THE MEDIA'S PORTRAYAL OF OFFSHORE AQUACULTURE IN THE PACIFIC AND HOW IT AFFECTS THE PUBLIC PERCEPTION OF THE AQUACULTURE INDUSTRY

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We certify that we have read this thesis and that, in our opinion, it is satisfactory in scope and quality as a thesis for the degree of Bachelor of Science in Global Environmental Science.

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ABSTRACT

As the aquaculture industry continues to develop, the National Oceanic and Atmospheric Administration (NOAA), is proposing to establish a Federal Aquaculture Permit Program in Federal waters of the Pacific Islands Region (PIR) based on recommendations from the Western Pacific Fishery Management Council (Council). This proposed program may have a variety of implications for the states and U.S. territories in the region, which includes the islands of Hawaii, Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands. However, for many individuals living in this region, it is still unclear whether the potential benefits of aquaculture production outweigh the environmental and socio-economic risks. To gain insight on the public's perception of the aquaculture industry and improve future communications, this study conducted a content analysis of regional newspaper articles pertaining to offshore finfish aquaculture in the Pacific Ocean from 2000-2017. This outlet of communication was chosen because media coverage is often an important source of information for consumers and the general public. Initial public scoping comments on preliminary alternatives of NOAA's Draft Programmatic Environmental Impact Statement for a Proposed Pacific islands Region Aquaculture Management Program were also evaluated. Articles were coded for themes related to topics discussed (e.g., risks and benefits of offshore aquaculture), tone (e.g., positive, negative), and sources referenced. Key findings include an evaluation of the frequency of themes portrayed throughout the media as well as an in-depth analysis of public or stakeholder opinion of offshore aquaculture. The overall intent of this research and the subsequent recommendations is to provide insights into public perceptions of the aquaculture

industry that may contribute to strengthening policy decisions for finfish aquaculture throughout the Western Pacific.

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LIST OF ABBREVIATIONS

NOAA: National Oceanic and Atmospheric Administration

FAO: Food and Agriculture Organization

NPS: National Park Service

MAFAC: Marine Fisheries Advisory Committee

WPRFMC: Western Pacific Regional Fishery Management Council

MSA: Marine Safety Agency

EPA: Environmental Protection Agency

MPA: Marine protected area

PEIS: Programmatic Environmental Impact Statement

FEP: Fishery Ecosystem Plans

EEZ: Exclusive Economic Zone

NEPA: National Environmental Policy Act

FAD: Fish aggregating device

PIR: Pacific Islands Region

UH: University of Hawaii

GMO: Genetically modified organism

CNMI: Commonwealth of the Northern Mariana Islands

CHAPTER 1. INTRODUCTION

1.1 What is aquaculture?

1.11 Overview of aquaculture

Aquaculture can be defined as the breeding and cultivation of aquatic organisms for commercial, recreational or public use (NOAA 2011). When compared to other forms of agriculture, aquaculture is often seen as very new and dynamic (FAO 2008). Today, the aquaculture industry produces almost 50% of the global seafood supply, and is perceived as having the potential to meet future seafood demands in a sustainable manner (FAO 2002).

Technology and cultivation methods that are used in aquaculture are continuously being refined in order to improve and adapt to industry needs and environmental changes. Many different species can be produced, including various species of finfish, shellfish and even algae (NOAA 2011). The systems in which these species are cultured are extremely unique and their characteristics often depend upon the type of species, location, and level of production that is being undertaken (NOAA 2011).

Currently, the majority of existing aquaculture takes place on land, in freshwater and in coastal marine waters (Gentry et al. 2017). Various environmental concerns can arise from mismanaged aquaculture systems, including nutrient and chemical waste, the spreading of aquatic animal diseases and impacts from antibiotic use, potential effects on wild species or sensitive marine areas, and the use of wild caught fish for aquaculture feeds (NOAA 2011). A variety of economic and social challenges have also been recognized, including market competition with wild stock fishers, competition with other users of the marine environment, degradation of ecosystem services, as well as potential impacts to diverse cultural traditions and values (NOAA 2011). The level of impact an aquaculture system will have on the

surrounding community is highly dependent of the species and regulatory systems that are in place, with some operations being more successful than others. However, when the industry is managed appropriately, aquaculture production has the potential to be a very sustainable way of cultivating seafood.

1.12 Potential of offshore finfish aquaculture

Unfortunately, the potentially negative impacts of aquaculture have associated the industry with high amounts of risk, making it challenging for the aquaculture industry to expand and evolve in certain areas. However, as more research is conducted, it is becoming evident that not all aquaculture systems produce the same end result (FAO 2008). Offshore aquaculture involving finfish species, while still a developing sector of the aquaculture industry, appears to have several advantages over near shore finfish culturing methods, as offshore fish cage culture has the potential to drastically increase the output of marine fish while also limiting the amount of nutrient waste produced (FAO 2008; Holmer 2010).

Benefits of sustainable offshore marine aquaculture can include wild species population restoration and conservation and the overall provision of safe, local seafood, which contributes to food security and human health and nutrition (NOAA 2011). Sustainable aquaculture can also contribute socio-economic benefits by creating local employment opportunities and by helping local communities to rely less on imported sources of seafood (NOAA 2011).

While balancing the potential risks and benefits of aquaculture is no easy task, it will be necessary in order to cope with the limits on commercial fishing and the projected increase in global human population. NOAA is proposing to establish a Federal Aquaculture Permit Program in the Pacific Islands Region (PIR) based on recommendations from the

Western Pacific Fishery Management Council (Council). In recognition of the growing need and desire to develop an aquaculture program in the region, the Council recommended amending the region's five Fishery Ecosystem Plans (FEPs) to establish a management program for aquaculture fisheries in the federal EEZ of the PIR. A Programmatic Environmental Impact Statement (PEIS) is being developed to analyze the impacts of alternatives to align with the NMFS' Marine Aquaculture Strategic Plan, published in May of 2016. The aquaculture management program would support long-term sustainable aquaculture in federal waters and provide a comprehensive framework for regulating such activities to ensure environmental responsibility and sustainability.

1.13 Context of aquaculture in Pacific

The proposed aquaculture FEP amendments would establish a federal management program for aquaculture fisheries in the Exclusive Economic Zone (EEZ) around the islands of the Pacific Islands Region (American Samoa, Guam, Hawaii, the Pacific Remote Islands, and the Northern Mariana Islands). In general, waters of the EEZ extend from 3-200 nm from shore. Therefore it became important to analyze regional attitudes toward environmental management. It has been suggested that cultural values can play a role in shaping an individual's environmental perceptions, as the physical setting in which a culture is founded will ultimately shape how the culture evolves over time (Tuan 1974). As a result, an individual's view and feelings toward a specific environmental issue, such as offshore aquaculture and its associated risks and benefits, will be inextricably tied to their cultural values and experiences (Tuan 1974). For example, native Hawaiians engaged in traditional aquaculture practices of their own, developing hundreds of fishponds throughout the islands'

coastal marine areas (Costa-Pierce 1987). While fishponds differ greatly from the systems introduced by offshore aquaculture, ideas of fish production and environmental management have been historically relevant for many people living on the islands, and often play a role in industry expansion throughout Pacific (Costa-Pierce 1987).

It can be assumed that future regional aquaculture policies and approaches to managing the environment can be greatly influenced by the Pacific's traditional values and will tend to operate within the constraints of the regional environment, economy, and socio-cultural norms (Thayer 2003; Wrigley 2017). Therefore, by evaluating the historical context of environmental management in the Pacific and through the analysis presented by this study, it can be observed that Western Pacific communities possess a unique outlook of offshore aquaculture and the related industry regulations.

1.2 Public perceptions influence on policy

In order to create effective aquaculture regulations, Federal Agencies are required to engage local community members and various stakeholders in the decision-making process (NEPA § 42 USC § 4321 et seq.). It is suggested that community outreach in regards to policy decisions can provide various policy benefits including access to local knowledge, broadening the range of legislative solutions, and can serve as a way to educate and empower the community while also supporting democratic processes (Stewart and Sinclair 2007). Consequently, in order to better understand the views of a local community, it becomes important to understand the various groups within a community and how individuals within those groups form their opinions (Young and Matthews 2011).

In today's society, discourses regarding finfish aquaculture throughout the United States tend to be highly influenced by environmentalists and industry groups (Young and

Matthews 2011; Wrigley 2017). These groups often dominate aquaculture policy debates, focusing primarily on issues of environmental risk and potential economic implications. However, individual stakeholders and members of the public can have other concerns that do not necessarily fit into either of these group's arguments (Young and Matthews 2011; Wrigley 2017). By evaluating the less prevalent opinions of individual stakeholders and members of the public, discussions about offshore aquaculture may be able to provide different, more complex perspectives regarding the potential social, economic, and environmental impacts of offshore aquaculture. This integration of opinions can help to create a balanced and thorough evaluation of offshore aquaculture, while also implementing aquaculture regulations that are relevant to diverse stakeholders within the community (Krause et al. 2015; Costa-Pierce 2010; Wrigley 2017).

Furthermore, the enacted policies that manage the aquaculture industry will impact future regional seafood systems by influencing the social, economic, and environmental conditions (Olson et al. 2014). Therefore, public perceptions may play a significant role in defining whether offshore aquaculture can be integrated into regional seafood systems and what kind of impact the industry will have on the surrounding community and environment. While public opinion can be a challenging object to study, media representations are often used to evaluate public perception and to uncover different media framings (Shlag 2011; Amber and Hall 2008).

1.3 Role of the media in the public perception of aquaculture

In today's society, many people of the general public rely on media sources for information about today's political, economic, environmental and/or social issues, including

those that involve offshore aquaculture (Behr and Iyengar 1985; Johnson-Cartee 2004). Media coverage is known to play a role in shaping public opinion; therefore, how the media chooses to portray aquaculture benefits relative to risks will have significant implications for consumer preferences and legislative policy (Amberg and Hall 2008; Feucht 2017). Throughout its history, the aquaculture industry has been represented both positively and negatively in media outlets; and although the magnitude of this influence can be difficult to evaluate, mass media does appear to affect the public's opinion about aquaculture and is one of the main outlets in which scientific information reaches the public (Shlag 2010, 2011; Gentry 2017). In addition, the use of media sources, such as news articles, as a representation for public opinion of aquaculture has been applied in a variety of studies over the past few decades (Gentry 2017; Amber and Hall 2008; Schlag 2011; Olsen and Osmundsen 2017).

For this study, a regional media content analysis was conducted in order to examine the presentation of aquaculture issues in the media as well as the effects that the coverage has on the recipients of the broadcasted information. (Bonfadelli 2010; Feucht 2017). This study assesses overall themes portrayed throughout media coverage; which stakeholders are most prevalent in news sources; what attitudes are associated with the aquaculture industry; and any other concerns or suggestions that may have been present. Public scoping comments from NOAA's proposed PEIS were also evaluated and compared with the media coverage analysis, in order to discern any other potential concerns about the aquaculture industry and evaluate differences between what is portrayed in the media and the ideas presented through NOAA's public scoping comments.

CHAPTER 2. METHODS

This study combined quantitative and qualitative content analysis techniques in order to develop a better understanding of how media outlets in the PIR cover topics involving aquaculture. By using both quantitative and qualitative analysis methods, this study helped to provide not only an overview of the media coverage of aquaculture, but also deeper insights into the media assessment and subsequent public perception of the aquaculture industry.

2.1 Text selection

All articles were searched for in Pacific regional newspapers of U.S. states or territories including Hawaii, Guam, American Samoa and the Commonwealth of the Northern Mariana Islands for stories pertaining to offshore finfish aquaculture. All articles were found through the online database Proquest or by searching archives of Pacific regional newspapers that had a keyword search option. Regional newspapers included the Guam Daily Post, Pacific Daily News, Pacific Island News Association, Samoa News, and the Honolulu Star Advertiser or Honolulu Star Bulletin.

The following search terms were used to identify the regional newspapers that were used for this study: "aquaculture" or "fish farm" or "mariculture" AND "Hawaii" or "pacific" AND "marine" or "offshore". News stories, editorials, and letters to the editor were selected for analysis if they contained subject matter pertaining to offshore finfish aquaculture or aquaculture products designated for consumption in the Pacific region. Articles pertaining specifically to shellfish cultivation, algae cultivation, and freshwater or land based aquaculture systems were excluded from the data set. All articles used fell in the time frame of January 2000 to January 2017.

In an attempt to further evaluate public and stakeholder opinion of offshore aquaculture, public scoping meeting commentary was also analyzed. NOAA held initial public scoping meetings throughout the PIR to collect comments and insight about potential effects of the proposed aquaculture management program from stakeholders.

Public scoping comments were obtained through a public record of NOAA's proposed PEIS scoping comments. A total of 38 condensed public comments were available for review, which were published to NOAA's online site in October 2016, after NOAA conducted scheduled PEIS public meetings throughout the Pacific Islands. It was also noted that the news sources selected for this study correlated with the newspapers that were chosen for public scoping meeting advertisements (excluding PACNEWS which provided 5 articles for this data set).

2.2 Analysis methods

Each article was categorized by title, publication date, newspaper source, region of interest, and document type. Articles that appeared in more than one source, i.e. Honolulu Star Advertiser and Samoa News, were counted separately as they had the potential to reach different audiences. A total of 92 articles were gathered; 82 of which were classified as news articles, 8 of which were classified as editorials, and 2 of which were classified as letters to the editor.

Quantitative textual analysis was conducted to categorize and quantify how frequently information was presented and in order to analyze whom information was presented by. Topics of interest, or themes, were determined before and during the study, to encourage an adaptive method of textual analysis. For this study, a theme consisted of an idea or concept pertaining to aquaculture, and could be present at least once in any given

article. More than one theme could be present in any given article, or in any given sentence. Certain themes were attributed to areas of text that met the designed subject matter criteria, as seen in Table 1. The various themes and classifications of text were compiled using the coding software NVivo for organizational purposes.

All articles and comments were also coded for any direct quotations about an aspect of the aquaculture industry. The speaker/source of the quotation had to be formally identified to be considered for coding. Articles may have included more than one source, and all relevant sources were coded regardless of their prominence. Sources were coded based on grouped organizations or affiliation rather than for the source's individual role or position. Categories of source affiliations included advocacy groups, fishery stakeholders, government organizations, university affiliates, aquaculture practitioners or industry groups, trade organizations, and citizens (e.g. landowner, fisherman).

Any quotations with a source or author were also coded for any tone that was present in their statement. Textual information or facts presented in news articles with no source were not coded for tone. If an article contained multiple instances of tone, each instance was analyzed separately. Instances of tone were placed into one of five different categories including positive, negative, neutral, uncertainty, and defensive. Public comments were coded for each instance of tone throughout the comment, as the comment in its entirety could be seen as a quote, except when referencing outside literature or policy. While the results from the quantitative analysis of tone categories provided general insight into the speakers' perceptions of aquaculture, it was noted that a more in depth content analysis was necessary in order to accurately discern a source's opinion towards aquaculture practices.

In order to thoroughly understand how aquaculture is conveyed by the media and therefore perceived by the public and various stakeholders, a more qualitative approach was also used to analyze the data set. This was achieved through an in depth contextual analysis and by cross-referencing different themes and source quotations.

CHAPTER 3. QUANTITATIVE ANALYSIS

For this study, quantitative content analysis served as a way to measure the frequency of certain themes and public or stakeholder opinion, in order to provide a general analysis of the media's influence on the public opinion of aquaculture (Riffe et al. 2005; Feucht 2017).

3.1 Timeline analysis

This study first analyzed the frequency of articles from January 2000 to January 2017 to illustrate how much attention aquaculture was getting in the media throughout the designated time period. A general timeline, illustrated in Figure 1, shows media coverage of aquaculture being most common from 2008-2012, with spikes in the number of articles occurring throughout the data set (i.e. 2005, 2014, 2016).

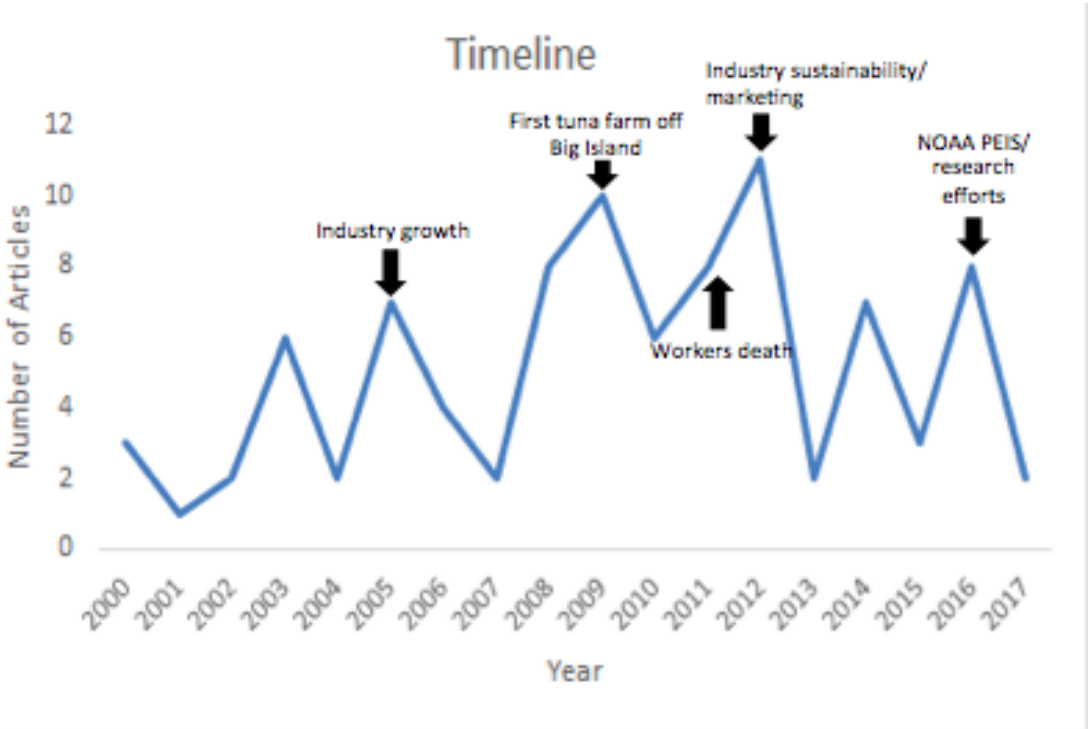

Figure 1. Frequency of articles throughout timeline; showing major events throughout time period. NOTE: This frequency displays newspaper articles only. All public-scoping comments were published/gathered in fall of 2016, therefore, deemed irrelevant when evaluating the frequency of articles throughout timeline.

Upon further analysis it was found that particular "newsworthy" events throughout this time period correlated with increased number of news articles during a specific year. For example, in 2005, there were multiple mentions of the CNMI's desire for more aquaculture and industry growth throughout the Pacific, including a potential expansion plan from the Bush Administration and the establishment of a Marine Aquaculture Task Force. In 2008, the CNMI again pushes for more industry growth, while the aquaculture industry in Hawaii faces angry Lanai fishermen. In 2009, several news articles mention the first proposed tuna farm developed by Hawaii Oceanic Technology off the coast of Big Island, while several other articles mention industry growth and how Kona Blue, another aquaculture company, plans to expand its practices to Mexico. In 2011, spikes in the number of news articles correlate with a worker's death on a local Hawaiian fish farm. Several other articles during this year mention how anti fish farm bills are being proposed and how environmental advocacy groups attempting to sue the federal government for illegal permitting. In 2012, the majority of news articles focus on how farmed fish are sustainable and urge consumers to buy locally farmed fish. However, during this year there are also two articles which mention how a local fish farm is forced to haul in its cages due to lack of investment. In 2014, many articles mention how the industry is improving aquaculture technologies, attempting to establish new farms, and holding aquaculture workshops, in order to improve community resilience and local economic conditions. In 2016, there is also a major spike in the amount of news articles produced, following the announcement of NOAA's proposed aquaculture management program and corresponding PEIS for offshore aquaculture. During this year several articles

also mentioned research efforts involving aquaculture and sustainability, involving both UH-Hilo and Kampachi Farms on Big Island.

3.2 Article classification

Each article was also classified based on what source it came from. A total of six different sources were used for this study including, the Honolulu Star Advertiser or Honolulu Star Bulletin, Samoa News, Pacific Daily News, Saipan Tribune, PACNEWS, and the initial public scoping comments from NOAA's PEIS. Multiple news/source outlets were used in an attempt to gain perspective from each island in the Pacific region that may be affected my NOAA's offshore aquaculture regulations. The number of articles from each source varied due to availability and publication. The overall distribution of articles can be seen in Figure 2, with the Honolulu Star providing 51% of all articles for this study.

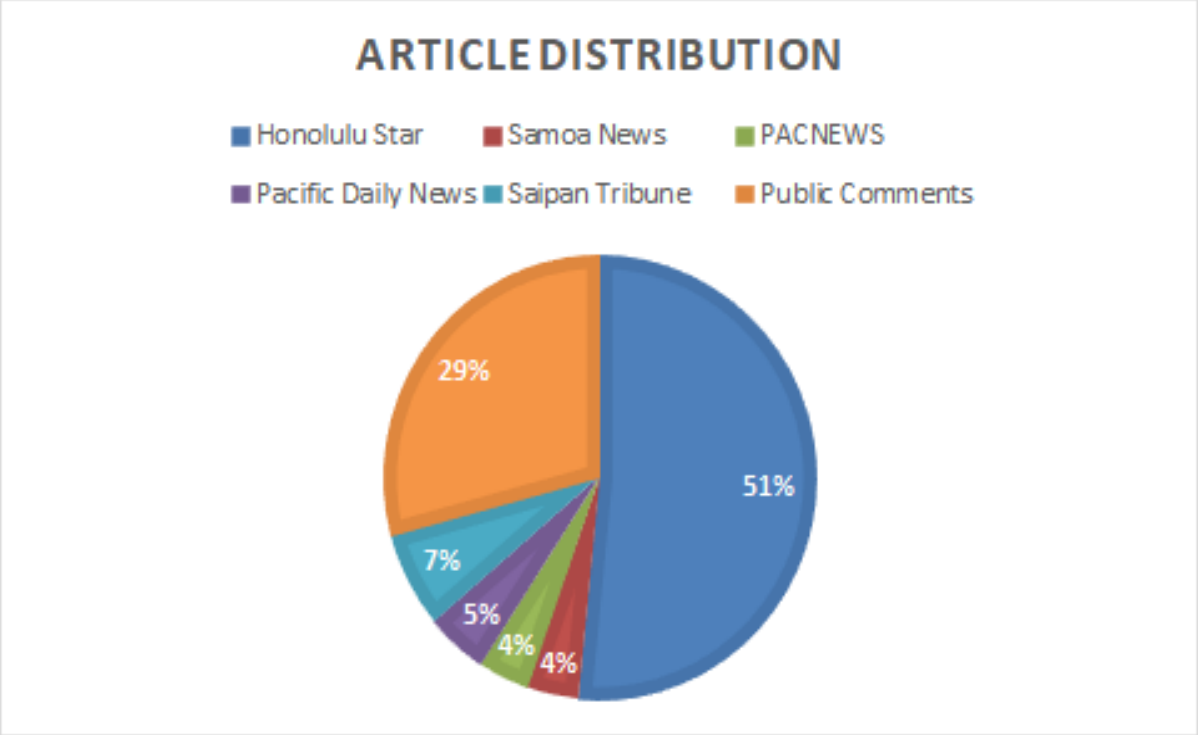

Figure 2. Percentage of articles/public comments from various news sources.

3.3 Location analysis

Each article was coded for the specific region or location that was being referred to, as seen in Figure 3. Any one location was only coded once for each given article, and more than one location could be present in any article. It was found that the islands of Hawaii were referred to most often (n=95), which correlates with the fact that the majority of news articles were taken from Hawaii based newspapers. Other Pacific Islands, including American Samoa (n=28), CNMI (n=29), and Guam (n=30) were referenced at comparable rates throughout the data set.

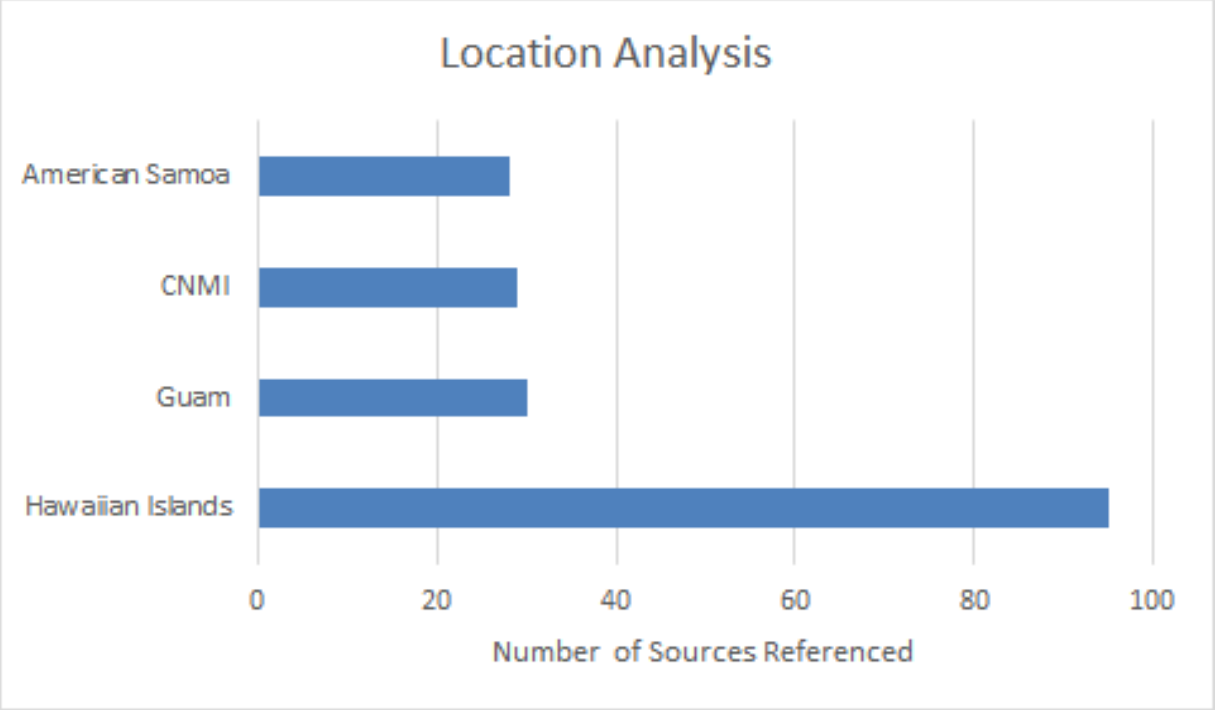

Figure 3. Represents the Pacific Islands present throughout the data set. NOTE: More than one location could be present in any given article. If an article referenced the 'Pacific Islands' all locations were coded as present.

3.4 Theme analysis

The overall frequency of themes was evaluated to understand what aspects of aquaculture are portrayed most often in the media. Major themes identified included: site

integrity, environmental benefit or sustainability, human health benefit, economics, environmental risk, human health risk, lack of environmental risk, political, research, and taste or quality. By coding each mention of an individual theme, it was found that economic subject matter was most prevalent, followed by issues of politics, and then environmental risk, as seen in Figure 4. Other themes, including cultural concerns, suggestions for the aquaculture industry/regulations, or other concerns that did not fit into the previously mentioned themes were coded separately and analyzed through in depth content analysis.

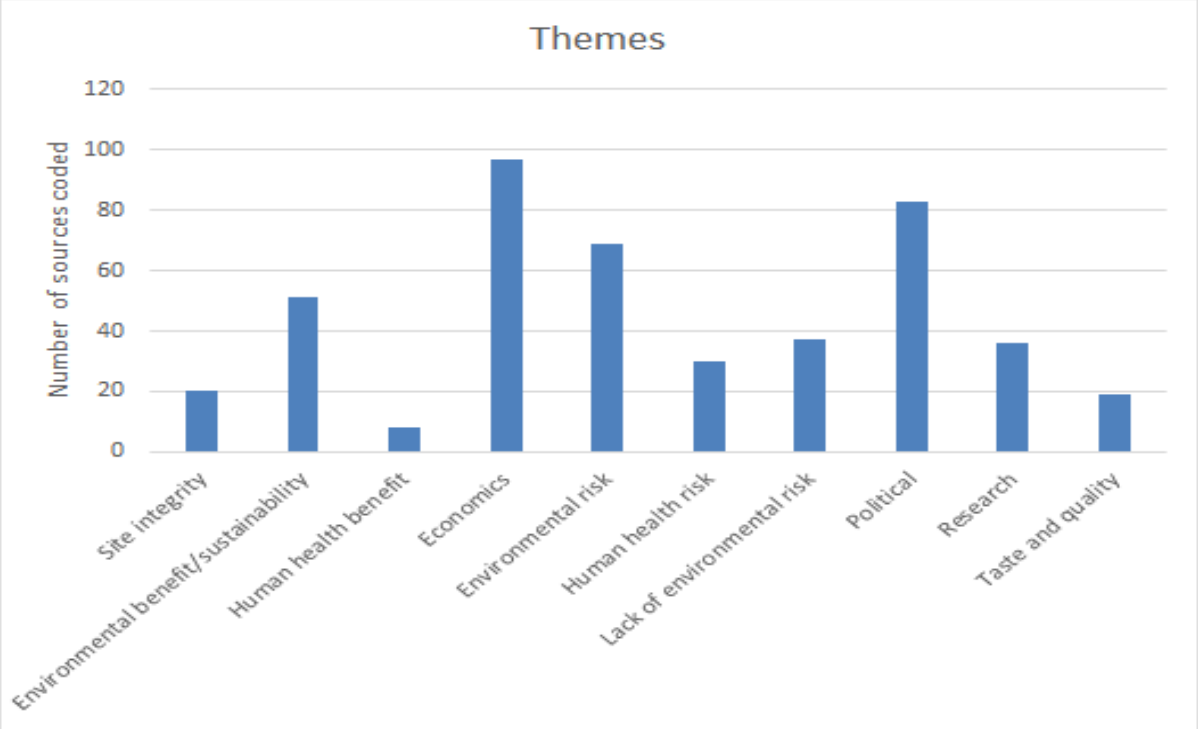

Figure 4. Prevalence of major themes throughout articles and public comments.

3.5 News articles vs. public comments theme presence

Major themes that were present in news articles vs. those present in public comments were also evaluated, in order to discern whether there was a correlation between the concerns of the public and the information that was portrayed by media outlets. It was found that

media outlets and public scoping comments often discussed similar issues; economic, political, and environmental risk concerns had the highest amount of references for each source category, as seen in Figure 5. However, after distinguishing the main topics of interest, it was found that different themes were portrayed more or less often depending on if the source was a news article or public comment. For example, news articles tended to push information about the taste and quality of aquaculture products, information regarding aquaculture research, environmental benefits, and the lack of environmental risk that is associated with offshore aquaculture. Likewise, public comments had a higher amount of references in regards to issues of site integrity and cultural concerns. These differences demonstrate that while major themes often dominate discussions about the aquaculture industry, there are still other less prevalent concerns that need to be addressed, which may or may not be useful when making policy decisions.

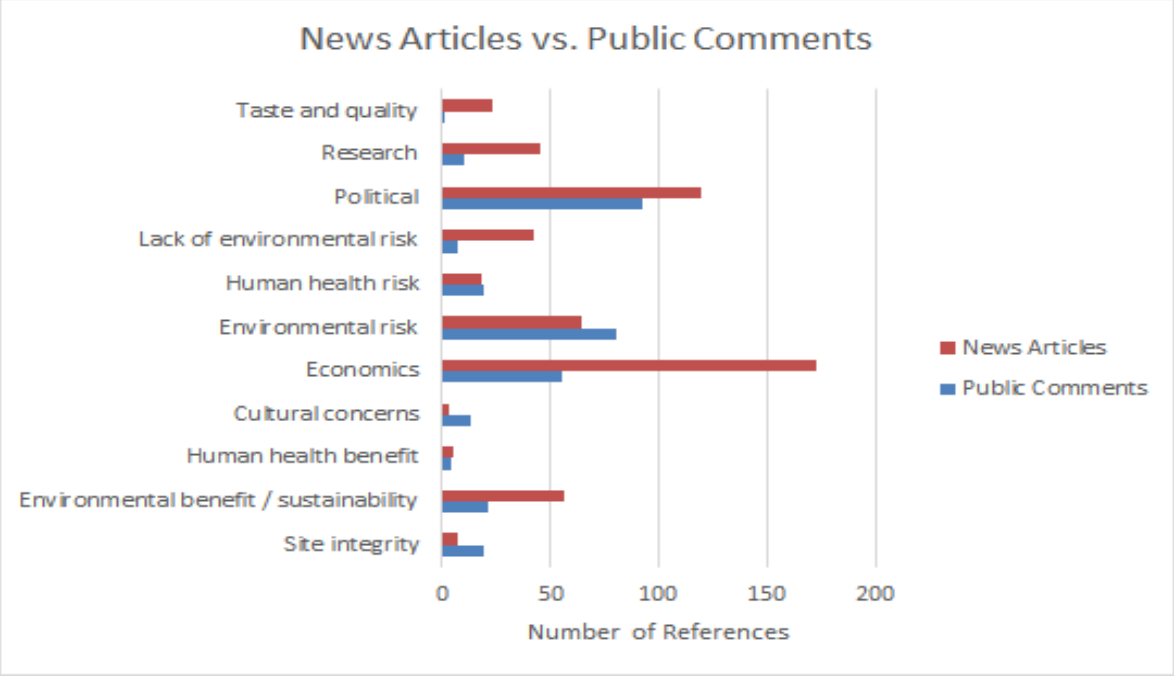

Figure 5. Prevalence of various themes in news articles vs. public comments. NOTE: a reference can be either one sentence or an entire paragraph, therefore this figure is only meant to illustrate overall trends in data.

Chi-square Test Results

A chi-square test was also performed on this data to test the association between the type of source (i.e. news article or public comment) and the major themes that were portrayed. It was found that there was a significant association between several of the themes and source type, as seen in Table 1.

Table 1. Chi-square test results

Major Themes	Value	df	Asymptotic Significance (2-sided)
Site integrity	15.986	3	0.001
Environmental benefit/ sustainability	7.015	3	0.071
Human health benefit	0.903	3	0.825
Economics	7.463	3	0.059
Environmental risk	17.475	3	0.001
Human health risk	13.82	3	0.003
Lack of environmental risk	9	3	0.028
Political	7.906	3	0.048
Research	4.554	3	0.208
Taste/quality	8.522	3	0.036

An association between "site integrity" and source type was found, X^2 (3, N = 130) = 15.9, $p \leq .05$. The relation between these variables was found to be significant; sources containing instances of site integrity were more likely to be a public comment than a news article. Examination of the cell frequencies showed that about 35% of the public comments contained an instance of site integrity, while only 8% of news articles contained issues pertaining to site integrity.

An association between "environmental risk" and source type was found, X^2 (3, N = 130) = 17.5, $p \leq .05$. The relation between these variables was found to be significant; sources containing instances of environmental risk were more likely to be a public comment

than a news article. Examination of the cell frequencies showed that approximately 78% of the public comments contained concerns about environmental risk, while only 43% of news articles contained instances of environmental risk.

An association between "human health risk" and source type was found, X^2 (3, N = 130) = 13.8, $p \leq .05$. The relation between these variables was found to be significant; sources containing instances of human health risk were more likely to be a public comment than a news article. Examination of the cell frequencies showed that about 43% of public comments were concerned with issues of human health risk, while only 15% of the total news articles reported on issues of human health risk.

An association between "political" and source type was found, X^2 (3, N = 130) = 7.9, $p \leq .05$. The relation between these variables was found to be significant; sources containing instances of politics were more likely to be a public comment than a news article. Examination of the cell frequencies showed that approximately 73% of the public comments contained political issues, while 60% of news articles portrayed political issues.

An association between "lack of environmental risk" and source type was found, X^2 (3, N = 130) = 9.1, $p \leq .05$. The relation between these variables was found to be significant; sources containing instances of lack of environmental risk were more likely to be a news article than a public comment. Examination of the cell frequencies showed that about 34% of news articles contained instances denoting the industry's lack of environmental risk, while only 13% of public comments portrayed this theme.

An association between "taste/quality" and source type was found, X^2 (3, N = 130) = 8.5, $p \leq .05$. The relation between these variables was found to be significant; sources containing instances of taste/quality were more likely to be a news article than a public

comment. Examination of the cell frequencies showed that approximately 18% of news articles contained instances of taste/quality, while only 3% of public comments were concerned with taste/quality.

3.6 Source affiliation frequency

Throughout the news articles and public comments, quotations with a source or author were also coded to distinguish which stakeholder groups were quoted most often. Articles may have included more than one source, and all relevant sources were coded regardless of their prominence. Sources were coded based on grouped organizations or affiliation rather than for the source's individual role or position. It was found that people from the aquaculture industry and government officials were quoted most often, followed by university affiliates and citizen sources, as seen in Figure 6. It was noted that while some citizen quotes were represented in newspaper articles, the majority of quotations were from NOAA's public scoping comments. There was also limited representation from fishery stakeholders, trade organizations, and advocacy groups.

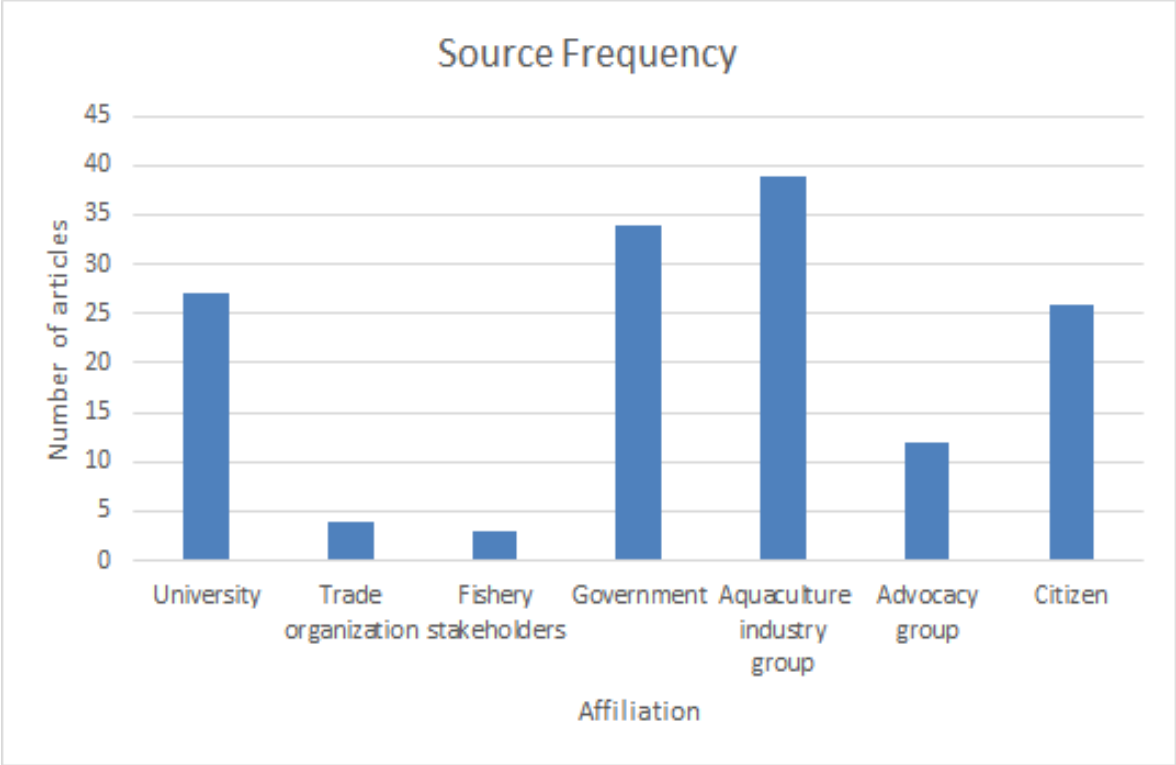

Figure 6. Frequency of source quotations throughout the data set.

3.7 Themes portrayed throughout source quotations

It was also found that there was a correlation between the distributions of major themes that were present throughout the various source quotations, as seen in Table 2.

Table 2. Number of references coded of major themes for source quotations.

	Site integrity	Environmental benefit or sustainability	Human health benefit	Economics	Environmental risk	Human health risk	Lack of environmental risk	Political	Research	Taste or quality
University	0	9	1	19	5	2	2	8	12	0
Trade organization	0	1	0	1	0	0	0	0	0	1
Fishery stakeholders	1	0	0	1	1	0	0	2	0	0
Government	8	3	1	21	16	0	3	32	4	1
Aquaculture practitioner or industry group	5	25	5	45	18	2	13	33	10	5
Advocacy group	2	0	0	7	22	6	0	21	0	0
Citizen	8	7	0	20	33	12	2	31	5	0

NOTE: a reference can be either one sentence or an entire paragraph, therefore this figure is only meant to illustrate overall trends in data.

It was observed that university sources were most likely commenting on issues of economics or research. Trade organizations were equally distributed between economics, environmental benefits/sustainability, and taste/quality topics. Fishery stakeholders were equally concerned with issues of politics, economics, environmental risk, and site integrity. Government affiliates often discussed political issues followed by topics regarding economics. Aquaculture industry groups primarily highlighted economic issues, as well as political topics and the environmental benefits of aquaculture. Advocacy groups were often concerned with the environmental risk of aquaculture and the subsequent regulations that are involved. Citizen sources were also highly concerned with aspects of environmental risk, politics, and economics.

3.8 Tone of source quotations

To gain an understanding of the general attitudes of the public and stakeholders in the aquaculture industry, each quotation with a source or author was coded for the tone that was present in their statement. Instances of tone were placed into one of five different categories including positive, negative, neutral, uncertainty, and defensive. This data was quantitatively analyzed to provide an overview of public and stakeholder opinion of offshore aquaculture, as seen in Figure 7.

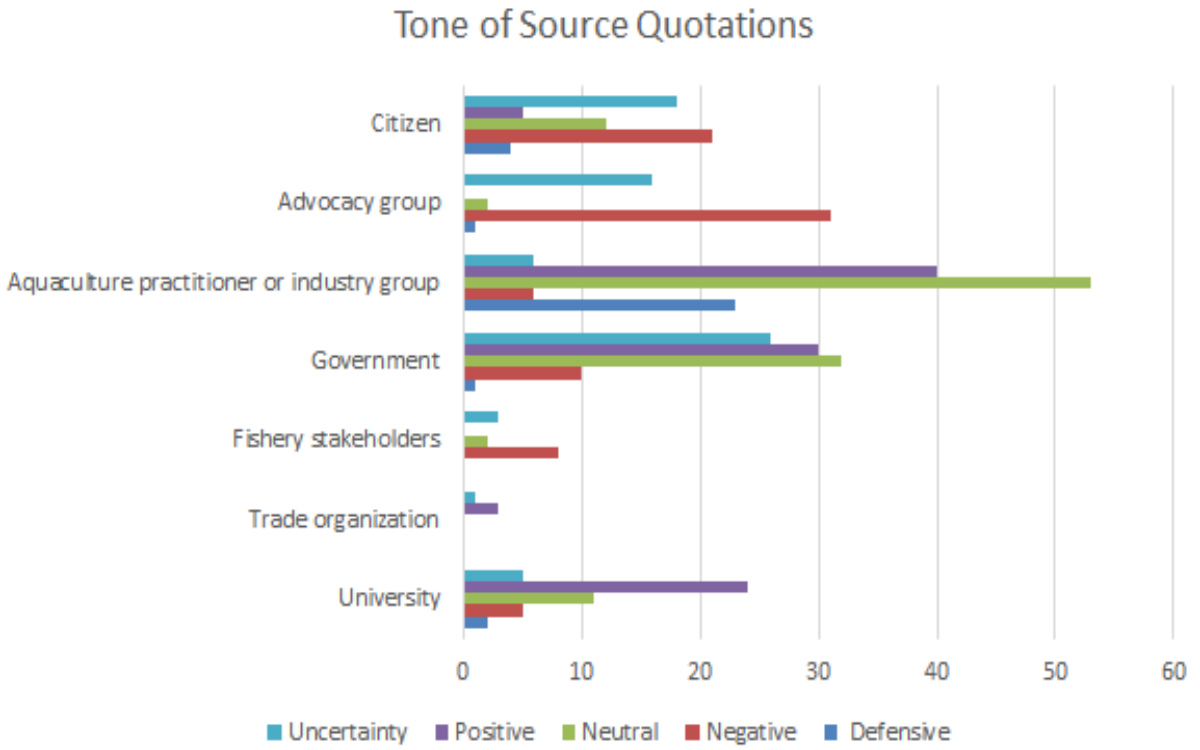

Figure 7. Portrays the # of references of tone per each source group. NOTE: a reference can be either one sentence or an entire paragraph, therefore this figure is only meant to illustrate overall trends in data.

It was found that government representatives, aquaculture practitioners and industry groups, trade organizations, and university affiliates primarily saw offshore aquaculture as being positive; where quotations from advocacy groups, fishery stakeholders, and citizens were found to be primarily negative. Instances of text that were categorized as “neutral” were disregarded during analysis as they typically contained general information or statistics about offshore aquaculture or provided suggestions for the aquaculture industry, therefore they did not provide meaningful insight into the community's’ opinion of offshore aquaculture.

CHAPTER 4. QUALITATIVE ANALYSIS

4.1 Tone analysis

In order to provide a meaningful evaluation of public and stakeholder opinion, an in depth content analysis was necessary to fully assess instances of tone.

4.11 Positive tone analysis

Positive instances of tone consisted primarily of quotations from government officials, university representatives, aquaculture practitioners, and trade organizations. Most of these sources saw new aquaculture ventures as an opportunity for Pacific Island communities to expand economically and rely less on imported seafood products from other nations. One university source even suggested that “we cannot be certain that seafood is produced sustainably by other nations, therefore Pacific Island communities should attempt to produce more seafood through aquaculture, in order to ensure the best possible aquaculture practices and environmental science”.

Most individuals from these groups viewed offshore aquaculture as a sustainable alternative to commercial fishing and suggested that the aquaculture industry could even help to reduce overfishing pressures on wild fish populations. Government representatives also stressed that the Pacific region has great potential for aquaculture expansion and that the state is eager to help aquaculture initiatives. Several government affiliates stated that the region's environmental conditions and cultural traditions would assist industry development; not only locally but also nationwide, as local traditions offer a unique perspective in regards to environmental management.

Trade organizations and aquaculture industry groups tended to focus on how farm raised fish is marketable as a high quality fish with great taste. Industry groups also commented how farmed fish products are beneficial for consumer health, as they are produced sustainably and offer local communities a nutritional source of dietary protein.

A number of government officials and aquaculture practitioners also indicated that the current industry regulations are working well, which was found to be somewhat contradictory to other opinions of the Pacific's community members.

Advocacy groups and fishery stakeholders had no instances of positive tone throughout this study, as quotations from members of these groups were found to be primarily negative. Approximately 8% of citizen sourced quotes were positive, regarding the potential for aquaculture to help reduce overfishing and the possible economic benefits.

4.12 Negative tone analysis

Negative instances of tone were found to be prominent throughout quotations from advocacy groups, fishery stakeholders, and concerned citizens. The majority of concerns stemmed from the environmental risks of aquaculture, including the use of wild fish for fish feed, the use of antibiotics and associated aquaculture diseases, and overall ecological impacts that can occur. Many sources referred to past industry problems that the aquaculture industry has faced in other parts of the world, as proof of the destruction that can come from mismanaged aquaculture facilities. Advocacy groups and citizens often believed that the environmental risks are too great, and that the aquaculture industry is too focused on commercial interests.

Many individuals mentioned potential social and economic conflicts that can be brought about from the expansion of the aquaculture industry. Fishery stakeholders and local

citizens were often concerned as to how new regulations would impact their traditional fishing grounds. There was also concern about how the production of farmed fish could potentially impact local markets and therefore local livelihoods. This relates to the notion that the offshore aquaculture industry is attempting to privatize the open ocean, leaving subsistence fishermen with fewer places to fish.

Many individuals also negatively commented how communications between government entities and the public are not appropriate. For example, negative quotes from government officials were primarily concerned with methods of communication that were used to inform the public and U.S. territories of NOAA's initiative to set regulations for the EEZ. It was found that the U.S. territory, American Samoa, was particularly against the initiative to set these regulations, and felt that voices of the minorities in the Pacific region are not being heard. Several individuals representing the American Samoa territory also felt that there was a lack of serious forum or period in which they could comment their opinions of the potential offshore aquaculture regulations.

While there were few instances of negative tone or uncertainty from university affiliates, certain individuals were concerned with the potential environmental risks that are associated with the aquaculture industry. Some individuals from this group also mentioned that high start up costs, combined with low funding and limits on expansion, often suppress the industries ability to expand.

Instance of negative tone from aquaculture industry representatives, while limited, were also present, however they were in regards to the industry's financing problems, long permit processes, and limits on farm size.

4.13 Uncertainty tone analysis

Instances of uncertainty about the aquaculture industry were primarily present in quotations from government officials and concerned citizens. Government officials often stressed the importance of having an adaptable plan in place to be able to adequately regulate economic and environmental standards of the aquaculture industry. Citizens often urged legislators to proceed with caution, suggesting that the growth of the aquaculture industry needs to be closely monitored and thoroughly researched.

Advocacy groups and university affiliates were unsure about the potential environmental impacts and how unknown variables, such as climate change, might affect the surrounding environmental conditions. Many individuals were also concerned about the effectiveness of government regulations and how government entities are going to monitor what goes on in the open ocean.

Fishery stakeholders were concerned about the potential influence of the aquaculture industry on market prices and how regulations will manage not only the number of operations but also the size of aquaculture operations. Other concerns stemmed from impacts on the fishermen's ability to continue catching fish, such as ecosystem impacts from increased levels of effluents or impacts on wild population migratory patterns.

Aquaculture practitioners were concerned and uncertain about leasing and permitting processes, future technological advances, and about producing an environmentally sustainable product. It was also mentioned that climate change and other unknown environmental variables will be challenging and that it is uncertain as to how the industry will be affected.

Overall, there were feelings of uncertainty throughout each stakeholder group evaluated in this study. It was found that concerns were generally related to the effectiveness of industry regulations and how government entities will ensure not only environmental sustainability of the aquaculture industry but also socio-economic standards that are established.

4.14 Defensive tone analysis

Instances of defensive tone were primarily found in aquaculture practitioner quotations. Many industry groups supported the current efforts of the aquaculture industry, stating how there are not only sufficient environmental regulations but also lack of environmental risk associated with aquaculture practices. Industry representatives also defended their commercial interests and suggested that they continually aim to support local industry growth. Government officials also defended the aquaculture industry, giving examples of how aquaculture has worked for other nations. University affiliates and several citizens also supported the aquaculture industry, saying that offshore aquaculture practices can be environmentally sustainable when managed correctly, ultimately helping produce seafood while reducing the pressures of overfishing.

4.2 News articles vs. public comments analysis

Based off of the chi-squared data that was obtained during this study, it was found that a more in depth analysis of certain themes was necessary, to determine if there were discrepancies between what was portrayed in the media and what was talked about in the public comments from NOAA's proposed PEIS. Significant themes included site integrity, environmental risk, lack of environmental risk, human health risk, politics, and taste/quality.

4.21 Site integrity

Through the chi-squared analysis, it was found that issues pertaining to site integrity were less prominent in news articles and more prominent in NOAA's public scoping comments. Overall, news articles were reporting information about the site integrity topics, including disruption of navigation, commercial fishing, recreational activities, and potential environmental disturbances, such as how fish farms will affect seabirds and other migratory marine animals; however it was found that the information presented could vary from article to article. For example, one article might say that aquaculture farms will not interfere with recreational activities, such as diving, because their locations will be beyond the depths of recreational diving. However, other articles would state that there are potential navigation concerns, as past farms have said that they would restrict recreational access, including activities of boating, fishing, and diving, for safety reasons. Likewise, depending on the article and proposed location of the farm, it was found that fisherman both approved and disapproved of future aquaculture farms in their fishing grounds. Some saw the potential fish-aggregating devices as a way to catch more fish, while others viewed the establishment of fish farms as a way to restrict access to their traditional fishing grounds.

When evaluating the public comments, it was found that issues of site integrity were more of a concern and often addressed more cultural issues. Several individuals commented that they feared the proposed aquaculture farms would have a negative impact on territorial waters and local cultural practices, stating that aquaculture farms were an attempt by the government to privatize the ocean and restrict public access. A majority of comments were also concerned with the potential impacts on commercial fishing, including navigational

issues, possible fishing exclusions around aquaculture farms, and issues pertaining to FADs. Some individuals also brought up other safety concerns, such as how visibility during night will be addressed; as well as general environmental concerns, such as how migratory marine animals (i.e. sharks, whales, birds) will be affected by aquaculture farms.

4.22 Environmental risk

Issues pertaining to environmental risk were also found to be more explicit in the public comments than in news articles. News articles tended to vaguely describe the potential environmental impacts of aquaculture, such as how concerns often stem from issues of disease transfer, fish escapes, waste production, and the use of antibiotics. News articles also focused on how environmental disasters involving fish farms have happened in the past or in other places around the world, with a follow up statement describing how more sustainable practices are currently being used throughout the Pacific. Several articles featured quotes from individuals associated with the aquaculture industry; which were usually either aquaculture practitioners stating that they have learned from past mistakes and have more sustainable practices currently in place, or advocacy groups stating how detrimental fish farms can be for the environment. Furthermore, it was also found that concerns about potential environmental impacts were almost always associated with environmental groups or "opponents" of the aquaculture industry, making ideas of environmental sustainability seem outlandish or extreme. Other news articles would have residents commenting on how they are concerned about their own safety, as aquaculture farms have the potential to aggregate sharks to the area. Consumer preferences also became associated with issues of

environmental risk, as a few articles discussed whether or not it is environmentally sustainable to buy farmed fish.

Public comments tended to provide more detail about the potential environmental risks of aquaculture, including the following topics: use of antibiotics, disease outbreaks, the use of wild fish for fish feed, waste production and pollution, the use of non-native or GMO species, the use of carnivorous fish vs. herbivorous fish, potential for fish escapes, ecosystem impacts and effects on marine protected areas, impacts on water quality, and negative effects on benthic life caused by dredging and anchoring aquaculture projects to the seafloor. Other comments focused on previous and historical problems with the aquaculture industry, including how effective management can be difficult in the open ocean. Several individuals stressed the importance of effective environmental monitoring systems as well as evaluating how farm size and location will affect the environmental impact an aquaculture farm will have. Overall it was found that public comments were more comprehensive regarding the potential environmental risks of aquaculture. It was also noted that while many of the comments regarding environmental risk were from concerned citizens, many of them were also from advocacy groups, fishery stakeholders, and government organizations, including the NPS, EPA, the U.S. Navy, the Recirculating Farms Coalition, Friends of the Earth, Blue Revolution Hawaii, the Ocean Stewards Institute, WPRFMC, and MAFAC.

4.23 Human health risk

Instances of human health risk were also found to be more prevalent throughout the public comments than in the news articles. Several news articles focused on particular instances of human health risk or workplace safety, including one case where an employee

died while performing maintenance on an aquaculture enclosure. Other reports concentrated on issues of disease and the use of antibiotics, and how consuming farmed fish might lead to adverse health effects. Sharks were also regarded as having the potential to negatively impact human health, as aquaculture farms may cause more sharks to frequent the waters surrounding Pacific Islands, which may or may not cause rates of shark attacks to increase.

Public comments often addressed similar issues that were portrayed in the news, including concerns about employee health, shark aggregation, issues of disease, the use of antibiotics, and the potential to create drug resistant pathogens. Other comments focused on potential impacts on wild fish populations, including how potential escapes might affect the healthfulness of wild fish and therefore the health of consumers that buy those fish, and also how impacting wild fish populations might affect the health of poorer nations that rely on wild fish as their major source of protein.

4.24 Lack of environmental risk

Instances pertaining to aquaculture's lack of environmental risk were found more often in news articles than in public comments. Several news articles featured quotes from aquaculture practitioners stating how offshore aquaculture farms are located in areas with stronger oceanic currents, which help to remove certain aspects of environmental risk, including waste/effluent production, impacts on water quality, and impacts on the benthic community. Several articles also focused on how aquaculture companies are engaging in environmentally sustainable practices, including purchasing sustainable fish feed, using large cages to prevent disease outbreaks, and exploring the potential of polyculture, which uses multiple trophic level species to reduce the amount of waste produced (Troell 2009). Other

articles concentrated on how local aquaculture companies have rigorous and diligent environmental monitoring systems in place, which have shown that aquaculture farms have little to no ecosystem impacts. While most companies vowed that their farms will have no environmental impacts, one article featured a quote from a aquaculture practitioner stating that sharks may be attracted to aquaculture farms, however if they are attracted, it is completely natural for sharks to be curious about a large cage of fish and that public safety will not be at risk, because the species will most likely be a sandbar shark which is not threatening towards humans.

While there were some public comments that discussed the industry's lack of environmental risk, it was noted that the majority of these comments were received from aquaculture industry or research groups, including Ocean Stewards Institute, Hawaii Oceanic Technology Inc., and MAFAC. Most commenters believed that if the environmental standards were properly executed and regulated, then the aquaculture industry would have minimal impact on the surrounding environment. Overall it was found that public comments often proposed similar ideas to those present in the news articles, including the assumption that offshore currents help to mitigate the environmental impact of offshore aquaculture, as well as the idea that aquaculture farms have no environmental impact on the surrounding ecosystem or migratory species. Certain individuals also commented on how there should be no exclusion of non-native species, stating that non-native species were not a threat to the native environment.

4.25 Political

Through the chi squared analysis it was found that more public comments contained instances of political discourse, when compared with the amount present in news articles. The majority of public comments offered recommendations on how the industry should be regulated, including suggestions pertaining to permitting, the permit process, environmental regulations, record keeping, and monitoring processes. Other public comments included more opinion-based statements; for example, one concerned citizen stated that what NOAA is attempting to do should not be legal, as it is an attempt to privatize the ocean, which is a public trust resource. Several public comments, from both the American Samoa government and local Hawaiian citizens, also felt that the United States government is not demonstrating lawful processes, and still see the U.S. as a foreign power which is invading their native territory. Other comments also focused on regulatory complications, including legislative conflicts with the MSA and the NEPA process.

News articles often commented on proposed regulations and what they aim to do for the aquaculture industry. Several articles also mentioned upcoming meetings about aquaculture legislation, including NOAA's initiative and public scoping meetings in 2016. Other articles featured quotes, which either stated how Hawaii's industry is highly regulated or that the overall industry needs more regulatory framework in place. Several articles also described the permit process or mentioned how certain aquaculture companies were applying or had been approved for a permit or lease. It was also noted that Samoa News featured an article that described how American Samoa feels there are communication problems between the U.S. government and their own government, and that they do not have the ability to

provide meaningful comments on the new aquaculture regulations or other legislative matters.

4.26 Taste and quality

Instances of taste or quality were much more prominent in the news articles than in the public comments. Only one public comment, from the Ocean Stewards Institute, mentioned how domesticated species can offer certain benefits, as the animals are often raised to be slow, docile, and tasty.

More often, news articles focused on consumer preferences, stating how farmed fish are of high quality and are "sashimi grade" fish. Several articles also stated that local chefs approve, with farmed fish gaining popularity on local restaurant menus. One article even mentioned how president Barrack Obama enjoyed a locally farmed fish at the prestigious Alan Wong's restaurant in Honolulu. Other articles described the different kinds of fish that were being farmed locally, with descriptions on how to cook and eat the fish, and the associated health benefits of eating fish, such as how it is a great source of protein and omega 3s. There were also articles that stated how aquaculture farms in Hawaii are highly regulated, therefore consumers should feel safe and know that they are purchasing a sustainable product.

4.3 Other concerns analysis

Other concerns, which did not necessarily fit into the designated categories of this analysis, were also coded and evaluated using a more depth contextual analysis process. This allowed for other related issues about aquaculture to be realized, offering a variety of different perspectives, which helps to cover potentially neglected topics.

4.31 Geographical isolation

It was suggested that the geography of the Pacific Islands, in relation to future offshore fish farms, could pose problems for adequate environmental management, including issues such as the relative distance to shore, potential issues with communication, and the overall technical capacity of aquaculture farms and transport vessels. This notion relates back to the idea that offshore aquaculture is associated with a "lack of control," as some aquaculture projects have the potential to be isolated, from both government officials and the safer environmental conditions that are associated with near shore and land-based aquaculture systems.

4.32 Environmental disasters and climate change

The issue of disaster preparedness and environmental change was also referred to as a topic for concern. Environmental scientists have predicted that the effects of climate change and subsequent amount of environmental disasters are to drastically increase over the next few decades, therefore it will be critical that both existing and new aquaculture projects will be able to adapt to the various environmental changes (NOAA 2011). In general, potential consequences that could arise from climate change and impact the aquaculture industry may include increases in temperature, precipitation, ocean acidity, sea level rise, extreme weather events, climate variability and disruption of global oceanic currents (FAO 2008). However, research regarding the full extent of these effects is still uncertain, as not all impacts of climate change will necessarily affect the aquaculture industry. The level of impact climate change will have on any aquaculture system is heavily dependent on the regional conditions and the degree of climate change that occurs in any given area (FAO 2008).

Other sources were concerned about the aquaculture industry's impact on climate change. This could include the potential contribution of carbon emissions from the production and transportation of feed and product, as well as all other associated operations activities. In response to these various concerns, NOAA and other aquaculture industry members have stressed the importance of adaptability and innovation when creating new government regulations for the industry (NOAA 2011).

4.33 Island perspective and cultural concerns

The Pacific Islands can be considered very unique when compared to other regions of the United States. This idea became relevant during analysis in regards to the notion that national policies regulating aquaculture tend to focus on a "continental" legislative approach. Several individuals voiced the suggestion that aquaculture regulations should include the "island community perspective," as the ecological and societal structure of the Pacific Islands provide not only a unique historical legislative context but also distinctive environmental conditions, which are found nowhere else in the United States.

Traditionally many Pacific Islanders had successful environmental management systems of their own, and were believed to be very aware of the natural limitations of their local environment (Costa-Pierce 1987). Various scientific studies have used island ecosystems in order to better understand both natural and social sciences, as they offer "closed" areas of study where local inhabitants are constrained by the limited natural resources of that specific island (Deschenes 2004). However, as western technologies and politics have expanded across throughout the Pacific Islands, traditional management practices have been overrun by the effects of globalization, causing many of the Pacific's traditional self-sustaining societies to become heavily reliant on imported products. As small

island ecosystems become subject to global economic systems and environmental changes, they often face a variety of new challenges (Deschenes 2004). Furthermore, as motivations shift towards commercial interests and profits, the local economy can become more focused on exploitation and traditional resource use practices are often upset by wage/price distortions and environmentally intrusive technology (Deschenes 2004).

In regards to aquaculture, several individuals expressed similar concerns, stating that the expansion of the aquaculture industry throughout the Pacific could result in the privatization of the ocean, essentially robbing many local people of their traditional livelihood practices. To combat these effects, it was suggested that profits from the aquaculture industry should attempt to benefit local interests first, before exporting products to other nations. It was also suggested that the aquaculture industry should attempt to improve the livelihoods of the local communities first; in order to create a self sustained industry so that the people of the Pacific Islands no longer rely on imported goods and services.

Several individuals from throughout the Pacific region also expressed the need to investigate how expanding open ocean aquaculture might impact indigenous traditional and customary practices. This theme was found to be particularly prominent in testimony from both the Hawaiian Islands and American Samoa, as some citizens and government officials from these areas still see the United States as illegally occupying their territories. Several comments also suggested the importance of aquaculture facilities providing access to indigenous fishing grounds and religious/cultural areas, with a desire for an investigation of the best way for offshore aquaculture to be culturally respectful.

4.34 Means of communication

While main concerns of aquaculture production often include aspects of environmental and socio-economic risks, there were also a variety of additional concerns that were expressed throughout this study. These concerns were generally more indirectly related to the aquaculture industry, and often allowed insight into the public opinion of legislative processes. It was found that some U.S. territories, particularly American Samoa, felt that there was a lack of meaningful communication between the U.S. federal government and U.S. territories. For this reason, many government officials and members of the public from American Samoa took this opportunity to comment as a way to express that the "indigenous opinion" was not being heard, not only in regards to NOAA's new aquaculture regulations, but throughout the history of U.S. expansion in the Western Pacific Islands. Multiple U.S. territories expressed the desire for more independence from the U.S. government, and that their reliance on the United States was often undermined by the lack of educational and health services provided.

The Pacific Island communities offer a unique blend of traditional and western ways of life, therefore it would be appropriate that the way information is communicated to the public be unique and allow for all members of society to participate in government processes. Science communication is not always straightforward, with one of the main issues being the language through which information is presented to the public. In the Pacific Island community, there can also be formal language barriers, leaving various members of the community confused and unable to express their concerns about regulatory issues. By analyzing this issue further, if the audience cannot understand what is being explained, there

will ultimately be a lack of meaningful commentary on the topic, proving the entire process of legislative public outreach to be futile.

4.4 Suggestions analysis

Throughout this content analysis, it became apparent that many sources and articles provided suggestions for aquaculture methods or the future aquaculture industry. These suggestions were coded separately and analyzed to provide recommendations for future offshore aquaculture policies.

Overall, suggestions for the industry included a variety of topics, such as offshore aquaculture policies and permits, environmental risks, potential cultural impacts, economics, and environmental benefits. There were several instances where individuals suggested offshore aquaculture as a solution to overfishing, as the Pacific region offers a healthy marine environment suitable for aquaculture. Many individuals expressed a desire for new technology, more information, and more research pertaining to the social, economic, and environmental impacts of offshore aquaculture. It was also suggested that policy makers should use a multidisciplinary approach that includes scientists, policy makers, and the public working together, in order to make the most informed policy decisions possible.

Suggestions involving environmental sustainability were prevalent as well; some individuals called for more sustainable systems to be established, such as land-based aquaculture, while others focused on improving the offshore aquaculture industry by exploring alternative methods, such as polyculture. Overall, issues of environmental risk were of concern to many individuals that provided suggestions, therefore it is recommended

that future aquaculture regulations seriously consider the potential environmental impacts of offshore aquaculture.

Individuals representing the aquaculture industry often made suggestions based on more commercial interests. Suggestions included: evaluating aquaculture systems and regional policy decisions on a case by case basis, providing business incentives and funding opportunities, assistance in the wake of environmental disasters, granting permissions to use alternate fish species (non-native), no blanket exclusions over marine protected areas, making the permit process easier, and issuing permits for longer periods of time.

Individuals representing non-industry groups tended to be more focused on the holistic implications of expanding the offshore aquaculture industry in the Pacific. Suggestions included: creating national guidelines for offshore aquaculture, fully evaluating the potential social and economic implications, implementing strict environmental regulations and prohibiting offshore aquaculture facilities in Marine Protected Areas, a push for local investment in offshore aquaculture and localized benefits from industry profits, and the issuing of short term permits for aquaculture ventures.

A variety of suggestions were also focused on potential cultural and social impacts of the aquaculture industry. It was suggested by several individuals that aquaculture practices should encourage indigenous participation in planning and development process, and that commercial profits should benefit the local community first and avoid exporting aquaculture products until local communities are self sufficient. Other individuals stressed that aquaculture activities should allow access to indigenous fishing grounds and religious/cultural areas, to ensure that the industry does not disrupt any traditional practices.

While the opinions of different individuals were often conflicting, the suggestions revealed by this study may provide various insights that could improve future regulations. Overall, by assessing the content of suggestions presented throughout this data set, it was found that aquaculture regulations in the Federal waters of the Western Pacific should encompass an adaptable management plan that will ensure the environmental, social, and economic sustainability of local communities in that area. It is recommended that new aquaculture ventures be thoroughly evaluated on an individual level by multiple agencies to ensure that regulations are properly enforced. Furthermore, it is suggested that continued research and public education remain a priority, in order to expand our understanding of aquaculture's relationship with other ecosystems.

The suggestions found by this study were also cross-referenced with NOAA's public scoping report, which analyzed the same public comments evaluated by this study. It was found that NOAA's public scoping report provided a more detailed analysis of the legislative suggestions present in the public comments, listing each suggestion in bulleted format (ECO49 Consulting LLC 2017). The information presented by NOAA's public scoping report strongly correlated with the analysis presented by this study, demonstrating the overall effectiveness of the report's legislative and analytical process.

This study also demonstrated how many of the public scoping comments tended to present more in depth ideas about offshore aquaculture when compared with regional newspaper articles. Therefore, it can be assumed that those participating in the public scoping process are either highly motivated by an aspect of offshore aquaculture, potentially a stakeholder in the aquaculture industry, already engaged in the public scoping process, or all of the above. The various discrepancies found between what is portrayed in the media vs.

what was revealed by the NOAA's public scoping comments, shows how the general public may be exposed to more superficial and "newsworthy" aquaculture topics. In order to ensure that the public is receiving adequate information about offshore aquaculture, it is suggested that NOAA and/or other government or industry representatives engage and update media outlets with new aspects of aquaculture research. It is also recommended that science communication remain a priority and that various methods of public outreach are employed to guarantee that the public is exposed to information about offshore aquaculture. Overall, by thoroughly informing the public about offshore aquaculture, it becomes more likely that more individuals will become engaged in the public scoping process, which ensures that regulations are not only extensive but also effective.

CHAPTER 5. CONCLUSION

Overall, this study aimed to thoroughly analyze the public's perception of offshore aquaculture in the Pacific and how that opinion may or may not be influenced by the media's representation of the aquaculture industry. By using both quantitative and qualitative methods of content analysis, this study helped to provide different perspectives and ideas about the offshore aquaculture industry. Quantitative content analysis served as a way to measure the frequency of certain themes and public or stakeholder opinion, in order to provide a general analysis of the media's influence on the public opinion of aquaculture. A more qualitative approach was also used to analyze the data set, in order to thoroughly understand how the media portrays offshore aquaculture, how the public may be influenced by media outlets, and any other concerns that may not have been immediately realized.

Major themes, including issues pertaining to politics, economics, and environmental risk were found to be the most prevalent topics throughout both news articles and the public comments. News articles often reported on these issues in an informative matter, describing industry changes, market prices and major aspects of environmental risk. Public comments tended to be more in depth about political, economic, and environmental issues, and often presented suggestions for legislation. The suggestions revealed by this study may provide various insights that could improve future regulations and strongly correlated with the findings presented by NOAA's public scoping report.

While the media may have had some influence over public opinion in regards to these major themes, it was found that the public comments collected during the initial scoping process for NOAA's PEIS presented a variety of other concerns, including geographical constraints of offshore aquaculture, risks produced by environmental disasters and climate

change, various cultural concerns, and site integrity issues, that were not discussed in the news articles selected for this study. Likewise, several news articles highlighted other topics, such as taste and quality, lack of environmental risk, and the environmental sustainability of aquaculture, which were rarely addressed throughout the public comments. Public comments from NOAA's PEIS initial scoping process also involved concerns about the methods of communication that were used to inform the public of the new aquaculture regulations, and several citizens and government affiliates from both American Samoa and the Hawaiian Islands used this opportunity to comment as a platform to voice their frustrations about the historical takeovers of their countries by the U.S. government. Several individuals that provided public comments also felt that they did not have the ability to provide meaningful input for the new aquaculture regulations, showing that there might be issues with legislative outreach initiatives and aspects of science communication.

Various perceptions of the aquaculture industry were also present in NOAA's public scoping comments and the news articles used in this study, and often correlated with a source's affiliation. Throughout this data set it was found that aquaculture practitioners, government affiliates, and researchers were quoted most often, while quotations from the public, advocacy groups, and fishery stakeholders were not as prevalent. It was also observed that the source's affiliation might have played a role in what they were discussing. Aquaculture industry groups primarily highlighted economic issues, as well as political topics and the environmental benefits of aquaculture. University sources were most likely commenting on issues of economics or research, while government affiliates often discussed political issues or topics involving economics. Fishery stakeholders, advocacy groups, and

quotations from the public were generally concerned with issues of environmental risk, politics, and economics.

Positive instances of tone consisted primarily of quotations from government officials, university representatives, aquaculture practitioners, and trade organizations. Most individuals from these groups viewed offshore aquaculture as a sustainable alternative to commercial fishing and suggested that the aquaculture industry could help to reduce overfishing pressures on wild fish populations while also providing local economic benefits. Negative instances of tone were found to be prominent throughout quotations from advocacy groups, fishery stakeholders, and concerned citizens. The majority of concerns stemmed from the environmental risks of aquaculture, impacts on traditional and commercial fishing grounds, past industry problems, and issues with government communication of legislative processes. Overall, these trends regarding source affiliation and tone were found to be more applicable for the news articles used in this study, while the public comments tended to be more variable in terms of public and stakeholder opinion.

As the aquaculture industry continues to grow throughout the Western Pacific, it is suggested that aquaculture regulations in the Federal waters of the Pacific Islands Region encompass an adaptable management plan that will ensure the environmental, social, and economic sustainability of local communities in that area. This study has shown that while main concerns are about political, economic, and environmental risk topics, there are also many other less prevalent issues involved and public and industry stakeholders can have various opinions about the offshore aquaculture industry.

Appendix

Table 3. Summary of themes analyzed throughout text

Categories	Description
Site integrity	Related to impacts to the visual or cultural aesthetic of a location. This includes negative impacts to overall site image, as well as impacts on recreational sites (e.g., access, navigation). This can also include positive impacts to a location's "image." e.g. "His department is concerned about moi cages attracting fish-eating birds to the area and posing a danger for planes" (Article 012).
Taste/Quality	Pertained to the taste or quality of aquaculture products from a consumer perspective (e.g., flavor, fresh, premium, high-quality, sushi grade, etc.). This includes taste or quality differences between wild-caught and aquaculture products. e.g. "A Big Island company that hopes to raise a variety of high-quality fish in submerged cages" (Article 005).
Human Health Benefit	Focuses on human health benefits from eating seafood or aquaculture products (e.g. seafood as a source of protein, nutritional value). e.g. "Seafood is identified as healthy food. …Why not grow your own seafood to feed your people?" (Article 083).
Environmental Benefit/ Sustainability	Related to aquaculture developments that make fish production more sustainable by reducing pressures (e.g. overfishing) on wild stocks. Note: Sustainability should be coded only in terms of environmental impacts, not in terms of other sustainability types (e.g., economic). e.g. "Offshore aquaculture is an evolutionary method to produce finfish rather than deplete precious ocean stock" (Article 003).

Lack of Environmental Risk	Focuses on defending the aquaculture industry, indicating that aquaculture methods are safe for the environment and have little to no impact on surrounding ecosystems. e.g. "An open-ocean fish farm would have little effect on public activities or marine ecosystems, according to a draft environmental assessment" (Article 007).
Human Health Risk	Related to any past, present, or future human health issues. This includes problems related to food safety (e.g., mercury contamination or antibiotics/diseased fish affecting human health) and others. Code also for risks of aquaculture operation (e.g., working conditions). e.g. "It's possible that this problem of antibiotic resistance could affect human populations if these genes are passed from fish pathogens to human pathogens" (Comment 030).
Environmental Risk	Focuses on any past, present or future environmental problems caused by aquaculture systems. This includes any impacts to sensitive habitats or protected species, any impacts on water quality (e.g. effects from effluent, chemicals, or antibiotics) and any introduction of non-native species. This also includes any impacts on wild stocks involving the spread of disease or parasites, escaped cultured fish, or use of wild fish stocks for feed. Text coded for environmental risk was also coded for the following sub-codes when applicable. - Chemical or waste production - Impact on other species - Risk of fish escaping - Use of wild stock fish for fish feed - Risk of disease or use of antibiotics
Economics	Related to the economic viability of implementing aquaculture, the potential economic benefits (e.g., development of industry, creation of jobs, attraction of outside investors), or the risks and associated economic losses. Code also for mentions of aquaculture product prices and approximate industry worth. e.g "The $13 million expansion plan sought to boost Moi production to 5 million pounds a year, a roughly fourfold increase and enough to generate an estimated $20 million in annual sales" (Article 006).

Fish Production	Focuses on amounts of fish being produced (e.g. any increase or decrease in fish production). Note: Does not include any mention of monetary gain/loss. e.g. “At its inception, Kona Blue only produced about 3,000 pounds of whole fish a week. Today, it produces an average of 20,000 pounds of fish a week” (Article 002).
Political	Focuses on governance issues and may reference a law, bill, regulation, or permitting issue. This includes mention of improving the permitting process, eliminating redundant permit requirements, and ensuring the efficiency of the MSA and ESA consultation process. This also includes any concern for lack of clarity in agency roles and responsibilities or conflicting agency mandates. Also, code for actions taken by legislature or an individual holding political office. e.g. “Federal regulations now making their way through Congress may increase the opportunity to develop fish farms” (Article 001).
Research	Focuses on developments related to aquaculture, scientific studies, or discussion of research objectives and/ or outcomes. This includes mentioning of ongoing research or funding received for new research. e.g. “Research on large-scale floating platform for open-ocean aquaculture already is taking place at the University of Hawaii” (Article 001).
Suggestion	Any text that provides a suggestion to either improve the way human populations produce seafood or a way to improve the aquaculture industry or methods (e.g. aquaculture industry should have shorter permitting process, or Hawaii should have more funding for aquaculture practices). e.g. “ Standards for the marine aquaculture industry should regulate the release of nutrient and chemical pollutants generated in fish farms, promote species not dependent on fish meal and fish oil for feeding and limit aquaculture to indigenous species” (Article 003).

Other Concerns	Any other concerns about aquaculture that do not fit into the above categories (e.g. issues with communication of new aquaculture policies, comparison with terrestrial agriculture, climate change, or disaster preparedness). e.g. “Many studies have shown that local livelihoods and food systems, especially those of the poor in developing countries, have been severely undermined by aquaculture production for richer nations” (Article 024).
Cultural Concerns	Focuses on impacts to cultural or traditional practices of Hawaii, American Samoa, Guam or the Northern Mariana Islands. e.g. “Aquaculture activities and facilities should provide access to indigenous fishing grounds and religious/cultural areas” (Comment 009).
Traditional Practices	Focuses on relating modern aquaculture techniques to traditional practices (e.g. fishponds in Hawaii). e.g. “Aquaculture has not been without controversy, even though its history in Hawaii dates back to ancient fish ponds” (Article 001).

Table 4. Description of tone criteria

Type of Tone	Description
Positive	Source quotation was positive or it supported proposed aquaculture practices or industry policy e.g. "Offshore aquaculture is an evolutionary method to produce finfish rather than deplete precious ocean stock," she said. (Article 003).
Defensive	Source quotation defended aquaculture practices (e.g. providing evidence that aquaculture methods have no negative environmental impacts) e.g. '"Everything they've written about has been very inflammatory and not very factual," said Randy Cates, chief executive officer of Hukilau Farms.' (Article 021).
Neutral	Source quotation did not contain any instances of support or opposition, but simply presented facts or information e.g. "I have 100,000 to 200,000 fingerlings at any time and harvest 5,000 to 6,000 pounds of moi a month," (Article 057).
Uncertainty	Instances of skepticism, uncertainty, or questions related to aquaculture methods or policies e.g. "I believe they have the right idea," said Umamoto, who spent three months on a bluefin 'ahi farm in Spain. "But nobody knows what will happen" (Article 060).
Negative	Source quotation was negative or opposed aquaculture practices or industry policies, includes instances of risk association with aquaculture e.g. "Hawai'i's agencies are not prepared to effectively regulate any expansion of the industry and have struggled to regulate the two existing operations," the report said.' (Article 058).

Table 5. List of source categories/affiliations

Source Category	Affiliation
Advocacy Groups	• Aquaculture Planning & Advocacy LLC • Hawaiian Islands Humpback Whale National Marine Sanctuary • National Aquaculture Association • Food & Water Watch • Maui Tomorrow • Recirculating Farms Coalition • Pono Aquaculture Alliance
Fishery Stakeholders	• Western Pacific Fishery Management Council • Hawaii Longline Association
Government	• State Aquaculture Development program DOA • Pohnpei Senator • American Samoa Senate • State Department of Transportation and Airports Division • State Shark Task Force • State Board of Land and Natural Resources • National Oceanic and Atmospheric Administration • Palau Minister of Resources and Development
University (e.g., professor, researcher)	• Kona Blue Water Farms scientist • Hawaii Institute of Marine Biology • University of Hawaii Sea Grant Program • University of Hawaii Economic Research Organization • University of Hawaii professor/researcher • Oceanic Institute
Aquaculture practitioner or industry group	• Cate International/Hukilau • Kona Blue Water Farms • Maui Fresh Fish LLC • Kampachi Farms • Blue Ocean Mariculture LLC • Pacific Planktonics • Mamala Bay Seafood LLC

	• Hawaii Oceanic Technology Inc. • Unlimited Aquaculture • Natural Energy Laboratory of Hawaii Authority
Trade organization	• Ulupono Initiative • Hawaii Venture Capital Association

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