2019.

3.5. Sampling

To recruit participants for the survey, we contracted with Qualtrics, a professional survey firm who handled all contact with survey participants. We collected 3,600 completed surveys,

resulting in approximately 720 participants per condition (i.e., four experimental conditions and one control condition). This distribution would ensure adequate statistical power to investigate small to medium-sized effects of the stimulus on participants' attitudes and behavioral intentions. Qualtrics provided a representative sample of U.S. residents, recruited through a "proprietary blend" of online channels, based on a number of criteria or "quota variables" (e.g., age, education, political ideology) selected to ensure that the sample was representative of the U.S. public based on the most recent U.S. Census data. In addition, the study sample included an approximately even-split of individuals residing in urban or suburban metropolitan areas and rural areas. Finally, we oversampled the 19 coastal U.S. states[3] (i.e., those containing ocean coastline) to ensure that the sample included adequate numbers of individuals who live in states where marine aquaculture takes place.

3.5. Measures

Participants completed a 52-question survey, which included predominantly multiple choice and Likert-scale questions, as well as one free-response question.

3.6.1. Codebook

Within the survey, the free-response question asked participants: "If you were asked to describe marine aquaculture to a family or friend, what would you say?" To analyze the open-ended responses from this question, we developed a codebook (see Appendix 2). Categories for the codebook were determined based on central themes in each of the experimental stimuli, including human health, environment, economy, and type of engagement.

[3] Coastal states were as follows: ME, NH, RI, MA, CT, NY, NJ, DE, MD, VA, NC, SC, GA, FL, TX, LA, AL, MS, CA, OR, WA, AK, HI.

3.6.2. Perception of benefit and risk

These responses were coded based on whether the content was focused on positive or negative aspects of aquaculture. The general aquaculture benefit variable focused on the positive aspects, benefits, and general usefulness associated with aquaculture (Krippendorff's alpha = .96). The general aquaculture risk category focused on negative aspects or risks associated with aquaculture, which had 99% intercoder agreement. While responses were coded based on general categories of either benefits or risks of aquaculture, they were further broken down into subcategories of human health, environmental, or economic benefits or risks. Human health benefits included a good source of fish for human consumption, safer products, or increased nutritional benefits (Krippendorff's alpha = .76). Environmental benefits included sustainability, supporting marine life, or protecting the environment (Krippendorff's alpha = .93). Lastly, economic benefits included increased job markets and a boosted American economy (Krippendorff's alpha = .85). Results of intercoder reliability tests suggested appropriate levels of agreement between two independent coders on all risk/benefit-related variables.

Responses were also coded for general aquaculture risks. The environmental risk category, of which had 99% agreement, referenced risks of aquaculture on ecosystems, plants, animals, or the environment. Lastly, both the human health risk and economic risk categories had 100% agreement.

3.6.3. Level of engagement

Level of engagement was measured with respect to three levels, indicating low to progressively higher assumed cognitive engagement with the stimuli: (1) minimal engagement, (2) explanatory engagement, and (3) evaluative engagement. Importantly, each response could be coded as fitting one or more of these levels of engagement. Hence, a response could be both

explanatory and evaluative. The minimal engagement variable was represented by responses expressing little engagement or interest (e.g., reporting an answer such as "no," "nothing," or "n/a") (Krippendorff's alpha = .71), as well as expressing uncertainty about the content (e.g., "I don't know," "I wouldn't know what to say") (Krippendorff's alpha = .84).[4] The explanatory engagement was present when responses regurgitated or described information from the stimuli (Krippendorff's alpha = .90). Finally, evaluative engagement was coded when responses reflected an individual's perspective or opinion on the topic (e.g., "boring", "exciting," "I like this idea", etc.) (Krippendorff's alpha = 0.55.).[5]

3.6.4. Environmental attitude

Environmental values were measured using the New Environmental Paradigm (NEP) scale. The scale included 15 items to measure participant environmental values. The survey prompted individuals to indicate their degree of agreement with certain statements based on a 7-point Likert-scale from strongly disagree to strongly agree. Sample statements included, "When humans interfere with nature, it often produces disastrous consequences" and "humans have the right to modify the natural environment to suit their needs." Based on an exploratory factor analysis, the final scale includes six items that loaded on the first factor (M = 5.40, SD = 1.09, α = .87).

[4] We originally had two separate categories for minimal engagement (minimal to no engagement vs. uncertainty about the topic). However, the numbers for both categories were so low, we decided to combine the two for statistical purposes.

[5] There were a low number of cases (336 cases out of 3600 total), which indicates less than 10% of people responded with evaluative engagement. For future research, there might be alternative ways to measure the reliability when there are a low number of occurrences for a code (e.g., Gwet's AC1 calculation).

3.6.6. Political ideology

Political ideology was measured using three Likert-scale questions. The questions prompted participants to rank their political orientation (1 = very liberal; 4 = independent; 7 = very conservative) about political issues, economic issues, and social issues. All three items were averaged into an index for political ideology due to high reliability (M = 3.85, SD = 1.09, α = .97).

3.6.7. Affect

The degree of positive or negative affect was measured using the Linguistic Inquiry and Word Count (LIWC) software program. Developed by a linguist, this program reads a given text and counts the percentage of words that reflect different emotions, thinking styles, social concerns, and parts of speech. The text-analysis function compares each word in the text with a user-defined dictionary. Although there are many dimensions through which we could analyze the text, we focused on the output measuring "emotional tone." This measures responses based on a percentage of 0-100% and either positive or negative emotional tone.

3.6.8. Individual characteristics

Individual characteristics were measured by responses to multiple choice or open-ended questions. Some of these questions included age, sex, race/ethnicity, education level, household income, state of residence, and type of area (e.g., urban, rural, suburban). Age was measured by participants typing in the number of their age (M = 46.33). Sex was measured using a multiple-choice question, offering "male," "female," and "other" options (80.1% female, 19.6% male, 0.03% other). Race/ethnicity was measured using a multiple-choice question, and which included the following categories: White; Black or African American; Asian or Asian American; Native American, American Indian, or Alaska Native; Native Hawaiian or Pacific Islander; Hispanic or

Latino; Other (White = 80%, Black = 9.5%, Asian or Asian American = 3.6%). Participants were asked to indicate their total household income before taxes for the previous year by a multiple choice question, starting at "Less than $10,000" and incremental brackets to the final category of "More than $200,000" (*M* = $200,000). Education was measured using a multiple choice question regarding the highest level of education completed, including the following response categories: Less than High School; High School / GED; Some College; 2-year College Degree; 4-year College Degree; Master's Degree; Doctoral Degree or beyond (27.5% = 4-year College Degree; 25.1% = Some college; 18.9% = High School / GED). State of residence was measured with a drop down menu of potential states (coastal states = 56.1%; non-coastal states = 43.9%). Finally, participants were asked to record the type of area they live in using multiple-choice answers of "urban," "rural," and "suburban" (rural = 40.6%; suburban = 37.4%; urban = 22.0%).

3.7. Analysis

The free-response questions were analyzed qualitative methods; however, I will use other survey questions to supplement research and create a holistic understanding of the data. For the first and second research questions, I used chi-square analysis. For the third research question, I employed a one-way ANOVA analysis. Finally, I used logistic regression to analyze research question four. By using IBM SPSS Statistics Version 26 for the statistical analysis, I was able to consider the range of responses with respect to participants' sociodemographic characteristics and assigned message condition.

CHAPTER 4

RESULTS

For the purpose of appropriately comparing conditions, I break down the analysis into two "groups" of conditions: (1) narrative text, narrative video, and control, and (2) infographic video, text, and control. Because the narrative text and narrative video feature the same language, the data will be more easily comparable. For the same reason, I study the infographic and text together because they both employ the same language, but through different modes.

4.1. Research question 1

The first research question asked how message type influences an individual's perception of benefits and risks regarding (a) human health, (b) the environment, and (c) the economy.

4.1.1. General benefit

First, considering the text and infographic conditions, there was a significant association between message type (textual, infographic, or control) and an individual's perception of aquaculture benefits [$\chi 2$ (1) = 415.26, $p < 0.001$]. Among all three conditions, participants showed the infographic displayed a substantially higher likelihood of reporting aquaculture benefits. Of all participants who responded with general aquaculture benefits, 53% were shown the infographic, 37% were in the textual condition, and 10% were in the control condition. Additionally, 388 individuals responded to the infographic with mention of aquaculture benefits, which greatly exceeded the expected count of 237– that is, they mentioned general aquaculture benefits more than would be expected by chance. Individuals in the control group communicated aquaculture's benefits significantly less than expected (expected count: 290, count: 72).

Next, comparing just the narrative experimental conditions, there was a significant association between message type (narrative text, narrative video, and control) and an

individual's perception of aquaculture benefits [$\chi 2$ (1) = 242.99, $p < 0.001$]. Both groups of participants in the experimental groups, whether shown the narrative text (42%) or the narrative video (46%), revealed a high likelihood of mentioning aquaculture's benefits. Similar to the previous combination of experimental groups, the control group participants demonstrated a much lower likelihood of mentioning aquaculture benefits than anticipated, while the narrative text and narrative video participants far exceeded their expected count.

4.1.2. Human health benefit

There was a significant association between message type (textual, infographic, and control) and an individual's perception of aquaculture benefits on human health [$\chi 2$ (1) = 153.01, $p < 0.001$]. Compared to 40% of textual group participants, only 20% of infographic group participants mentioned human health benefits related to aquaculture. However, both textual and infographic participants exceeded their expected count– that is, they mentioned health benefits more than would be expected by chance. Once again, the control participants were less likely to mention aquaculture benefits than expected by chance (count: 16, expected: 109).

In addition, there was a significant association between message type (narrative text, narrative video, and control) and an individual's perception of aquaculture benefits on human health [$\chi 2$ (1) = 42.21, $p < 0.001$]. Results suggest that being in both the narrative text (40% of participants within the condition) and narrative video conditions (47%) were associated with a higher likelihood of mentioning aquaculture benefits related to human health, as compared to the no message control group (13%). Both narrative text and narrative video participants exceeded their expected count for mentioning human health benefits.

4.1.3. Environmental benefit

There was a significant association between message type (textual, infographic, and control) and an individual's perception of aquaculture benefits to the environment [$\chi 2$ (1) = 245.55, $p < 0.001$]. Similar to general mention of aquaculture benefits (see above), viewing of the infographic was associated with mentioning environmental benefits (54% of participants in the infographic group), compared to the textual (37%) and control group (9%). The number of participants mentioning environmental benefits in the infographic group exceeded the expected number.

There was also a significant association between message type (narrative text, narrative video, and control) and an individual's perception of aquaculture benefits to the environment [$\chi 2$ (1) = 209.67, $p < 0.001$]. Closely mirroring findings reported from the benefits and human health variables, narrative video (47%) and narrative text (44%) showed similarly high percentage of participants mentioning aquaculture benefits, but with a focus on the environment. Moreover, more participants in the narrative text and video conditions mentioned environmental benefits than would be expected by chance.

4.1.4. Economic benefit

There was a significant association between message type (narrative text, narrative video, and control) and an individual's perception of aquaculture benefits to the economy [$\chi 2$ (1) = 12.48, $p < 0.01$]. Although very few people mentioned the economic benefits of aquaculture, participants shown the narrative text and narrative video still exceeded the expected count.

Similarly, there was a significant association between message type (textual, infographic, control) and an individual's perception of aquaculture benefits to the economy [$\chi 2$ (1) = 33.70, $p < 0.001$]. Notably, no control group participants mentioned economic benefits. In general, counts

across all five experimental conditions revealed extremely low numbers in reporting economic benefits. While all expected counts were relatively low, actual counts were even lower yet.

4.1.5. General risk

There was not a significant association between message type (textual, infographic, control) and an individual's perception of aquaculture risks [$\chi 2$ (1) = 3.69, p > 0.05]. Additionally, there was not a significant association between message type (narrative text, narrative video, control) and an individual's perception of aquaculture risks [$\chi 2$ (1) = 3.55, p > 0.05].

4.1.6. Human health risk

There was not a significant association between message type (narrative text, narrative video, and control) and an individual's perception of aquaculture risks to human health [$\chi 2$ (1) = 2.50, p > 0.05]. However, there was a significant association between message type (textual, infographic, control) and an individual's perception of aquaculture risks [$\chi 2$ (1) = 6.25, p < 0.05]. Across all five conditions, the reported number of participants who mentioned human health risks of aquaculture were extremely low: control (0 participants), narrative text (1), narrative video (3), textual (0), and infographic (3). As a result of these low frequencies, it is difficult to thoroughly analyze the data and arrive at a conclusive result regarding aquaculture human health risks.

4.1.7. Environmental risk

There was not a significant association between message type (textual, infographic, control) and an individual's perception of aquaculture risks to the environment [$\chi 2$ (1) = 0.45, p > 0.05]. Further, the low number of occurrences of individuals reporting environmental risks in

the narrative text and narrative video conditions violated the conditions necessary for running a chi-square test.

4.1.8. Economic risk

There was not a significant association between message type (narrative text, narrative video, and control) and an individual's perception of risks to the economy [$\chi 2$ (1) = 2.500, p > 0.05]. Similar to environmental risks, the low number of occurrences of individuals reporting economic risks related to aquaculture in the textual and infographic conditions violated the conditions necessary for running a chi-square test.

4.2. Research question 2

The second RQ asked how message type influences an individual's engagement in the experimental stimuli.

4.2.1. Minimal engagement

There was a significant association between message type (textual, infographic, control) and responses displaying minimal engagement [$\chi 2$ (1) = 57.86, p < 0.001]. The control group revealed the highest number of participants (61%) with minimal engagement, although participants from all three groups displayed more engagement than expected. Moreover, there was not a significant association between message type (narrative text, narrative video, and control) and responses displaying minimal engagement [$\chi 2$ (1) = 9.22, p > 0.05].

4.2.2. Explanatory engagement

There was a significant association between message type (narrative text, narrative video, and control) and responses displaying explanatory engagement [$\chi 2$ (1) = 25.99, p < 0.001]. Among all three conditions, participants showed nearly equal distribution of explanatory engagement: 38% of the control group, 32% of the narrative video group, and 30% of the

narrative text group. Additionally, counts within the narrative text and narrative video groups appeared to be slightly higher than expected, while the control group count was slightly lower than anticipated (count: 662, expected count: 707).

There was a significant association between message type (textual, infographic, control) and responses displaying explanatory engagement [$\chi 2$ (1) = 77.19, $p < 0.001$]. Among all responses displaying explanatory engagement, 36% were within the control group, 30% within textual, and 34% within infographic. The experimental conditions (textual and infographic) included more instances of explanatory engagement than expected. Similar to the group of conditions mentioned above, the control group showed less explanatory engagement than anticipated (count: 662, expected count: 740).

4.2.3. Evaluative engagement

There was not a significant association between message type (textual, infographic, or control) and responses displaying evaluative engagement [$\chi 2$ (1) = 13.25, $p > 0.05$]. Similarly, there was not a significant association between message type (narrative text, narrative video, control) and responses displaying evaluative engagement [$\chi 2$ (1) = 8.86, $p > 0.05$].

4.3. Research question 3

The third research question asked how message type influences a person's expressed affect toward aquaculture. In an effort to understand how different message types can influence an individual's affect toward aquaculture, a one-way ANOVA was conducted.

4.3.1. Affect

There was not a statistically significant difference between message type and an individual's expressed affect toward aquaculture, F (4, 3595) = 0.80, $p = 0.52$.

4.3.2. Positive emotion

There was not a statistically significant difference between message type and an individual's expressed positive emotion toward aquaculture, F (4, 3595) = 0.33, p = 0.87.

4.3.3. Negative emotion

There was not a statistically significant difference between message type and an individual's expressed negative emotion toward aquaculture, F (4, 3595) = 2.22, p = 0.06. Although the p-value was greater than the conventional cut-off of .05, it is still close enough to suggest marginal significance. The participants in the control condition revealed the lowest amount of negative emotion in their responses (M = 0.31, SD = 1.92). In contrast, individuals shown the narrative video were most likely to reveal negative emotion (M = 0.84, SD = 6.97). In terms of the other experimental conditions, values for negative emotion were textual (M = 0.44, SD = 2.55), infographic (M = 0.40, SD = 2.58), and narrative text (M = 0.72, SD = 4.98).

4.4. Research question 4

The fourth research question asked how a person's environmental attitude and political ideology relate to their views of aquaculture. Binary logistic regression was used to measure how a person's political ideology and environmental attitude relates to their views on aquaculture. Binary logistic regression measured the effect of the experimental group predictors (i.e., textual, infographic, narrative video, narrative transcript, and no message control) on the dependent variable (i.e., views on aquaculture– expressed as a binary, present or absent condition).

4.4.1. General benefit

As shown in Table 1 below, the model predicting the general mention of aquaculture benefit was significant ($\chi 2$ = 28.437, df = 2, p < 0.001). NEP significantly predicted an individual's likelihood of mentioning aquaculture benefits (B = 0.18, SE = 0.04, Wald = 23.55,

df = 1, $p = 0.000$, Exp(B) = 1.19). The more environmentally conscious a participant was, the more likely he or she was to mention aquaculture benefits (i.e., the odds of mentioning aquaculture benefits increased by a factor of 1.2 for every one unit increase in NEP score). Political ideology was not significant in predicting individual's mention of aquaculture benefits ($B = 0.002$, $SE = 0.02$, Wald = 0.01, df = 1, $p = 0.90$, Exp(B) = 1.00).

Table 4.1. *General aquaculture benefit*

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
NEP Score	0.177	0.037	23.553	1	0.000*****	1.194
Political Ideology	0.002	0.0188	0.016	1	0.899	1.002
Constant	-1.639	0.240	46.660	1	0.00	0.194

4.4.2. Human health benefit

The model predicting the mention of aquaculture benefits on human health was not significant ($\chi 2 = 4.44$, df = 2, $p > 0.05$).

4.4.3. Environmental benefit

The model predicting mention of aquaculture benefits to the environment was significant ($\chi 2 = 51.74$, df = 2, $p < 0.001$). As illustrated in the table below, NEP was statistically significant in predicting the likelihood of an individual mentioning aquaculture benefits on the environment ($B = 0.26$, $SE = 0.042$, Wald = 39.86, df = 1, $p = 0.000$, Exp(B) = 1.30). The more environmentally conscious a participant was, the more likely he or she was to mention environmental aquaculture benefits (i.e., odds of mentioning environmental aquaculture benefits increased by a factor of 1.3 for every one unit increase in NEP score). In contrast, political ideology was not statistically significant in predicting the likelihood of an individual mentioning

aquaculture benefits to the environment (*B* = -0.005, *SE* = 0.02, Wald = 0.06, df = 1, *p* = 0.80, Exp(*B*) = 1.00).

Table 4.2. *Aquaculture and human health benefit*

Variables	B	S.E.	Wal	df	Sig.	Exp(B)
NEP Score	0.264	0.042	39.863	1	0.000*****	1.302
Political Ideology	-0.005	0.020	0.062	1	0.803	0.995
Constant	-2.584	0.275	88.163	1	0.00	0.076

4.4.4. Economic benefit

The model predicting the mention of aquaculture benefits to the economy was not significant ($\chi 2 = 0.12$, df = 2, $p > 0.05$).

4.4.5. General risk

The model predicting the general mention of aquaculture risks was not significant ($\chi 2 = 0.72$, df = 2, $p > 0.05$).

4.4.6. Human health risk

The model predicting mention of aquaculture risks on human health was significant ($\chi 2 = 9.90$, df = 2, $p < 0.05$). Political ideology was not significant in predicting the likelihood of an individual mentioning aquaculture human health risks (*B* = 0.006, *SE* = 0.254, Wald = 0.01, df = 1, *p* = 0.982, Exp(*B*) = 1.01). However, as revealed in the table below, NEP scale score significantly predicted the likelihood of an individual mentioning human health risk (*B* = 2.88, *SE* = 1.448, Wald = 3.97, df = 1, *p* = 0.046, Exp(*B*) = 17.89). These results indicate that the more environmentally conscious a participant was, the more likely he or she was to mention human health risks associated with aquaculture (i.e., the odds of mentioning human health risks

increased by a factor of 17.89 for every one unit increase in NEP score). It should be noted that the raw numbers for this calculation were extremely low, with only four of 3,600 participants reporting human health risks. While these findings have statistical significance, we are cautious to place considerable weight on these results and their real-world application.

Table 4.3. *Aquaculture and human health risk*

Variables	B	S.E.	Wal	df	Sig.	Exp(B)
NEP Score	0.284	1.448	3.967	1	0.046*	17.888
Political Ideology	0.006	0.254	0.001	1	0.982	1.006
Constant	-25.047	9.868	6.443	1	0.011	0.000

4.4.7. Environmental risk

The model predicting the mention of aquaculture risks to the environment was not significant ($\chi 2 = 1.29$, df = 2, $p > 0.05$).

4.4.8. Economic risk

The model predicting the mention of aquaculture risks to the economy was not significant ($\chi 2 = 2.12$, df = 2, $p > 0.05$).

CHAPTER 5

DISCUSSION

5.1. Overview

The present study investigated the influence of message type on perceptions of aquaculture. I also examined participant engagement with the stimuli. Lastly, I observed how (a) affect, (b) environmental attitude, (c) political orientation relate to views on aquaculture. This investigation employed four experimental conditions and a control condition with no message.

5.1.1. Research question 1

The first research question explored how message type influenced perceptions of aquaculture benefits and risks. In terms of reporting general aquaculture benefits, it appears that using some sort of experimental condition was more successful in eliciting aquaculture benefit responses than the control condition with no message. Comparing the conditions featuring the same text information (textual and infographic conditions) with the control, participants in both experimental conditions communicated benefits of aquaculture more than would be expected by chance. Further, individuals shown the infographic seemed particularly responsive to the stimulus.

Among responses specifically mentioning human health, environmental, and economic benefits, there was a continued pattern of individuals in the experimental groups (i.e., all conditions except the control) mentioning aquaculture benefits more than would be expected by chance. Alternatively, the control group reported significantly less benefit information than expected. This pattern persisted across all categories of aquaculture benefit (i.e., human health, environmental, and economic). For discussion purposes, I will be speaking about patterns found among all categories of aquaculture benefit, which include general, human health,

environmental, and economic benefits. Between the textual and infographic group, the infographic generated the most aquaculture benefit responses. Across all five conditions, the infographic was the most effective in producing responses mentioning all types of aquaculture benefit (i.e., general, human health, environmental, and economic). In a similar study, Rickard, Yang, Liu, and Boze (in review) explored the effects of video-based narrative persuasion, in comparison to persuasive messages delivered in text-based or video-based infographic formats, on support for aquaculture. Mirroring findings from the present study, scholars found a higher degree of transportation in their informational text condition than in the narrative video condition. With respect to mode of communication, Shen et al. (2015) found that narratives delivered via audio and video produced significantly more impact than print-based stimuli. In agreement, the overall results from this study also found that the infographic and narrative video produced the highest frequencies of aquaculture benefit responses.

The first research question also analyzed how message type influenced an individual's perception of aquaculture risks. Unsurprisingly, due to the exceptionally low number of aquaculture risk responses, there was little significant association between message type and an individual's perception of aquaculture risk. The only significant relationship was found regarding human health risks of aquaculture within the textual group– in which a total of zero control participants, zero textual participants, and only three infographic participants mentioned human health risks. While we recognize the statistical significance of this finding, it is difficult to analyze these numbers and arrive at a conclusive result because the frequencies were so low. In line with these results, Rickard et al. (2018) conducted two complementary studies– a 15-year content analysis and focus group discussions– exploring aquaculture which revealed that few of

their focus group participants rejected aquaculture altogether on the basis of its apparent riskiness.

Despite the limited number of responses, we can nonetheless draw important conclusions regarding aquaculture risk perceptions related to the stimuli. First, it appears that none of the conditions produced an overall negative response within the participants. This indicates an overall effectiveness of the stimuli messages, as well as a lack of apparent boomerang effect (Bryne & Hart, 2009) from the experimental conditions. (In other words, the stimuli– which featured the positive attributes of sustainable aquaculture– did not seem to promote different, and/or additional thoughts of aquaculture risk.) Further, the no-message control condition did not generate significantly more or less risk-oriented responses than the experimental conditions. These results indicate that individuals' baseline perceptions of aquaculture may have been relatively neutral to positive. However, because we did not assess participants' familiarity with aquaculture prior to the survey, it is difficult to determine the exact degree to which the stimuli influenced people's perceptions. In addition, individuals who know little to nothing about aquaculture might naturally assume a neutral attitude toward aquaculture due to their lack of knowledge, rather than exhibiting an informed, impartial opinion.

In a similar study on perceptions of shellfish aquaculture, D'Anna and Murray (2015) found that uncertainty was the primary driver in interview participants' responses. In the present study, this uncertainty about aquaculture may have manifested in the minimal benefit *or* risk responses expressed among the control group. Further, D'Anna and Murray (2015) noted that participants exhibited a generally low awareness of aquaculture, which may be another contributing factor to the present study's overall low number of risk-related responses (see also Rickard et al., 2020). Lastly and simply due to study design, individuals may have been primed

to write about aquaculture benefits more than risks because the stimuli message promoted the merits of aquaculture.

To expand further, D'Anna and Murray's (2015) aquaculture study utilized a similar focus on the overarching themes of the environment and economy, with an additional 'lived experience' category. This work, conducted in British Columbia, looked at perceptions of shellfish aquaculture through interviews with participants directly involved in aquaculture (i.e., "industry interviewees") and participants indirectly affected by or involved in aquaculture (i.e., "non-industry interviewees"), as well as household surveys. Mirroring findings from the present study, the scholars found that industry interviewees focused on environmental and economic benefits, while survey participants, non-industry interviewees, and still a considerable amount of industry interviewees, expressed environmental concerns. Inconsistent with findings from the present study– which showed few risk-oriented responses– D'Anna and Murray (2015) found a general concern for aquaculture environmental risk among all their study participants.

This study is not the only one to investigate discourse surrounding aquaculture. In 2016, Rickard and Feldpausch-Parker conducted a 10-year regional newspaper study on aquaculture, which identified a significant amount of high risk-focused content. Even considering this influx of negative media surrounding aquaculture, participant responses in the current study did not reflect the internalization of said risk-framed aquaculture news reporting. However, as previously mentioned, this study did not assess people's exposure to or familiarity with aquaculture prior to the survey. Further, even if people were exposed to aquaculture information, we cannot assume it would directly affect and/or create a lasting impact on their perception (Scheufele & Tewksbury, 2007). In other work, Rickard and Feldpausch-Parker (2016) and Froelich et al. (2017) reported a recent increase in positive vernacular surrounding aquaculture

news, with specific mention of benefits and sustainability. This shift toward a more positive narrative surrounding aquaculture could be contributing to individuals' increased awareness of new information, or at least (indirectly) made the experimental stimuli more salient to participants.

5.1.2. Research question 2

The second research question explored how message type influenced an individual's engagement in the experimental stimuli, measured via a free-response question asking participants to "describe marine aquaculture to a family member or friend." Within the textual group, the control participants were most inclined to comment with minimal engagement, which we defined as little to no engagement/interest (e.g., reporting an answer such as "no," "nothing," or "n/a") or expressing uncertainty about the content (e.g., "I don't know," "I wouldn't know what to say"). In this sense, we used "engagement" as a proxy for a degree of cognitive processing. Recent studies have shown an overall low level of awareness and knowledge surrounding aquaculture processes and products (Feucht & Zander 2015; Freeman et al., 2012; Schlag & Ystgaard, 2013; Rickard et al., 2018; Rickard et al., 2020; Vanhonacker et al., 2011). With little knowledge about the topic of aquaculture, individuals in the control group (who received no message stimuli) may be responding with less engagement, interest, and overall content as a result of their minimal knowledge base. To that end, it is reasonable to assume that using some type of stimuli rather than no stimuli is more effective in eliciting engagement and message-consistent attitudes (e.g., positive aquaculture attitudes, reporting benefits of aquaculture).

The second research question further explored the relationship between message type and responses displaying explanatory engagement, defined by responses that are descriptive or

regurgitate information from the stimuli. Within the narrative sub-group of conditions (narrative text, narrative video, and control conditions), participants in each group were relatively equally distributed in their display of explanatory engagement. The textual experimental sub-group (textual, infographic video, and control) showed the same pattern in displaying explanatory engagement. These findings suggest that neither the control condition, narrative conditions, nor textual conditions led individuals to respond disproportionately with an explanatory response. Rather, individuals may be naturally inclined to respond this way because the open-ended survey question prompted participants to "describe marine aquaculture to a family member or a friend." Consequently, individuals may have instinctually responded in an explanatory manner, regardless of the stimuli they were shown. In retrospect, this may have been a limitation to the study design.

Lastly, the second research question investigated the relationship between message type and responses showing evaluative engagement, defined by responses that reflect an individual's perspective or opinion on the topic (e.g., "boring", "exciting," "I like this idea", etc.). Among all five conditions, none revealed a significant association between message type and evaluative engagement. It can be inferred that none of the stimuli were more or less likely to provoke an evaluative, opinionated, or emotional response. At first glance, these findings appear incongruent with Green and Brock's (2002) Transportation-Imagery Model, which posits that narratives bring about high cognitive and emotional involvement. Green and Brock (2000) also state that the ideal transportation experience is facilitated by highly involving, descriptive, and imagery-rich narratives. That said, it is possible that (a) the narrative stimuli in this study did not provide adequate imagery to facilitate transportation and its subsequent effects, which I have not

explored directly in this thesis; or (b) contrary to Green and Brock (2000; 2002), the narrative format may not be as effective as previously thought, as I explain further below.

5.1.3. Research question 3

The third research question asked how message type influenced a person's expressed affect toward aquaculture, as measured through linguistic analysis using LIWC software. The one-way ANOVA results revealed no statistically significant relationship between affect and message type. Similarly, there was no statistically significant relationship between positive emotion toward aquaculture and message type. Negative emotion, however, displayed enough statistical significance to suggest a relationship with message type. Out of all five conditions, individuals shown the narrative video were most likely to express negative emotion. Such findings raise the possibility that aspects of the narrative video, including the message or speaker, were somewhat off-putting to participants, which I also return to below.

These affect results were surprising, as we had designed the study under the assumption that people are naturally "wired" to be sensitive to information presented in the narrative format (Green & Brock, 2002). The literature also suggests that narrative elicits high levels of cognitive and emotional engagement (Green & Brock, 2002) that can ultimately lead to story-consistent attitudes (Green & Clark, 2013) and opinion change (Braddock & Dillard, 2016). There is a discrepancy between this information and findings from the current study, as those individuals who viewed the narrative video appeared more likely to express negative emotion. While these findings were unexpected, it is possible that individuals sensed Seaver's overarching aim to promote aquaculture, rather than perceiving the story as an authentic, personal testimony. Similarly, Moyer-Gusé et al. (2019) found that the combination of an environmental narrative and pro-environmental public service announcement (compared to the environmental narrative

alone) led to greater opposition and lower intentions of engaging in environmentally-friendly behaviors.

In their keystone work on narrative, Green and Brock (2002) attribute propensity for transportation to the medium, artistic craftsmanship, and the recipient's ability to engage in imagery. Had the narrative video included more *vivid information*, defined by Nisbett and Ross (1980) as information that is "(a) emotionally interesting, (b) concrete and imagery-provoking, and (c) proximal in a sensory, temporal, or spatial way" (p. 45, as cited in Green & Brock, 2002), there may have been increased opportunity for transportation and thus, the adoption of story-consistent attitudes (e.g., supportive of sustainable aquaculture). While this is a promising line of discussion in the narrative field, it is not one that I specifically analyze in this study; therefore, I will return to this topic in the "future research" section.

5.1.4. Research question 4

The fourth and final research question examined the relationship between a person's political ideology and environmental attitude and their views of aquaculture. The results showed that an individual's environmental attitude, measured by their NEP scale score, is associated with a greater likelihood of mentioning general aquaculture benefits, as well as environmental benefits. Inconsistent with this finding, in a study of online public comments to federal agencies on proposed aquaculture regulation, Froehlich et al. (2017) found that environmentalists tended to write negatively about aquaculture. Alternatively, in a study measuring U.S. support for aquaculture as a food technology, Rickard et al. (2020) found that environmental values were associated with support for aquaculture. In tandem with results from the present study, this positive relationship suggests that higher environmental-consciousness may lead to greater salience of aquaculture information. Results also revealed a link between reports of aquaculture

human health risk and high environmental attitude. While the results display statistical significance, it is difficult to place considerable weight on this correlation because the *n* is so small (four out of 3,600 participants reported human health risks) and thus, can result in a skewed model. That said, we acknowledge these findings and encourage future researchers to investigate this relationship further.

To the second part of this research question, results indicate that political ideology does not predict an individual's views on aquaculture. While previous literature acknowledges the relationship between political orientation and environmental concern (Longo & Baker, 2016; Tognacci et al., 1972), it is possible that aquaculture has not yet gained the same degree of politicization as other environmental issues in the public sphere within the U.S. (e.g., climate change). To this end, the lack of association between political orientation and aquaculture may be attributed to a lack of exposure and overall awareness. It is also important to note that the stimuli discussed *sustainable* aquaculture, which is portrayed positively and likely has less stigmatization than other, more commonly-found forms of commercial aquaculture. For instance, certain types of aquaculture production, such as raising salmon in ocean net pens, have been highly publicized and politicized (Amberg & Hall, 2010)– consequently influencing recipients' interpretation of aquaculture benefits and risks. With respect to this study's findings, it is possible that while the general topic of aquaculture is not directly linked to political orientation, there are certain *types* of aquaculture, or communities in which aquaculture is practiced, that invoke contentious opinions and political association.

Recent research efforts have also taken interest in the relationship between aquaculture and political ideology. In a similarly focused study, Yang, Rickard, Liu, and Boze (under review) conducted a messaging experiment to explore U.S. adults' support for sustainable aquaculture.

The results revealed that, in some cases, being liberal was linked to stronger support for aquaculture. Altogether, findings from the current and previously mentioned studies suggest varying conclusions. First, well-circulated issues in the public sphere (e.g., climate change, net-pen salmon farming) are more familiar to people and therefore, have a higher chance of generating strong opinions, policy discussions, and thus, association with political ideology. On the contrary, topics such as aquaculture– with minimal knowledge and awareness among some lay audiences– may be less fertile for political ties because they have less impetus in spaces of public discourse. Reflecting on the entirety of research question four, we suggest that the legacy and understanding of aquaculture is more linked to environmental attitude than political ideology. Further, it is reasonable to assume that within the realm of outreach, sustainable aquaculture advocates may focus less on people's political orientation. Rather, they might reach out to an already environmentally-conscious population who appears to be more receptive to aquaculture information and thus, inclined to support it. In addition, Rickard and Feldpausch-Parker (2016) note that reports of aquaculture benefits (e.g., sustainability) are often linked to certain types of aquaculture (e.g., shellfish, seaweed) due to the increasing popularity of the "local" food movement. With this in mind, advocates might also focus promotion efforts on specific types of aquaculture that are relevant to their target communities. As a result, recipients may be more apt to support aquaculture, given that it is a product of local and familiar food sources.

5.2. Limitations of the study

In this study, I acknowledge several limitations. First, this is primarily a quantitative study that relies on post-positivist methods of data collection and analysis. While this approach was sufficient, different aspects of individuals' perceptions of aquaculture could have been

acknowledged with alternative epistemological perspectives employing more qualitative methods. For instance, approaching the study from an interpretivist or critical paradigm would have encouraged the use of open-ended interviews, focus groups, or participant observation to collect data. This approach might have given participants an opportunity to be more expressive in their responses than the survey allowed. In general, these qualitative methods are seen as a channel for researchers to develop holistic and complex accounts of individuals' experiences (Creswell, 2014). Recognizing that the practice of these paradigms and qualitative methods can produce "deep understanding of human actions, motives, and feelings" (Lindlof & Taylor, 2011, p. 9), this type of data collection also reduces the ability to have a large sample size. For instance, the present study used an online survey and national participant panels, which gave us the ability to access a significant number of people across the country. Although we were not able to deeply engage with one person's particular experience, the data was diverse and roughly (though not wholly) generalizable to the U.S. public on several demographic variables. Moreover, this study's use of quantitative methods ensured a degree of validity with respect to our ability to control for the varying experimental groups (Creswell, 2014).

Another limitation is regarding the first research question, which investigated individuals' perceptions of the risks and benefits of aquaculture. Four out of five of the conditions employed stimuli that communicated positive aquaculture information, therefore leading individuals to a significantly higher likelihood of discussing benefits rather than risks in their responses. Additionally, this study did not assess individuals' prior exposure to aquaculture information. With this in mind, we predict that responses in the current study may have been less extreme due to a general lack of knowledge, rather than an overall neutral or positive perception of aquaculture. Due to these aspects of the stimuli design, participants may have been less

inclined to report risks related to aquaculture. Below, I outline one approach to modify the stimuli used in future studies.

5.3. Future research

Building on this exploratory study, I suggest several directions for future research. To begin, there is potential to integrate more experimental conditions. Because this study only used two modes of narrative (text and video), the findings are somewhat limited. Future research could employ several videos with varying length or different speakers. The present study used a 3:10 minute narrative video in an effort to maintain audience attention, but it is possible that individuals need more time to be drawn into the narrative for transportation and opinion-change to occur. Due to the truncated video length, a lot of information was compiled into a short amount of time, which could have also given viewers a sense that the narrative was overly focused on advocacy and thus, inauthentic (Moyer-Gusé et al., 2019). Further, studies could use different speakers in each video to counter viewer bias toward a certain speaker and ensure validity in their findings. By practicing *stimulus sampling*, the use of multiple instances of a stimulus category in research (Wells & Windschitl, 1999), researchers could better ensure construct validity within the study. Ultimately, using a wider range of message types can help reveal more nuanced information about the inner workings of narrative as a mode of communication.

Additional work is necessary to explore individuals' degree of transportation with stimuli. Given that transportation is an important component of developing story-consistent attitudes (Green & Brock, 2002), it might be worth exploring this particular facet of narrative. This analysis would deepen understanding of the operationalization of narrative and specifically, how transportation may serve as a mechanism that influences participants' perceptions of

aquaculture. Although this particular topic was outside the scope of my thesis, we have begun exploring the relationship between message type and transportation in other work (Yang et al., under review).

With respect to research question four, we took rudimentary steps toward investigating how political orientation and environmental attitude relate to views on aquaculture. Future research could expand on this work, employing path analysis to explore how perceptions of aquaculture are influenced by different message types, political orientation, and environmental attitude, in both direct and indirect ways. In an online experiment, Rickard, Yang, Liu, and Boze (in review) have already begun looking at environmental attitude and political ideology as moderating variables using a narrative video and narrative text condition. The study considers how exposure to narrative may influence transportation, emotions, and risk benefit perceptions and, in turn, how such perceptions affect attitudes and behavioral intentions toward sustainable aquaculture.

Lastly, it would be worth embarking on a more nuanced investigation of individuals' level of engagement. This study measured engagement based on the length and content of responses; however, there is an opportunity to further assess this variable by analyzing specific cognitive processes behind responses. These processes can be recognized and studied as *systematic*, carefully attending to and elaborating on the content of a message, or *heuristic*, processing the message superficially and attending only to the peripheral cues of the content (Todorov et al., 2002).

CHAPTER 6

CONCLUSION

This study investigated the influence of message type on individuals' perceptions of aquaculture. Specifically, I looked at how different message conditions influenced perceptions of aquaculture risks and benefits with regard to human health, the environment, and the economy. This work also investigated how message type influenced individuals' engagement and expressed affect toward aquaculture. Finally, I explored how individuals' environmental attitude and political orientation related to their views of aquaculture. For data collection, we employed the survey firm Qualtrics to disseminate an online questionnaire to 3,600 individuals nationwide. This study contributed to the goals of SEANET, an NSF-funded grant focused on Maine's sustainable aquaculture development under four themes: carrying capacity, aquaculture in a changing environment, innovation in aquaculture, and human dimensions. The current study specifically supported goals of the human dimensions theme.

In investigating the research objectives described above, the present study revealed a range of results, some expected and others surprising. To begin, findings indicate that overall, the narrative video and infographic video were the most effective in producing stimuli-consistent attitudes (e.g., showing support for aquaculture, communicating benefits of aquaculture). While both videos produced overall higher responses regarding aquaculture benefits, there were still instances when the textual condition outperformed the infographic, or the narrative text response-count closely followed that of the narrative video. When comparing all five conditions– which I do cautiously, as the content varies and does not align perfectly for comparison– the infographic led more individuals to report benefits regarding aquaculture. As described in the discussion section and in tandem with affect results (revealing a relationship between negative

emotion and the narrative video), we were surprised to learn that the narrative condition (i.e., narrative video) did not entirely outperform the textual condition (i.e., infographic video). It is possible that these counterintuitive findings were a result of a potentially off-putting message, speaker, or a combination of both. Furthermore, these findings suggest that simple, less resource-intensive message types, such as the infographic video, might still be appealing to audiences. While not to discredit the power of narrative in certain scenarios, it is possible that communicating information in a clear, concise manner via information-based message types is still a relevant and preferable means of communication (Lazard & Atkinson, 2015).

Another prominent finding from this study was the lack of relationship between political ideology and views of aquaculture. Conversely, we found a relationship between environmental attitude and reports of general aquaculture benefits, as well as human health benefits. While environmental issues are often intertwined with political ideology, these findings suggest that political orientation is not as closely linked to the aquaculture industry as other environmental topics (e.g., climate change). In today's polarized political climate, individuals are often categorized and boxed in by their political affiliation, which can reduce their ability to have productive conversations surrounding controversial topics. Specifically, I was interested in these controversial topics, and aquaculture, with a focus on environmental and human health implications, presented as the "perfect storm." Contrary to my previous beliefs, this study's results reveal that political orientation does not play a significant role in an individual's perception of aquaculture; rather, environmental attitude may be a more reliable predictor. While unexpected, this information offers a promising future for aquaculture. Whereas most controversial environmental issues are entangled in the political arena, aquaculture has not yet gained that association. This offers a precious window for scientists, advocates, communicators,

and the like to inform the public about the emerging potential of the aquaculture industry without binding political implications. That said, outreach efforts and resources might still be best geared toward individuals with higher environmental consciousness– as this study's findings indicate higher salience of aquaculture information among individuals with high environmental attitude. Although the development of aquaculture is inherently political (e.g., competing interests around issues ranging from protecting environmental quality to safeguarding viewsheds) and will have major implications for coastal communities and economies, the lack of major political ideological entrenchment or contestation will provide space for clearer communication and increased information salience.

These results contribute to a more holistic understanding of people's views of aquaculture. Ideally, this information will help facilitate more productive conversations surrounding sustainable aquaculture and its benefits. Some aquaculture organizations have already begun using narrative to communicate their constituents. The Maine Aquaculture Institute conveys the importance of aquaculture with videos of local sea farmers telling stories about their experiences on the water.[6] The National Aquaculture Association also enlisted Chef Barton Seaver to discuss his upbringing around the ocean and the evolution of his advocacy for sustainable seafood[7]. These efforts to communicate with narrative format can be supported and enhanced by further research in the field. Additionally, understanding how different message types influence individuals' perceptions might help contribute to more meaningful and influential conversations regarding larger environmental issues, such as hydrofracking or climate

[6] Readers can access videos of Maine fisherman telling stories about aquaculture here: https://maineaqua.org/videos/.
[7] Readers can access a video Barton Seaver giving a narrative regarding sustainable seafood here: https://thenaa.net/videos/chef-barton-seaver-talks-about-us-farm-raised-seafood

change. As a result, individuals might have the increased capacity to soften preconceived notions, gain new perspectives, and find common understanding. This space could also provide a more inclusive environment for a range of voices to be heard, which might simultaneously allow for more comprehensive and creative solutions to emerge.

I grew up witnessing my family negotiate their environmental stewardship and political affiliation– which seemed both perplexing and fascinating to me. This experience was lasting, profound, and left a deep imprint. As a result, nearly fifteen years later, the focus of this work was fueled by a deep curiosity of the interplay between people's political leaning and their relationship to the environment. While the results from this study were unexpected, they offered a space for me to humbly reflect on my own perceptions. Reflective of patterns in political polarization, perhaps I had also categorized and reduced individuals to their political orientation, therefore making presumptions about their attitudes. While there is undoubtedly a relationship between political affiliation and environmental concern (Leiserowitz et al., 2019a; Tognacci et al., 1972), results from this study have challenged me to conceptualize the nuanced nature and complexity of people's relationships to environmental issues. Serendipitously, I have arrived at the same place I had hoped for those who participate in sticky, controversial conversations– one of inclusivity, open-mindedness, and understanding.

In arriving at this new perspective, I intend to enter the field of social sustainability with a holistic, reflexive understanding of people's perceptions of the environment. Perhaps I don't have to instinctively brace myself to meet people's political ties; instead, I can practice new ways of communicating, while remaining open to their perspective. Findings regarding narrative's performance might further inform the ways I communicate about environmental issues. Although there is a considerable amount of evidence supporting narrative as an effective mode of

communication, perhaps we need to employ this tool with more care and consideration. Broadly, researchers should be diligent about their plans to operationalize and conceptualize narrative (Dahlstrom et al., 2017). Specifically, I call attention to the narrative's speaker, message, and length, as well as the importance of stimulus sampling. Ultimately, this study's findings and my subsequent conclusions are not to disprove the effect of narrative on attitudinal or behavior change, but rather to give its employment the acute attention it deserves.

As I wrap up my degree at UMaine, I am simultaneously serving as an Energy Efficiency Education Specialist with AmeriCorps. This position requires the ability to communicate information about pressing environmental issues and the importance of taking sustainability-centered action. Similar to aquaculture, some of these topics are contentious and might hold a range of preconceived notions. With my research in mind, I can use what I've learned about the effectiveness of different message types to communicate new information to community members. First, I could practice using a loose form of stimulus sampling by giving a range of my own personal narratives regarding energy conservation. I might also rely on the 'tried and true' message types, such a simple, information-based infographic video. Lastly, I will pay mind to those who are naturally drawn to environmental conservation. While my work calls me to engage with individuals of varying knowledge bases and interest levels, it might be worth focusing intensive outreach and education efforts on those who project higher environmental attitudes.

Beyond this summer AmeriCorps position, I am excited to enter the workforce during such a critical time in history. During this global pandemic and period of heightened distress regarding human health, there has also been an emerging awareness about the way we appreciate the environment and interact with one another. Synchronously, this study has given me a deeper understanding of the way humans relate to wicked problems (Rittel & Webber, 1973)– of which

aquaculture, along with many other environmental issues, fit the bill. Today, the coronavirus has presented many of us with the complexity, confusion, and overwhelming essence of these wicked problems. However, even with the strenuous implications of the pandemic, I can feel an optimism and eagerness to join the ranks of those who seek to create a more unified social experience and harmonious relationship with the environment around us. By practicing appropriate communication methods, mindfulness to see the complexity of people's perceptions, and respect to engage through and beyond differences, we might also begin to create spaces of discourse that inspire innovative solutions to these wicked problems we encounter.

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APPENDIX 1: Stimuli

Condition 1: Text [information sheet format]

What is marine aquaculture?

Marine aquaculture is the breeding and harvesting of aquatic plants and animals, such as oysters, clams, mussels, seaweed, shrimp, and salmon, and it usually takes place in the ocean. Shellfish, finfish, and seaweed farming is a steady source of safe, nutritious, and environmentally sustainable seafood for consumers in the U.S. and worldwide.

Why do we need sustainable aquaculture?

- One in seven people worldwide rely on fish for protein. Aquaculture can help meet this increasing demand and reduce pressure on our oceans.
- Sustainable aquaculture produces safe products and protects coastal environments by reducing contaminants in seafood and limiting the spread of disease.
- Aquaculture supports healthy communities and local economies, especially as traditional fisheries and supply chains are affected by a changing climate.

What does marine aquaculture look like in the United States?

Farmed seafood products make up about half of the world's seafood supply, but U.S. production lags behind much of the world. In 2016, the U.S. reported a $14 billion seafood deficit, which means we import much more fish, shellfish, and seaweed than we produce in our own waters. Currently, the U.S. has a small, but vibrant commercial marine aquaculture industry supported by world-class research and technology. From growing salmon in ocean pens in Maine, to raising oysters in floating cages in Washington, marine aquaculture businesses currently operate in all 23 U.S. coastal states. Doubling current production could result in tens of thousands of jobs in coastal communities.

Is U.S. farm-raised seafood safe, and why should you buy it?

U.S. laws governing the harvest and processing of seafood for human consumption are among the most stringent in the world. Buying U.S.-grown farmed fish and shellfish guarantees that your seafood meets rigorous state and federal standards and supports American jobs.

What can you do?

The easiest and most important thing you can do is to ask yourself: "Do I eat sustainable seafood?" Let your favorite businesses know that ocean-friendly seafood is on your shopping list and your dinner menu. Your local grocer, favorite restaurant, or campus cafeteria can all play a crucial role in the conservation of ocean resources, and these businesses listen to their customers. Ask them to support sustainable seafood and start making a difference today!

Condition 2: Text + images [video format]

This narrated, 3:07 minute video features photographs and illustrations to accompany a narrated version of Condition 1 by celebrity seafood chef Barton Seaver. To view the info-graphic video, see: https://www.youtube.com/watch?v=e2HqLOn7YU8&feature=youtu.be**.**

Condition 3: Narrative [video format]

This 3:10 minute video features Barton Seaver telling a story that broadly incorporates aspects of three themes: (1) his biography/identity with respect to the ocean (e.g., searching for shellfish in the Chesapeake Bay as a child); (2) the status/history of working waterfronts (especially in the U.S.) (e.g., declining fisheries mean that aquaculture can supplement traditional fishing livelihoods); (3) the role of sustainable aquaculture in the food industry/food system (e.g., how chefs can feature farmed seafood in their restaurants). The video is filmed from the inside of a kitchen. [To view narrative video, see: http://bartonseaver.com/video]

Condition 4: Narrative text [written transcript of narrative video]

I'm Barton Seaver. I'm a chef, author, and seafood evangelist. Now, I came to that because I spent my time as a boy in the Chesapeake Bay exploring all things salty, scaled, and shelled— and wondering what they tasted like. So it was not a stretch that I ended up in professional restaurants as a chef, as a manifestation of those early experiences. I began to become very aware of, and mindful of the environmental impact that we have— what's called sustainable seafood – when we are eating seafood. And this came about from a single, sort of, watershed moment when I was a young chef. I was putting together my first menu, a very personal narrative about what of my past I wanted to share with my guests, and I called up my fish purveyor and said, "*Send me bluefish, striped bass, blue crabs, oysters. I want all the things I loved when I was a kid*." And he said to me, "*Kid, what are you talking about? We ate all of those. What else do you want?*"

And I realized right then and there, that the way that we eat largely determines how this world is used. And that the choices that I make as a chef— I have a responsibility for that— to make sure that I'm not harming the environments that sustain us. And so I felt really *confused*! I mean, should I even be serving seafood at all? So, I did more research. I visited a lot of farms. I visited a lot of fisheries. And I saw that at the time, aquaculture really was, as I put it, "farmed and dangerous." It had a lot of environmental strikes against it. But I kept learning and I kept seeing more and more.

And I found one farm that was producing Arctic char, a salmon-like fish that I could believe in. Sure, it still has a couple of environmental strikes against it, but it was *progressive*, it was getting better, it was *innovative*, and it provided dozens of jobs in an area where the poverty level was very high. But when I was serving this in my restaurants, I got judged for it. I got

critiqued and scolded for serving it. And I felt like I was being judged, but without all the facts present. Because bottom is this was a product that I stood behind, that really represented what we should be pursuing.

And I began to shift my entire perception of aquaculture. It's no longer "farmed and dangerous." It's no longer an *impediment* to environmental sustainability— rather, I see it as a gateway to it. And as much as environmentalism or sustainability is about reducing our impact on ecosystems, we also have to focus on maximizing the impact that ecosystems have on us. And aquaculture like it's practiced in 23 coastal states around this country— especially here in Maine, where you have men and women who have been working on the water for hundreds of years— there's a heritage and a social norm to it. They deserve the opportunity to be the architects of new food systems that are purposed with sustaining people. And so, their success is my success. We're all a community; we're all in this together. And a rising tide of aquaculture rises all boats.

APPENDIX 2: Codebook

Aquaculture Content Analysis

Response themes: Code for the presence or absence of each of the following themes (1= present, 0= absent), unless noted otherwise. Code regardless of the prominence of the theme (i.e., each article may have more than one instance of a theme, and/or more than one theme present).

VARIABLE OPERATIONAL DEFINITIONS:

V1= Benefits of aquaculture:

The focus is on the positive aspects, benefits, and general usefulness associated with aquaculture. This may include mention of food safety, sustainability, an increased job market, ability to feed more people, and/or high quality fish products. Additionally, benefits may include the general progressive or sustainable nature of aquaculture as an industry.

- **V1a= Human health benefits:** Specific reference to human health benefits of aquaculture to humankind, on an individual, community, or global scale.
    - Examples: good source of fish for human consumption, nutritional benefits of eating seafood, safer products, safe for human consumption.
- **V1b= Environmental benefits:** Specific reference to benefits of aquaculture on ecosystems, plants, animals, or the environment at large. Note: all mentions of "sustainability" in the environmental sense should be coded in this category.
    - Examples: sustainable, ecologically sustainable, good way to protect our environment, helping marine life from going extinct, safer for the fish, safe for the environment
- **V1c= Economic benefits:** Generally references an enhanced economy or increased job market in some way and/or references support for community or culture.

- Examples: provides jobs for many, helps the economy, important to US economy, boosts economy, American jobs, supports working waterfronts

V2= Risks of aquaculture:

The focus is on the negative aspects or risks associated with aquaculture (e.g., farmed and dangerous, not natural, animal abuse, the spread of toxic waste and disease).

- **V2a= Human health risks:** Specific reference to health risks to humans, which could be related to food safety (e.g., vibrio in shellfish, mercury contamination in fish).
- **V2b= Environmental risks:** Specific reference to risks of aquaculture on ecosystems, plants, animals, or the environment at large. Note: all reference to lack of "sustainability" in the environmental sense should be coded in this category.
- **V2c= Economic risks:** Specific reference to risks of aquaculture to humankind, could be on an individual, community, or global scale, and could reference economic risks (e.g., investment required in infrastructure for aquaculture operations).

V3= Minimal engagement:

This measures the degree of assumed participant cognitive engagement with the material.

- V3a= Little to no engagement or interest in content
  - Examples: no, nothing, na, n/a
- V3b= Unsure about the topic, uncertain how to interpret information
  - Examples: I don't know, I wouldn't know what to say

V4= Explanatory engagement:

Explanatory, regurgitating factual information from stimuli, explaining or comparing processes.

- Examples: sustainable seafood, provides safe seafood, fish farming, protein and nutrients from fish, humans effect on the aquatic ecosystem

V5= Evaluative engagement:

Evaluative, commentary, expresses personal opinion or perspective on the topic.

- Examples: boring, exciting crappy, stupid, interesting, important, I like this idea, I would recommend aquaculture products to a family member

APPENDIX 3: Survey

CONSENT FORM

Marine Aquaculture Study

You are invited to participate in a research project being conducted by personnel from the University of Maine, including Dr. Laura Rickard, a faculty member in the Department of Communication and Journalism, and Tabitha Boze, a Master's student in the Department of Communication and Journalism. The purpose of the research is to better understand individuals' perspectives on aquaculture. You must be at least 18 years of age to participate.

What will you be asked to do?

If you decide to participate, you will be asked to take an anonymous survey. Examples if questions include: "In a typical month, how often do you consume seafood?" During the survey, you may also be asked to read a short article or watch a short video about aquaculture and answer questions about it. We will also ask demographic questions, such as your age. You are free to skip any questions you do not wish to answer. The entire survey will take approximately 15 minutes to complete.

Risks

Except for your time and inconvenience, there are no foreseeable risks to participating in this study.

Benefits

There are no direct benefits to you; however, this research may help us understand how best to communicate about the topic of aquaculture with public audiences.

Confidentiality

This study is anonymous. Your name will not appear in any of the electronic data we collect. The information you provide in response to the survey questions will be treated with professional confidence and will only be used for research purposes. There will be no records linking you to the data collected, which will be kept on a password-protected computer and/or cloud-based data storage system, and will be kept indefinitely. You will have the option to share your email address at the end of the survey to receive a farm-raised seafood recipe from celebrity chef Barton Seaver. Your email address will not be linked to your survey responses, will only be used to send the information, and will be destroyed after the recipe has been sent.

Voluntary

Participation is voluntary. If you choose to take part in the study, you may stop at any time or skip any questions within the survey. Submission of the survey implies consent to participate.

Contact Information

If you have any further questions, comments, or concerns about the study, you may write or call the Principal Investigator (PI), Dr. Laura Rickard, at (207) 581-1843/ laura.rickard@maine.edu. You may also contact the Co-PI, Tabitha Boze at tabitha.boze@maine.edu. If you have any questions about your rights as a research participant, please contact the Office of Research Compliance, University of Maine at (207) 581-2657/ umric@maine.edu.

By continuing to the next page, you are agreeing to participate.

Demographics

First, we have a few questions about you:

In the space below, please indicate your age.

What was your total household income before taxes for last year?

- Less than $10,000 $50,000 - $74,999
- $10,000 - $14,999 $75,000 - $99,999
- $15,000 - $24,999 $100,000 - $149,999
- $25,000 - $34,999 $150,000 - $199,999
- $35,000 - $49,999 More than $200,000

When it comes to political issues**,** you generally consider yourself to be:

- Very Liberal
- Basically liberal
- Independent, but leaning towards liberal
- Independent
- Basically independent, but leaning towards conservative
- Very conservative

When it comes to economic issues**,** you generally consider yourself to be:

- Very Liberal
- Basically liberal
- Independent, but leaning towards liberal
- Independent
- Basically independent, but leaning towards conservative
- Very conservative

When it comes to social issues**,** you generally consider yourself to be:

- Very Liberal
- Basically liberal
- Independent, but leaning towards liberal

- Independent
- Basically independent, but leaning towards conservative
- Very conservative

What is your sex?

- Male
- Female
- Other

Which of the following best describes your race/ethnicity?

- White
- Black or African American
- Asian or Asian American
- Native American, American Indian, or Alaska Native
- Native Hawaiian or Pacific Islander
- Hispanic or Latino
- Other

What is the **highest level** of education you have completed?

- Less than High School
- High School / GED
- Some College
- 2-year College Degree
- 4-year College Degree
- Master's Degree
- Doctoral Degree or beyond

In which state do you currently reside?

What best describes the type of area you live in?

- Urban
- Suburban
- Rural

About how often do you visit coastal areas?

- Daily
- Weekly
- Monthly
- A few times per year
- At least once per year
- Never

Do you own or rent a home within 50 miles from the ocean?

- Yes
- No

Consumption

In a typical month, how frequently do you consume seafood?

- Daily
- Weekly
- Once a month
- Rarely
- Never

Textual condition:

Marine aquaculture refers to the breeding, rearing, and harvesting of aquatic plants and animals. U.S. marine aquaculture, which takes place mostly in the ocean, produces primarily oysters, clams, mussels, shrimp, salmon, and other marine fish. In the last ten years, there have been debates about the benefits and disadvantages of marine aquaculture in the United States.

Now you will read an article introducing important information associated with marine aquaculture. Please read the article below carefully. The **Arrow** to proceed will appear when you finish reading.

Message attention check_read

Please answer the following question based on the content of the story you just read.

What type of farming is discussed in the article?

- Traditional fishing
- Sustainable agriculture
- Transgenic agriculture
- Sustainable aquaculture

Infographic condition:

Marine aquaculture refers to the breeding, rearing, and harvesting of aquatic plants and animals. U.S. marine aquaculture, which takes place mostly in the ocean, produces primarily oysters, clams, mussels, shrimp, salmon and other marine fish. In the last ten years, there have been debates about the benefits and disadvantages of marine aquaculture in the United States. Now, you will watch a video introducing important information associated with marine aquaculture. Please watch the following video carefully. The **Arrow** to proceed will appear when you finish watching.

Message attention:

Please answer the following question based on the content of the video you just watched.

What type of farming is discussed in the video?

Traditional fishing

Sustainable agriculture

Transgenic agriculture

Sustainable aquaculture

Narrative text condition:

Marine aquaculture refers to the breeding, rearing, and harvesting of aquatic plants and animals. U.S. marine aquaculture, which takes place mostly in the ocean, produces primarily oysters, clams, mussels, shrimp, salmon, and other marine fish. In the last ten years, there have been debates about the benefits and disadvantages of marine aquaculture in the United States. Now you will read an article introducing important information associated with marine aquaculture. Please read the article below carefully. The **Arrow** to proceed will appear when you finish reading.

Narrative video condition:

Marine aquaculture refers to the breeding, rearing, and harvesting of aquatic plants and animals. U.S. marine aquaculture, which takes place mostly in the ocean, produces primarily oysters, clams, mussels, shrimp, salmon and other marine fish.

In the last ten years, there have been debates about the benefits and disadvantages of marine aquaculture in the United States.

Now, you will watch a video introducing important information associated with marine aquaculture. Please watch the following video carefully. The **Arrow** will appear when you finish watching.

Control condition prompt

Marine aquaculture refers to the breeding, rearing, and harvesting of aquatic plants and animals. U.S. marine aquaculture, which takes place mostly in the ocean, produces primarily oysters, clams, mussels, shrimp, salmon and other marine fish. In the last ten years, there have been debates about the benefits and disadvantages of marine aquaculture in the United States.

Trans_Textual

Please answer the following questions **based on the article you just read.**

While I was reading the article, I could easily picture the events in it taking place.

1 not at all 2 3 4 5 6 7 very much

While I was reading the article, activity going in the room around me was on my mind.

1 not at all 2 3 4 5 6 7 very much

I could picture myself in the scene of the events described in the article.

1 not at all 2 3 4 5 6 7 very much

I was mentally involved in the article while reading it.

1 not at all 2 3 4 5 6 7 very much

After finishing the article, I found it easy to put it out of my mind.

1 not at all 2 3 4 5 6 7 very much

I wanted to learn how the article ended.

1 not at all 2 3 4 5 6 7 very much

The article affected me emotionally.

1 not at all 2 3 4 5 6 7 very much

I found myself thinking of ways the article could have turned out differently.

1 not at all 2 3 4 5 6 7 very much

I found my mind wandering while reading the article.

1 not at all 2 3 4 5 6 7 very much

The events in the article are relevant to my everyday life.

1 not at all 2 3 4 5 6 7 very much

The events in the article have changed my life.

1 not at all 2 3 4 5 6 7 very much

Trans_Video

Please answer the following questions **based on the video you just watched.**

While I was watching the video, I could easily picture the events in it taking place.

1 not at all 2 3 4 5 6 7 very much

While I was watching the video, activity going in the room around me was on my mind.

1 not at all 2 3 4 5 6 7 very much

I could picture myself in the scene of the events described in the video.

1 not at all 2 3 4 5 6 7 very much

I was mentally involved in the video while watching it.

1 not at all 2 3 4 5 6 7 very much

After finishing the video I found it easy to put it out of my mind.

1 not at all 2 3 4 5 6 7 very much

I wanted to learn how the video ended.

1 not at all 2 3 4 5 6 7 very much

The video affected me emotionally.

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I found myself thinking of ways the video could have turned out differently.

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I found my mind wandering while watching the video.

1 not at all 2 3 4 5 6 7 very much

The events in the video are relevant to my everyday life.

1 not at all 2 3 4 5 6 7 very much

The events in the video have changed my life.

1 not at all 2 3 4 5 6 7 very much

Message evaluation

Now, please tell us your opinion about the information related to marine aquaculture you saw just now.

The information was credible.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

The information was interesting.

- Strongly Agree
- Somewhat Agree

- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

The information was informative.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

The information was relevant to my life.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

Open-ended question:

If you were asked to describe marine aquaculture to a family or friend, what would you say?

Emotion

On a scale from 0 (not at all) to 10 (very much), **when you think about marine aquaculture**, what do you feel?

- Anxious
- Angry
- Worried
- Hopeful
- Inspired
- Encouraged
- Optimistic
- Guilty
- Sad

Behavioral intention

For each statement below, please indicate **how likely** you are to engage in the following actions.

I will support policies that fund research on marine aquaculture.

- Extremely unlikely
- Very unlikely
- Somewhat unlikely
- Not sure
- Somewhat likely
- Very likely
- Extremely likely

I will support policies that expand marine aquaculture operations in the U.S.

- Extremely unlikely
- Very unlikely
- Somewhat unlikely
- Not sure
- Somewhat likely
- Very likely
- Extremely likely

I will support policies that expand marine aquaculture operations outside of the U.S.

- Extremely unlikely
- Very unlikely
- Somewhat unlikely
- Not sure
- Somewhat likely
- Very likely
- Extremely likely

I will buy marine aquaculture products.

- Extremely unlikely
- Very unlikely
- Somewhat unlikely
- Not sure
- Somewhat likely
- Very likely
- Extremely likely

I will look for marine aquaculture products when I purchase seafood.

- Extremely unlikely
- Very unlikely
- Somewhat unlikely
- Not sure
- Somewhat likely
- Very likely
- Extremely likely

Risk perception

Please indicate the extent to which you **agree or disagree** with the following statements about marine aquaculture practices.

Marine aquaculture has the same problems as some types of land-based agriculture (e.g., use of antibiotics, pollution).

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly DisagreE

Marine aquaculture is a good way to relieve pressure on wild populations of fish and other marine species.

- Strongly Agree
- Somewhat Agree

- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

In coastal areas, marine aquaculture operation can interfere with recreational activities (e.g., swimming, boating).

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

The marine aquaculture industry supports U.S. communities by providing a source of local jobs.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

Marine aquaculture operations can alter views, create noise, or introduce new smells.

- Strongly Agree
- Somewhat Agree
- Neutral

- Somewhat Disagree
- Disagree
- Strongly Disagree

Marine aquaculture is an unnatural process.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

Marine aquaculture practices are unethical.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

Marine aquaculture produces a consistent, affordable product.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree

- Strongly Disagree

Marine aquaculture provides a healthy food source for people who can't afford wild-caught seafood.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

Farm-raised seafood is produced more efficiently than wild-caught seafood.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

NEP

Please indicate how much you agree with the following statements:

When humans interfere with nature, it often produces disastrous consequences.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree

- Disagree
- Strongly Disagree

Human ingenuity will insure that we do not make the earth unlivable.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

Humans have the right to modify the natural environment to suit their needs.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

Humans are severely abusing the environment.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

Plants and animals have as much right as humans to exist.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

We are approaching the limit of the number of people the earth can support.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

The earth has plenty of natural resources if we just learn how to develop them.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

Please indicate how much you agree with the following statements:

The balance of nature is strong enough to cope with the impacts of modern industrial nations.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

The balance of nature is very delicate and easily upset.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

The earth is like a spaceship with very limited room and resources.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

The so- called "ecological crisis" facing humankind has been greatly exaggerated.

- Strongly Agree
- Somewhat Agree

- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

Humans were meant to rule over the rest of nature.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

If things continue on their present course, we will soon experience a major ecological catastrophe.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

Humans will eventually learn enough about how nature works to be able to control it.

- Strongly Agree
- Somewhat Agree
- Neutral

- Somewhat Disagree
- Disagree
- Strongly Disagree

Despite our special abilities humans are still subject to the laws of nature.

- Strongly Agree
- Somewhat Agree
- Neutral
- Somewhat Disagree
- Disagree
- Strongly Disagree

Email

Would you like to **receive a farm-raised seafood recipe** from celebrity chef Barton Seaver? If so, please enter your email address below. **Please note** that your email address **will not** be connected to your answers to this survey, and **will be destroyed** once the recipe has been sent.

DEBRIEFING FORM

Marine Aquaculture Study

Thank you for participating in this research. We really appreciate your help.

The main purpose of this study is to explore how people react to different types of message about marine aquaculture. Depending on random assignment, you were assigned to 1 of 5 conditions (no message, text, video infographic, text-only narrative or video narrative). We then asked about your reactions to the messages, which allows us to study whether message format plays a role in influencing your perception of marine aquaculture and your intentions to support marine aquaculture in the future. For further reading on the topic of this research:

Freeman, S., Vigoda-Gadot, E., Sterr, H., Schultz, M., Korchenkov, I., Krost, P., & Angel, D. (2012). Public attitudes toward marine aquaculture: A comparative analysis of Germany and Israel. *Environmental Science & Policy, 22*, 60–72.

Green, M. C., & Brock, T. C. (2002). In the mind's eye: Transportation-imagery model of narrative persuasion. *Anthropological Quarterly, 74*(3), 101-103.

Hall, T. E., & Amberg, S. M. (2013). Factors influencing consumption of farmed seafood products in the Pacific Northwest. *Appetite, 66*, 1–9.

Again, if you have any further questions, comments, or concerns about the study, you may write or call the Principal Investigator (PI), Dr. Laura Rickard, at (207) 581-1843 or laura.rickard@maine.edu. You may also contact the Co-PI, Tabitha Boze at tabitha.boze@maine.edu. If you have any questions about your rights as a research participant, please contact the Office of Research Compliance, University of Maine at (207) 581-2657 or umric@maine.edu.

BIOGRAPHY OF AUTHOR

Tabitha Charlotte Boze was born in Kalamazoo, Michigan and grew up in Richland, Michigan where she graduated from Gull Lake High School in 2014. Following high school graduation, she moved to Marquette, Michigan to attend Northern Michigan University, play on the Women's Varsity Soccer Team, and enjoy Lake Superior. In 2018, Tabitha graduated Magna Cum Laude with a Bachelor of Arts in Environmental Studies & Sustainability and a minor in Spanish. After completing her Master's, Tabitha plans to work as a city sustainability coordinator. This position will allow her to engage with a range of stakeholders– citizens, businesses, organizations, academics, and municipalities– to integrate sustainability and initiate systematic change. In this and all her endeavors, she will continue to bring her passion to protect the environment in tandem with a desire to unite and empower communities. Tabitha is a candidate for the Master of Arts degree in Communication from the University of Maine in August 2020.