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Dear Ronald Baird:

Enclosed please find our report entitled *Analysis of Marine Aquaculture Policies*. Preliminary work was completed in Worcester, Massachusetts prior to our arrival in Maryland. The report was written at the National Oceanic and Atmospheric Administration during the period October 25 through December 15, 2004.

Copies of this report are being submitted simultaneously to professors Joseph Petruccelli and James Demetry for evaluation. Upon faculty review, the original will be catalogued in the Gordon Library of Worcester Polytechnic Institute.

We would like to thank our liaison, Dr. James McVey, for his help and guidance on our project.

Sincerely,

Magdalene Laszczak

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ANALYSIS OF MARINE AQUACULTURE POLICIES

Report Submitted to:

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Abstract

This project was completed for the National Oceanic and Atmospheric Administration to provide an evaluation of state and federal regulatory policies concerning offshore aquaculture. A sample consisting of eleven coastal states and territories was investigated. Archival research and interviews were conducted to gather detailed information on each state. Recommendations were synthesized to improve federal aquaculture regulations for the Exclusive Economic Zone. A model state was proposed as a means of conveying recommendations for state aquaculture policies.

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- 3: Background: Entire Team
- 4: Methodology: Russell Shuman and Nikhil Sreenath
- 5: Results and Discussion: Magdalene Laszczak and Joseph Papp
- 6: Conclusions: Entire Team
- 7: Recommendations: Entire Team

Appendices:

- A:Sponsor Description: Joseph Papp
- B:Interview Questions: Entire Team
- C:Answers to Interview Questions: Entire Team
- D:State Ranking Algorithm: Joseph Papp and Nikhil Sreenath
- E:Detailed State and Federal Research Findings:Entire Team
- F:Aquaculture Production Values:Russell Shuman

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1.0 Executive Summary

The United States annually imports 11 billion dollars worth of seafood (National Marine Fisheries Service, 2003, p. 1). Through the implementation of commercial aquaculture, it is possible to reduce the United States' dependence on imported seafood. Aquaculture needs to move offshore if the United States is to significantly increase its production of seafood. Open ocean aquaculture is beginning to develop and expand in state coastal waters, but there is little or no expansion in the Exclusive Economic Zone (EEZ).

The goal of this project is to analyze the state and federal regulatory and policy issues for aquaculture in order to synthesize recommendations for improving federal policies and regulations. We examined state policies to inform our framing of federal regulation recommendations. By exploring these different state policies and regulations, it was possible to outline a model state. This model state proposes how a state would promote aquaculture in an environmentally safe way.

Discussions with NOAA representatives led to our decision to research eleven states and territories within the United States. The information on state and federal policies was acquired through archival research and interviews with aquaculture representatives in each state. The research was compiled and analyzed in tables, which are defined in the results and discussion chapter. Our state findings were then compared with federal regulations and policies. Through this research of state and federal regulations and policies, we were able to create a set of recommendations for future federal policies governing the EEZ.

After an extensive analysis of the data, several conclusions were drawn. We found that the public and the government need to be educated on aquaculture in order to make informed decisions. The permit process in many states was long and involved multiple agencies,

making it difficult to open a coastal aquaculture facility. Regulations governing aquaculture at the federal and state level are not clearly defined (Rubino & Wilson, 1993, p. 1). Many states are interested in moving to offshore aquaculture and have addressed aquaculture in their policy making.

These conclusions were based on the analysis of our results and findings. From these conclusions we have drawn five recommendations, including a model state:

We recommend that:

1: The federal government make a definitive determination of which agencies have permitting and regulatory authority in the EEZ.

2: The federal government designate a lead agency for marine aquaculture. A single lead agency with regulatory power is desirable because of the communication and regulation issues inherent with multiple agencies.

3: Environmental regulations be fashioned to protect the environment without placing excessive obstructions on industry growth. Clearly defined and easily accessible regulations need to be created. Environmental regulations concerning aquaculture facilities can minimize pollution. Within these regulations, the agency responsible for enforcement must be specified.

4: Permits be site and use specific. Every aquaculture facility is different and permits need to accommodate each facility. The permitting process should be straightforward, thorough, and efficient. A streamlined permit process that is cost effective can facilitate industry growth.

5: State governments address aquaculture in their policy making

A model state includes:

- A single lead agency in charge of issuing permits and enforcing regulations.

- A streamlined permitting process that is one stop, lasts no longer than 60 days, and clearly defines all fees involved.
- Enforcement through a government agency or a third party.
- Environmental controls, such as mandatory water samples, escape prevention plans, or a yearly survey of the sea floor.

Offshore aquaculture has the potential to prosper in the United States. With the establishment of federal policies for offshore aquaculture and with suitable regulation, the industry can progress in an environmentally safe manner.

2.0 Introduction

The overfishing of indigenous species and the growing demand for seafood has led to the development of aquaculture. The National Aquaculture Act (1980) defines aquaculture as “the propagation and rearing of aquatic organisms in controlled or selected aquatic environments for any commercial, recreational, or public purpose.” Unregulated expansion of aquaculture can lead to damaging effects on the environment. Properly regulated aquaculture provides an efficient means of producing seafood that can aid the United States in competing in the global seafood market. The growing demand for seafood is accommodated by importing billions of dollars of seafood every year, which contributes significantly to the federal trade deficit (Rubino & Wilson, 1993, p. 2). Through the development of a successful aquaculture industry, the United States can maximize its seafood yields and become a global leader in aquaculture.

The National Oceanic and Atmospheric Administration (NOAA) is a government organization that has among its charges the promotion of the best utilization of the ocean resources of the United States. NOAA analyzes the aquaculture industry in hopes of encouraging its growth. For the aquaculture industry to be successful, it must be both productive and environmentally friendly (NOAA, 2002, Mission Statement). Aquaculture can have a substantial impact on the environment and these effects can become devastating if they are not controlled. Federal and state regulations have been implemented to control the aquaculture industry. The diversity and multiplicity of these regulations can be restrictive and can prevent the industry from thriving in United States (Rubino & Wilson, 1993, Chapters I and IV). A combination of effective policies has the potential to encourage responsible offshore aquaculture that employs precautions to minimize negative environmental impacts.

Promoting the growth of aquaculture, while also preserving the environment, is a controversial tradeoff. Legislation on aquaculture in many countries has been too relaxed. Many Asian countries have had problems with pollution caused by poorly regulated aquaculture industries (Cicin-Sain, 2001, p. 105). Some countries have had to shut down their aquaculture operations temporarily while regulations were being modified, while others have been able to modify legislation without a break in aquaculture operations (Cicin-Sain, 2001, p. 127). Since aquaculture falls under both state and federal jurisdiction, aquaculture in the United States is bound by stringent policies and a complex permit process. Previous studies conclude that a policy framework for governing aquaculture is necessary in the United States.

Over the past eleven years, state and federal policies regarding aquaculture have changed, and NOAA has not had the opportunity to analyze them. At present, there is a need for more consistent aquaculture legislation and regulations in the United States. Since specific policies vary from state to state, the growth of large, multi-state aquaculture corporations is hampered, although large corporations would be well suited to the industry because of the high startup cost of entering the market. The future of the aquaculture industry in the United States is still uncertain, but NOAA feels that with improvements in policies and the permit process, aquaculture in the United States can expand in a safe and environmentally friendly way (Rubino & Wilson, 1993, p. 4).

The purpose of this Interactive Qualifying Project (IQP) is to analyze the present coastal state regulatory and policy issues in order to synthesize a recommendation for improving federal policies governing the industry. NOAA needs an analysis of current state aquaculture regulations and practices; such an analysis will enable the agency to predict how states will react to emerging federal policies. Analyzing the effectiveness of state and federal

offshore aquaculture policies will also identify their strengths and weaknesses. Creating a recommendation on how to improve legislation and regulations concerning the aquaculture industry will help NOAA continue to fulfill one of its missions of improving the United States' economy through aquaculture.

3.0 Background

NOAA (1977) defines aquaculture as “the culture or husbandry of aquatic animals or plants by private industry for commercial purposes or by public agencies for augmenting natural stocks” (p. 2). Given the current and future demands for seafood, aquaculture will play a larger role every year to help meet those demands. Presently, the permitting process required to start an aquaculture business is often restrictive to the growth of the industry. The restrictions from government policies and regulations are preventing the U.S. from becoming a major competitor in the global seafood market (Arsenault et. al, 2002, p. 3). Currently, seafood is the second largest import in the U.S., totaling 11 billion dollars a year (NMFS, 2003, p. 1).

While the U.S. aquaculture industry grows slowly, aquaculture is expanding globally. The effects of aquaculture on the environment are one of the most critical factors in regulation. While this has become the primary concern of legislators in the U.S., other countries’ industries have worked with their governments to improve aquaculture and make it profitable without adversely affecting the environment. The U.S. has the potential to develop open ocean aquaculture, and while it is beginning to flourish in some states, aquaculture development remains stagnant in others.

3.1 Exclusive Economic Zone

In 1983, President Ronald Reagan signed proclamation 5030, which established the U.S. EEZ. The EEZ extends up to 200 nautical miles (370 km) from the U.S. coastline. It starts at the end of the state coastal waters that extend to three nautical miles offshore, with the exception in the Gulf of Mexico, which is nine nautical miles. The EEZ falls under

national jurisdiction outlined in the requirements of the 1982 United Nations Convention of the Law of the Sea (FGIS, 2004, Development).

The EEZ provides the opportunity for the expansion of offshore aquaculture establishments. Currently, there are few federal regulations for the Exclusive Economic Zone that explicitly reference aquaculture (Cicin-Sain, 2001, p. 3). With newly enacted federal regulations, the EEZ can become a valuable resource in offshore aquaculture development.

The four terms used to describe the general location of an aquaculture facility are inland, coastal, offshore, and open ocean. Inland aquaculture describes establishments that are located on land and have man made ponds and/or holding tanks. Coastal aquaculture refers to the state controlled waters and extends from the shoreline start of the EEZ. Offshore aquaculture describes a type of farming that uses fish cages and is located inside the EEZ. Open ocean aquaculture encompasses both coastal and offshore aquaculture.

3.2 NOAA's Previous Studies

NOAA has completed previous studies on aquaculture. The study *Issues in Aquaculture Regulation* discusses the environmental impacts of aquaculture, regulations, and the permit process. Through examination of the previous study, it is possible to determine the changes in aquaculture businesses, regulation, and the permit process in the past decade.

3.2.1 Issues in Aquaculture Regulation

Aquaculture is an expanding industry all over the world. In an attempt to promote proper regulation in this growing industry, NOAA presented a guidebook entitled *Issues in Aquaculture Regulation* (Rubino & Wilson, 1993, p. 1). This book was created for a variety of people involved with aquaculture. These people included federal policy makers, legislators, public and private aquaculturists, and representatives of citizen, fishing, and environmental

groups (p. 2). Rubino and Wilson defined the topics they covered, listed what they considered the best management practices (BMPs) for aquaculture businesses, and made recommendations for policies.

The guidebook addressed concerns surrounding the use of public waters for aquaculture. It acknowledges environmental impacts are important concerns and that state legislators need to create clearly defined regulations (p.17). It further contends that by doing in-depth research and being selective on the locations of aquaculture facilities, aquaculture entrepreneurs can profit and not adversely affect public use of the water (p. 21).

3.2.2 NOAA Aquaculture Plan

In 1977, NOAA created an aquaculture plan. This plan was created to deal with what were then viewed as the approaching problems associated with supply of seafood to the U.S. Even in 1977, it was obvious that there would be supply problems with seafood in the coming decades. With growing demand and the realization that wild catch seafood is not in infinite supply, it was predicted that each year it would be harder for the U.S. to find available seafood to import, and prices would rise rapidly (NOAA, 1977, p. 2).

While the rest of the world worked to double its aquaculture production between 1972 and 1977, the U.S. aquaculture industry remained static (p. 5). Because of the rapid increase in the number of aquaculture facilities in overseas countries, many of the environmental aspects of aquaculture production were overlooked. Many countries have now discovered some of the environmental problems associated with aquaculture and have regulated the industry accordingly.

In 1977, shrimp and salmon farms were among the biggest environmental concerns because of the large volume of fish being farmed and the pollution associated with it. While

NOAA's plan called for specific regulations on each kind of fish, salmon and shrimp were consistently cited as the prime examples of how and why legislation needed to be enacted (p. 18).

Recently, there has been growth in aquaculture within the U.S. Yet even with this recent growth, aquaculture in the United States remains a small industry and accounts for less than two percent of aquaculture production worldwide (Cicin-Sain, 2001, p. 13). Two decades ago, there was not much available information on the effects of aquaculture on the environment, but now there are many studies that legislators can rely upon to get all of the necessary background they need to make good decisions (Cicin-Sain, 2001, p. 20).

3.3 Environmental Issues

Aquaculture facilities can have both positive and negative effects on the environment, which raises many concerns in today's society. Negative effects can include water pollution, escaped hatchery fish, and ecosystem pollution. There can also be positive effects on the surrounding environment. Overfishing has decreased natural fish stocks, and aquaculture can provide an alternate resource for the seafood industry. Some farms are designed to replenish natural fish stocks by releasing juvenile fish back into the environment. Federal regulations have been implemented to address these environmental issues with the hope of promoting aquaculture in the United States. For policies to be effective, they have to address the many environmental aspects of aquaculture.

3.3.1 Waste Discharge

Waste discharge and water quality are the two main concerns related to aquaculture. Some fish farms produce large amounts of waste. Wastes can include particles from feces, uneaten food, nutrients from the feces, and chemicals and drugs such as pesticides,

disinfectants, and antibiotics. Discharges from aquaculture can contribute to nutrient enrichment in the surrounding area, which can lead to an increased production of algae. Algae growth can reduce the level of dissolved oxygen in the water and increase the water temperature, both of which harm fish populations (Bardach, 1972, pp. 67-92).

Nutrient pollution, particularly nitrogen, is a primary cause of environmental degradation in marine water (Rubino & Wilson, 1993, p. 15). Nutrient and fecal discharge from fish can be significant on a local scale. *The Aquaculture Magazine* stated that a farm of 200,000 salmon releases an amount of nitrogen equivalent to the waste from 20,000 people and an amount of fecal matter equivalent to the waste from 65,000 people (Hardy, 2000, p. 89). Nutrient pollution of surrounding waters can occur in any type of aquaculture. Typically, pond fish culture is less detrimental to water than are net pens located offshore because pond walls contain the water. However, the nutrient pollution in pond culture also depends on the frequency of waste discharge and the characteristics of the surrounding water (Brown, 1977, pp. 23-45).

The large amount of waste discharge from aquaculture has many environmentalists concerned. During the past twenty years, the federal government has imposed regulations governing aquaculture and the effects of waste products. In 1977, the Clean Water Act was implemented by the U.S. Environmental Protection Agency in order "...to restore and maintain the chemical, physical and biological integrity of all navigable waters" (EPA, 1977, p. 21). This act established the basic structure for regulating discharges of pollutants into the waters of the United States.

3.3.2 Drug and Chemical Use

Drugs and chemicals are used to treat disease outbreaks. Fish are highly susceptible to diseases, especially when living in close quarters such as holding tanks. A wide range of chemicals is used in aquaculture, including antibiotics, pesticides, hormones, pigments, and minerals (Brown, 1977, p. 215). In the United States, there are currently only about five drugs allowed for use in aquaculture (Food and Drug Administration, 2004, Drugs Approved for Use in Aquaculture). The use of chemicals can have potentially harmful effects on human health and surrounding ecosystems.

Disease can be a very large problem in aquaculture because of the high density of fish in each facility. One estimate made in 1992 concluded that more than 200 million catfish and 10 million trout were lost in one year to disease (Schnick, 1992, pp. 16-22). It has been stated that 96 percent of all fish diseases are directly related to stress (NOSB, 2001, Homepage). Since stress is a contributing factor to fish disease, improving water quality, lowering stock densities, and avoiding handling the fish can lower fish stress levels and reduce disease.

Chemicals such as chlorine, which are used to clean the tanks, can have detrimental effects on surrounding aquatic environments. According to Limburg (1980, pp. 56-78), the use of drugs and chemicals in aquaculture raises many regulatory issues. Drugs and chemicals used in fish culture could be inadvertently released into surrounding aquatic environments and negatively affect aquatic and marine species. The release of drugs could produce drug resistant bacteria and cause accumulations of antibiotics in native fish populations.

The use of drugs in aquaculture concerns the public and has to be consistently regulated by the government. Many of the hormones used in aquaculture raise concern because of their effects on humans. The Food and Drug Administration (FDA) has only

approved a handful of drugs for use in fish farms. It would help the industry, but not necessarily the environment, if the FDA could approve more drugs, although funding and time are limited. Additional public funding for the FDA would help develop approvals for new aquaculture drugs, which in turn would help facilities grow (Phillips, 2001, p. 36). Approving more drugs could also increase the environmental risks associated with drugs inadvertently being released into the surrounding environment.

3.3.3 Genetic Threats

Animals and other organisms can be a form of pollution. Aquaculture facilities in the U.S. sometimes unintentionally release their farmed fish into the surrounding environments. These introduced species can have damaging effects on native species by competing for food and habitat, which can ultimately lead to a displacement of biodiversity and extinction of native species (Limburg, 1980, p. 86). Large numbers of fish can escape from pens because of rainstorms or human error in the construction or maintenance of the net pens. Between 1987 and 1996, scientists documented at least a quarter million Atlantic salmon escapees on the West Coast alone (McKinnel & Thompson, 1997, p. 28).

Escapes of native species of farmed fish can harm wild stocks, especially where there are genetic differences among the fish. Hatchery fish have different genetic traits than wild fish have. Many farmed fish are selectively bred to maximize the profits of the aquaculture business. These selective strains can have smaller fins, bigger bodies, and more aggressive feeding behaviors (Limburg, 1980, p. 26). When these farmed fish escape, they interbreed with wild stocks, causing changes in the genetic makeup of the wild stocks. The main concern with selectively bred fish is that their genes will spread through wild species and eventually displace the natural fish populations (Limburg, 1980). One way to minimize the escape of

farmed fish is to build facilities that avert theft and prevent the escape of fish during flooding. Improving aquaculture facility procedures would reduce the chances of farmed fish being released into the natural fish populations.

3.3.4 Environmentalist and Public Concerns

Aquaculture facilities have an impact on the surrounding environment. Coastal aquaculture specifically raises concerns because of the large amount of feces produced by the fish, which deposit onto the sea floor. Environmentalists are concerned that without properly regulated aquaculture production, the benefits to the industry will be minimal compared to the large amount of environmental pollution produced. In an interview with Professor Costa Pierce of the University of Rhode Island, he stated, “the environmental impacts of an aquaculture facility are dependent on the system-type management at that location” (personal communication, September 21, 2004). This includes managing how water is re-circulated and how much effluent is released into the ecosystem. Some fish farms re-circulate and filter the water to minimize the amount of waste discharge and water use. Innovative re-circulation technologies can help businesses decrease the amount of waste discharged to the surrounding ecosystems (Gifford, 2004, pp. 34-46).

Similar to agriculture, aquaculture is considered a type of farming and there will always be waste discharge and pollution that is inherent to raising organisms. Aquaculture may never become a large industry in the U.S. because its environmental effects raise significant public concerns. Regulations that address environmental issues can reduce the pollution caused by these facilities and help alleviate public fears.

3.4 Industry

The aquaculture industry has the potential to equal traditional fishing as a primary method of seafood production. This section outlines how the United States can benefit from aquaculture and lessen its dependence on foreign seafood sources. It also describes the obstacles to growth.

3.4.1 Economic Benefits of Aquaculture

The United States' demand for seafood can be satisfied through domestic aquaculture. The retail seafood market, which is largely dominated by supermarket chains, demands large volumes of seafood on a regular basis during all parts of the year (NOAA, 2002, Appendix I). Domestic fishermen are only able to supply the seafood market on a seasonal basis due to the weather-dependent nature of their work. In order to meet the demand for seafood during all seasons of the year, the United States relies on imported seafood, which is almost always produced through aquaculture (NOAA, 2002, Appendix I).

According to one NOAA publication (2002, p. 31), "each dollar spent to produce an aquaculture product generates an additional \$2.50 of goods and services in the economy." This means that aquaculture is a profitable business that is more efficient financially when compared with traditional methods of fishing. Aquaculture can significantly benefit the economy of the United States, both in terms of increasing employment and reducing the national trade deficit (p. 31).

3.4.2 Obstacles to Growth

One reason why aquaculture has not grown as fast in the United States as it has in other countries is the complex and expensive permit process that a business must go through in order to start an operation. An aquaculture business wanting to open in the U.S. must get

permission from the Environmental Protection Agency, the U.S. Department of Agriculture, the U.S. Navy, and the U.S. Army Corps of Engineers, as well as all state regulatory agencies (Arsenault et. al, 2002, U.S. Policy).

Although the United States ranks third among nations in consumption of seafood, it is only eleventh in terms of aquaculture production (Goldburg, Elliott, & Naylor, 2002, p. 10). The aquaculture industry in the United States has the potential to grow and become the premiere seafood source in the world, but much work still needs to be done to streamline the process of starting and operating an aquaculture firm.

3.5 Government Regulation

Aquaculture is bound by the regulations that govern it on both the state and federal level. These regulations help ensure that aquaculture does not cause unforeseen problems to the public and the environment. Government regulations consider public health, industry restrictions, and the environment.

3.5.1 Present Problems

Present government regulations have caused many problems for the aquaculture industry. These regulations create an environment, which is not conducive to profits (Cicin-Sain, 2001, p. 10-13). There are numerous examples showing how inappropriate policies for governing marine aquaculture have hurt the industry. In many states, such as Massachusetts and Washington, applicants must fill out a large number of permit applications from several agencies. This becomes a long process costing a significant amount of money and deterring applicants from wanting to open aquaculture facilities. Without consistent and well defined processes, regulations have hindered industry success.

3.5.2 Federal Regulation

Numerous pieces of legislation regarding aquaculture have been enacted at the federal level. The following sections highlight the important aspects of federal legislation on aquaculture. The legislative acts paved the way for a broad range of federal regulations on aquaculture.

3.5.2.1 Magnuson Stevens Fishery Conservation and Management Act 1996

The purpose of the Magnuson Stevens Fishery Conservation and Management Act is to preserve the natural fishery resources of the United States (Feder, 1996, Purposes). The act recognizes that a sound fishing management system needs to be established before overfishing causes irreversible damage to the environment. Eight regional fishery management councils were created to oversee aquaculture in the EEZ.

3.5.2.2 Endangered Species Act 1973

The Endangered Species Act affects aquaculture by protecting species on the verge of becoming endangered or extinct (LeBlanc, 2004, Background). Since aquaculture systems use the same waters that other wildlife uses, a restriction enacted to protect an endangered animal could have an adverse effect on an aquaculture business. There is controversy over whether the federal government should reimburse companies and individuals who sustain significant economic losses while trying to protect endangered species.

3.5.2.3 Coastal Zone Management Act 1972

Another major piece of federal legislation is the Coastal Zone Management Act (CZMA). The goal of the CZMA is to preserve and protect coastal resources (OPIS Southeast, 2004, Coastal Zone Management Act). States create coastal zone management programs (CZMPs) that allow them to get financial and technical support provided through the CZMA.

CZMPs must be federally approved and must meet a strict set of standards. States with CZMPs review any activity allowed in waterways located in their particular state.

3.5.2.4 The Lacey Act

By restricting the movement of commercially sold wild species, including farm-raised fish, the Lacey Act restricts aquaculture growth. This act makes it unlawful to participate in commercial transactions involving any type of wild species when it is against state, federal, Native American tribal, or foreign law (US Fish and Wildlife Service, 2004, Lacey Act). Although this act seems to have little to do with aquaculture, it can affect aquaculture in certain situations (Anderson & Spatz, 1999, Regulation). For example, if a fish is transported into a state where aquaculture or the sale of farm-raised fish is illegal, the sale of that fish would be illegal.

3.5.2.5 National Aquaculture Act of 1980

The National Aquaculture Act of 1980 was enacted by Congress to establish a national aquaculture policy. This policy initiated a national aquaculture development plan and was intended to promote and support the advancement of aquaculture. Congress recognized aquaculture as having the potential to reduce the U.S. trade deficit in seafood products and provide a renewable resource for the country (National Aquaculture Act of 1980, 1980). This act also established a Joint Subcommittee on Aquaculture (JSA). The 1985 amendment to the act designated the United States Department of Agriculture as the permanent chair of the JSA.

3.5.3 Government Organizations

Many federal organizations have control over issues that affect aquaculture. It is important to understand the role that federal organizations have with respect to aquaculture to understand how these organizations are involved with policy creation.

3.5.3.1 National Oceanic and Atmospheric Administration

The National Oceanic and Atmospheric Administration (NOAA) has the strongest statutory basis for promoting and regulating marine aquaculture, since it is designated as the Federal Oceans agency (NOAA, 1998, Introduction). NOAA is divided into five main branches. These branches are: National Environmental Satellite, Data, and Information Service (NESDIS), National Marines Fisheries Service (NMFS), National Ocean Service (NOS), National Weather Service (NWS), and Office of Oceanic and Atmospheric Research (OAR). NOS, OAR, and NMFS work with aquaculture in the United States. NMFS's mission is to manage the commercial and recreational fisheries in the EEZ and also regulate fishing in the EEZ. OAR conducts research and has a division called the National Sea Grant College Program, which is responsible for funding college research programs. NOAA has brought together NOR, OAR, and NMFS to improve aquaculture in the United States. NOAA is creating a comprehensive aquaculture policy that will serve as a federal framework for the next ten to twenty years. This policy framework, if implemented, would help ensure the growth of aquaculture in the United States.

The National Marine Fisheries Service (NMFS) is a division of NOAA that is “responsible for the stewardship of the nation’s living marine resources and their habitat” (NMFS, 2004, p. 7). The division is particularly concerned with the protection of marine life in the EEZ. NMFS considers aquaculture to be a possible method of restoring depleted wild fish stocks. NMFS has been designated to manage the economic use of the EEZ (p. 8).

3.5.3.2 U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers has an interest in maintaining the navigability of U.S. waterways (Massachusetts Coastal Zone Management Office, 2004, Aquaculture White

Paper: Legal and Regulatory Issues). Aquaculture, if not managed properly, could hinder the navigability of major U.S. waterways. As described in the Federal Clean Water Act and section 10 of the Rivers and Harbors Act of 1899, the Corps issues Programmatic General Permits (PGP) that help protect against unauthorized dredge and fill from obstructing waterways.

3.5.3.3 United States Department of Agriculture

One of the federal agencies with primary jurisdiction over marine aquaculture activities is the USDA. Although this agency was designated as the lead agency in the National Aquaculture Improvement Act of 1985, NOAA and the U.S. Fish and Wildlife Service also have strong jurisdiction over aquaculture (Harris, 2004, About). Regional Aquaculture Centers (RACs), that encourage research in aquaculture, have been set up by the USDA (Harris, 2004, About). There are a total of five RACs and their mission is to support aquaculture research that would benefit consumers and the American economy by better utilizing natural resources.

3.5.3.4 Environmental Protection Agency

Protecting the quality of water is one of the many responsibilities of the EPA (EPA, 2004, Background). With the aquaculture industry expanding, water quality is a growing concern. The EPA is responsible for issuing National Pollution Elimination Discharge System (NDPES) permits. NDPES permits are jointly issued with individual state departments of environmental protection through consultation with specialists in the field.

3.5.3.5 Joint Subcommittee on Aquaculture

The Joint Subcommittee on Aquaculture (JSA) is a committee consisting of representatives from several federal agencies and was created by the National Aquaculture

Act of 1980 (Mayeaux, 2004, Homepage). Some of the JSA members include the Secretary of Agriculture, Commerce, and Energy. The JSA meets to discuss current issues in aquaculture and creates recommendations to increase the overall productivity of federal aquaculture research and assistance programs.

3.6 Conclusion

Aquaculture in the United States has been slow to develop partly because of the stringent policies and regulations at the state and federal level. From environmental to industrial aspects, there is a need for legislation to help the aquaculture industry as well as protect the environment. With properly defined and enforced regulations, marine aquaculture can flourish in the United States.

4.0 Methodology

In this project, present state regulatory and policy issues for open ocean aquaculture were analyzed and a recommendation for improving federal policies was synthesized. From completed background research, the principle concepts that needed to be investigated further were determined. This methodology section outlines the important state and federal policy issues that we analyzed for NOAA and how the analysis was completed. Each of these was researched through archival research and interviews. The goal of this methodology section is to provide a detailed illustration of the methods used to complete the project.

4.1 State Policies

We chose the states whose policies were analyzed based on the desire for geographical diversity and on recommendations from our contacts at NOAA. The final list of states and territories is as follows:

- Alaska
- California
- Florida
- Hawaii
- Louisiana
- Maine
- Massachusetts
- New Hampshire
- Rhode Island
- Washington
- Puerto Rico

Archival research was conducted on the permitting process, regulations, environmental controls, and educational outreach programs in each state. State policies were obtained from state regulatory agency websites as well as from sources found at the NOAA Central Library. The information found on each state is located in the results section of this report.

The findings from archival research were augmented by interviews with aquaculture representatives in each state. State aquaculture coordinators were identified through a list maintained by the State Aquaculture Coordinators Association. Representatives from state

agencies responsible for regulating aquaculture were contacted in those states that did not have a designated aquaculture coordinator. Phone interviews were proposed with the coordinators through email, but we were willing to conduct email interviews for those who preferred electronic correspondence.

A list of specific questions for each state was drafted, as well as a list of common questions to ask all of the states. The common questions were created to acquire information on offshore aquaculture in each state. Specific questions were asked to obtain additional material on specific state policies and regulations that could not be found in our research. A list of the detailed and common questions asked of each representative can be found in Appendix B. A detailed summary of each interview can be found in Appendix C.

A chart was created to characterize, classify, and compare our findings for each state based on the results of our archival research and interviews. The categories were selected to differentiate the strengths and weaknesses of each state's aquaculture policies and processes, and can be found in Table 4.1. Qualities for each state were categorized into high, medium, and low, based on their effectiveness in promoting aquaculture in a safe and environmentally friendly way.

The criteria were used to rate each category as high, medium, or low. A high rating in any section promotes aquaculture in a safe and environmentally friendly way. A low rating restricts the growth of the offshore aquaculture industry through policies or procedures such as stringent environmental regulations. The ratings for each category were entered into the ranking algorithm found in Appendix D. The algorithm determines whether the category should be ranked as a high, medium, or low overall. The final outputs of the algorithm were placed into Table 5.1 in the Results and Discussion section, and were used as an evaluation tool.

Table 4.1 – State Policy Ranking Criteria

Category:	Criteria:	High characteristic and explanation	Low characteristic and explanation
Permit Process:	Time required	Less than 60 days - businesses can start their facilities sooner	More than eight months - businesses must wait longer to start their facility
	Paperwork	Small amount - easier to obtain permits	Large amount - difficult to obtain permits
	Easy to find what you are looking for	Yes - easier to obtain permits	No - difficult to obtain permits
	Number of state agencies	One agency – simplifies the process	Multiple agencies - difficult to contact multiple agencies
Aquaculture Production Value:	Aquaculture production values	More than 100 million dollars - represents progress of aquaculture	Less than 10 million dollars - aquaculture has created less revenue
Education:	Public education	Present - well-informed public minimizes false pre-notions of aquaculture	Not present - more difficult for public to make informed decisions
	College education	Programs in place - promotes graduates to enter the aquaculture industry	No programs - does not encourage aquaculture industry
Fishermen Support:	Fishermen support	Present - fishermen see aquaculture as means to improve the industry	Not present - fishermen have strong opposition to aquaculture
Movement Offshore:	Attitude towards development	Positive - shows willingness of state to move offshore	Negative - state is not willing to move offshore
	Research in aquaculture	Present - improves technologies to minimize environmental effects	Not present - research needs to be done to improve aquaculture and its impacts
	Commercial aquaculture	Present - signifies that the state has already begun moving offshore	Not present - the state has not been able to move offshore
	Past/present offshore facilities	More than one – shows progress towards moving offshore	None – no past or present movement offshore
Government Support:	Guidance in starting a business	Provided - reduces the time and money a business must spend researching policies	Minimal guidance provided - business must spend its own resources to acquire necessary information
	Agency created for aquaculture	Yes - one agency devoted to aquaculture can focus its resources on aquaculture	No - other department priorities may overshadow aquaculture
	Plans for aquaculture development	Present - provides a direction for the industry and how it can be improved	Not present - state has no direction for industry growth

We extracted a list of the categories in each state that were rated high on the state characteristics chart. The details of why each category was rated high for a state were examined. The same procedures were followed for the low categories. The specific qualities that resulted in high and low ratings were compiled together and evaluated. This information was synthesized into a recommendation for federal offshore aquaculture procedures and regulations. A graphical representation of this synthesis procedure is located in Figure 4.1.

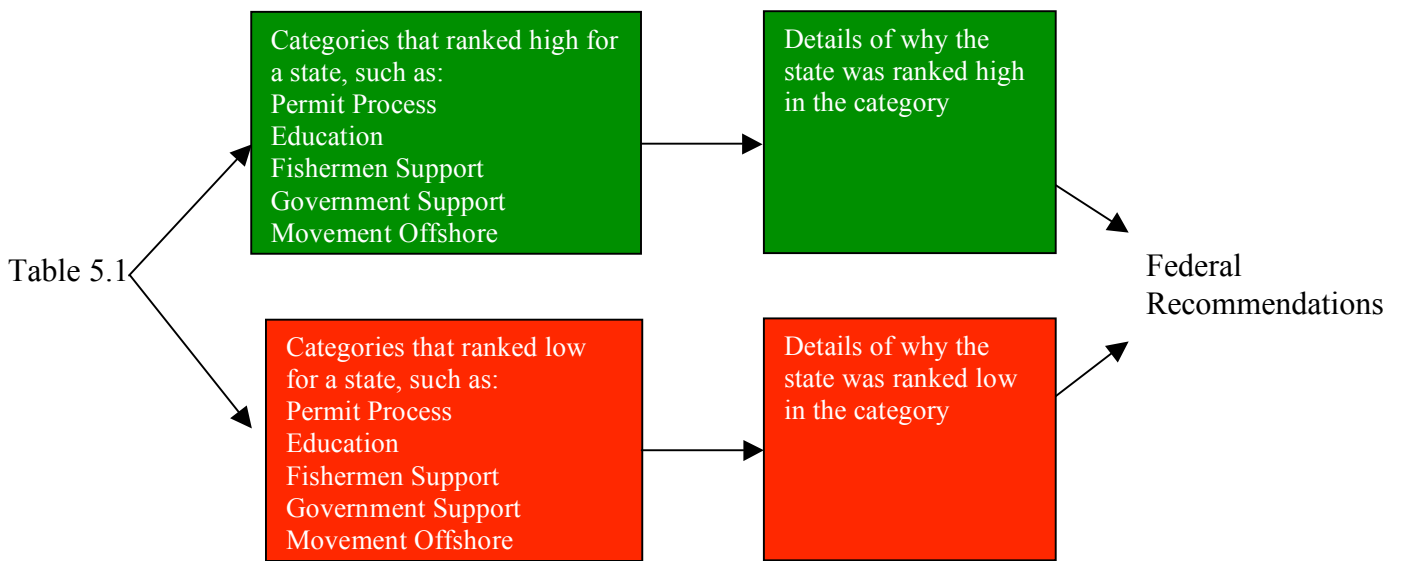


Figure 4.1: Graphical Representation of Synthesis Procedure

4.2 Federal Policies

Our primary method for researching federal aquaculture policies was archival research. NOAA’s Central Library was utilized to explore federal aquaculture legislation and regulations. NOAA’s library holds peer-reviewed journals from which we gained an understanding of the role federal legislation and regulation play in aquaculture. Law reference books served as a compilation of all applicable aquaculture policies at the federal level. Summaries of the applicable federal aquaculture policies can be found in the background section and in our results. By researching federal aquaculture regulations, we obtained a better

understanding of how to synthesize the results of our state research into a recommendation for federal policies.

5.0 Results and Discussion

A summary of the results of our archival research and interviews is presented and discussed in this chapter. The detailed results from our federal and state research are presented in Appendix E. Our findings were analyzed through the procedures documented in our methodology.

5.1 Coastal States and Territories

By researching the eleven coastal states and territories, it was possible to compile the information into six categories: education, fishermen support, government support, permit process, movement offshore, and aquaculture production values. These categories are the important issues surrounding open ocean aquaculture and offer critical points of comparison. We acquired the insight necessary for providing our recommendations by thoroughly exploring these issues.

5.1.1 Education

Educating the public about aquaculture is an important element in fostering the growth of the industry. The public needs to be informed of benefits and environmental concerns of open ocean aquaculture, since public opinion influences its development. For example, in Massachusetts the public has the power to deny an aquaculture business the ability to open (S. Soares, personal communication, November 10, 2004). Public forums allow citizens to voice their concerns and have them addressed by the aquaculturist.

Washington, Florida, Hawaii, Massachusetts, New Hampshire, and Rhode Island conduct aquaculture education in academic settings. Washington has a School of Fishery and Science that educates young people about aquaculture (Senator Swecker, personal

communication, November 19, 2004). NOAA Sea Grant has programs established in all of the states we sampled to conduct aquaculture research at the college level.

5.1.2 Fishermen Support

Fishermen's opinions about aquaculture tend to be negative, but as natural stocks become depleted fishermen look toward aquaculture. Alaskan fishermen oppose aquaculture because its development could lead to the decline of the fishing industry. On the other hand, New Hampshire fishermen have a more positive outlook on the aquaculture industry because of the trouble they are having with depleted natural stocks, especially Cod.

The fishing industry's support of aquaculture can be a powerful tool for the development of aquaculture. Snapper Farm Inc was able to obtain a permit for open ocean aquaculture quickly, partly because of the support they received from the Culebra Fishermen's Association (Bridger & Costa-Pierce, 2003, p. 267).

5.1.3 Government Support

Support from the government is required if the aquaculture industry is to grow. The industry can not easily progress without government funding, effective regulations, and a lead agency for aquaculture permitting. Regulation of the aquaculture industry is necessary for environmental protection. The state and federal regulations governing aquaculture need to be flexible enough to allow aquaculture to develop and at the same time minimize negative environmental effects.

Offshore aquaculture operations can have many effects on the surrounding environment. Environmental pollution from aquaculture can not be completely avoided, but with proper regulations and enforcement it can be minimized. If aquaculture is to be promoted

in a safe and environmentally friendly way, state environmental regulations need to be well defined and address all public concerns.

Some states have selected a lead agency for the regulation of aquaculture. California has designated the California Department of Fish and Game (CDFG) as its lead agency, and legislation was passed to provide guidelines and authority for aquaculture regulations (Conte, 2003, Agency). This agency is empowered to govern the aquaculture industry and establish proper regulations.

Other states, such as New Hampshire and Alaska, have few regulations explicitly addressing open ocean aquaculture. New Hampshire is hoping to create proper regulations when its research on coastal aquaculture is complete. In contrast, Alaska sees aquaculture as a threat to its fishing industry and is hesitant to incorporate finfish aquaculture into its economy.

5.1.4 Permit Process

The permit process is one of the first steps in starting an aquaculture business and is critical in ensuring the safety of the environment. An applicant must obtain all the necessary permits from the regulatory agencies, which vary in number and complexity from state to state.

Rhode Island has created a “one stop” permitting process by giving aquaculture regulatory power to one agency, the Coastal Resource Management Council (RI CRMC, 2004, Homepage). The time required to obtain the necessary permits can be very long and can discourage the applicant, but Rhode Island has reduced this time by having the review process last only thirty days (RI CRMC, 2004, Aquaculture Application Package).

In contrast, Washington has a very complex permit process with many agencies having jurisdiction over aquaculture. The multiple agencies make the permitting process

difficult because of the time required to coordinate between the agencies. The time for acquiring the permits tends to increase with the number of agencies involved.

Alaska has banned finfish aquaculture, with the exception of non-profit salmon hatcheries. The permit process for offshore aquaculture is not established since finfish aquaculture is not allowed, and the salmon hatcheries have to work with several state agencies to obtain the required permits. In addition, the window of applying for a permit is open only four months every other year.

States that have recognized the potential economic benefits of aquaculture have attempted to streamline the permit process. For example, the Massachusetts Department of Food and Agriculture created the Permits Guidance Document, which provides all the necessary information for an applicant who wants to start an aquaculture facility. Other states, such as Florida, have a single agency responsible for issuing aquaculture permits. This lead agency improves the permit process for open ocean aquaculture and supports the growth of the industry.

5.1.5 Movement Offshore

States such as Hawaii and New Hampshire want to investigate the feasibility of open ocean aquaculture. New Hampshire has funded a coastal aquaculture research site. At this site, different aspects of offshore aquaculture are being investigated, such as pollution, production, and waste management. The state is utilizing the site to see how viable offshore aquaculture is in its coastal waters (Cooperative Institute for Coastal and Estuarine Environmental Technology, 2004, Homepage).

Hawaii and Puerto Rico are the only two states we researched that have commercially owned and operated coastal aquaculture establishments. Snapper Farms Inc is located off the

coast of Puerto Rico and Cates International was established from a research facility in Hawaii. These states provide examples of the feasibility of future offshore aquaculture development.

5.1.6 Aquaculture Production Value

The production value was one indicator used to assess each state's aquaculture industry. There is no standardized reporting practice of production values for aquaculture. The production values that were gathered vary from aquaculture farm gate values to the total amount of aquaculture revenue for a year. The values we collected represented both inland and offshore aquaculture production and are all from the recent past. Louisiana has the highest production value, \$120 million, of the states we investigated. This value is attributed to the large inland aquaculture industry of the state (Louisiana State University AgCenter, 2004, Introduction). The range of aquaculture production values was useful in analyzing past successes that states have had with the aquaculture industry.

5.1.7 Federal Jurisdiction in the Exclusive Economic Zone

Our federal research provided us with additional insight for analyzing the interaction between state and federal policies. When the National Aquaculture Act was amended in 1985, the United States Department of Agriculture was designated as the permanent chair of the Joint Subcommittee on Aquaculture. NMFS has regulatory power over the EEZ, but the USDA could become a major player in regulating the EEZ if aquaculture is defined as a part of agriculture. For more information on the USDA and NMFS, refer to the Background chapter. The details of our federal research results can be found in Appendix E.

5.1.8 Analysis and Discussion

Given the large number of states and attributes, an analysis tool was devised to find trends. From the six categories, a graphical method of distinguishing the differences between the categories in each state was created. Following the criteria in each of the six categories in Table 4.1, each state was rated as a high, medium, or low in each category. A high rating in any section means that it promotes aquaculture in a safe and environmentally friendly way. A low rating in any section means that it restricts the growth of the offshore aquaculture industry through policies or procedures such as stringent environmental regulations. From this table, an algorithm described in Appendix D averaged the criteria into one rating per category per state. The detailed rankings for each criterion are located in Table D.1. The final output of the algorithm is in Table 5.1. Colors were added to the table to aid in analysis - low is red, medium is yellow, and high is green. From this table, noticeable trends are documented.

Table 5.1 – State Characteristics

State	Education	Fishermen Support	Government Support	Permit Process	Movement Offshore	Aquaculture Production Value
AK	M	L	L	M	L	M
CA	M	M	L	L	L	M
FL	H	M	H	H	M	H
HI	H	M	H	M	H	M
LA	M	M	M	L	M	H
MA	M	H	H	H	M	L
ME	M	M	M	L	M	M
NH	M	M	M	L	M	L
RI	M	M	H	H	M	L
WA	M	M	H	L	M	M
Puerto Rico	H	H	M	H	H	L

By grouping the states based on categories such as geographic location, general high and low tendencies, and land area, we were able to make several observations about the collected state data.

There are noticeable differences between results for the northern and southern states. For instance, Table 5.1 shows that aquaculture production values were lower in northern states than they were in southern states. This trend brings to light another issue involved with aquaculture development: locations selected for aquaculture could depend on water temperature, because different fish are native to different climates.

The northern states contain eleven out of the sixteen low ratings. The majority of these low values reside in the permitting processes column and in the aquaculture production value

column. This implies that the southern states have made more progress toward aquaculture development than the northern states have.

The permitting process varies greatly between states. Five states (CA, LA, ME, NH, and WA) have low ratings for permitting process, but only New Hampshire has a low value for both aquaculture production and permitting process. Four states (CA, LA, ME, and WA) have a low rating in the permit process category and also have either a medium or high aquaculture production value. Louisiana has shown that aquaculture production can thrive even with a difficult permitting process. Even with low ratings for permitting process, states such as New Hampshire are still conducting offshore aquaculture research. Most of this research is being conducted through the Sea Grant program.

The education category has no low values because Sea Grant has programs established in all of the states we sampled. This is important because it shows that these states are addressing the future of aquaculture through education of their citizens. By promoting public awareness through education, they can foster industry development and improve their economy.

Many fishermen support aquaculture development because of depleted natural fish stocks. Alaska was the only state to rank low in fishermen support because its fisheries are not as depleted as other regions of the U.S. With the growing demand for seafood, it is becoming apparent that the development of offshore aquaculture is an important step towards meeting the demand.

While many states have policies that promote aquaculture in a safe and environmentally friendly way, there are also policies that still restrict the growth of the

aquaculture industry. The results and analysis from our state and federal research are utilized to draw our conclusions and formulate our recommendations.

6.0 Conclusions

Our conclusions were synthesized from our findings after reviewing state and federal policies of the eleven states chosen. The following list contains the states we sampled, grouped by geographic location.

- | | | |
|---------------------|-----------------|--------------|
| Gulf of Mexico Area | New England | West |
| • Puerto Rico | • Rhode Island | • Alaska |
| • Louisiana | • Maine | • Washington |
| • Florida | • Massachusetts | • California |
| | • New Hampshire | • Hawaii |

This is one way that the data was separated to analyze trends. We analyzed the states that ranked low and high in the categories in Table 5.1: Education, Fisherman Support, Government Support, Movement Offshore, Permit Process, and Aquaculture Production Value. General conclusions were formed based on the attributes that were used to classify each category as a high or low. The conclusions are the basis for our recommendations to NOAA.

6.1 Education

Florida, Hawaii, and Puerto Rico were ranked as high in the education category. The NOAA Sea Grant program is well established in all of the states that ranked high in education. In Hawaii, public education is done through workshops, technical reports, tip sheets, site visits, and other means (HSGCP, 2004, Extension). Florida has elementary school programs in place to educate children about aquaculture. Having these types of educational programs can encourage people to start aquaculture businesses in the future. Aquaculture education is a helpful tool in providing growth for the industry.

No states ranked low in the education category, because every state had at least one aquaculture education program. However, the presence of an educational program is only one small step in supporting the development of aquaculture. For example, finfish aquaculture is prohibited in Alaska, despite its Sea Grant College Program.

6.2 Fishermen Support

Maine and Puerto Rico ranked high for fishermen support of aquaculture. The backing of the Culebra Fishermen's Association for open ocean aquaculture made it possible for Snapper Farm Inc to complete the permitting process quickly (Bridger & Costa-Pierce, 2003, p. 267). Maine fishermen have become much more pro-aquaculture since natural stocks became depleted along the New England coastline.

Alaska ranked low for fishermen support of aquaculture. Alaska's natural stocks are not depleted and the thriving fishing industry perceives aquaculture as a threat. By supplementing natural stocks with Salmon from non-profit Salmon hatcheries, Alaska has been able to maintain its natural stocks. Until fish populations decline, it is unlikely that the fishermen will endorse the development of aquaculture.

The voice of the state fishing industries can impact the progression of aquaculture. The fishing industry can have strong opposition to aquaculture because of the impact aquaculture has on it. Farm raised fish compete in the seafood market and sometimes cost less when compared with the price of wild fish. In states such as New Hampshire, where natural stocks have been depleted, fishermen have begun to support the development of the aquaculture industry as a means of creating additional employment opportunities (Stickney & McVey, 2002, p. 71).

6.3 Government Support

Out of the states sampled, government support ranked high in five states (FL, HI, MA, RI and WA). These state governments have recognized aquaculture as a profitable industry that can be regulated to minimize negative impacts on the environment. All of these states have clearly defined environmental controls and all have open ocean aquaculture permitting processes. Aquaculture has been included in their strategic plans and policies, which have provided recommendations on how to improve the industry.

Alaska and California were the two largest states in land area that we sampled. Alaska has low government support because of its extensive fishing industry and it has banned finfish aquaculture (State of Alaska Legislative Affairs Agency, 2004, Current Alaska Statutes). If Alaska's natural fish stocks become depleted, the government may recognize a need for developing offshore aquaculture. California's particularly high environmental concerns hinder the growth of aquaculture and make it a difficult to start a business.

Government support for aquaculture can be encouraged through education. Educating government officials on inland and offshore aquaculture can help them acquire a well-informed opinion of the subject. Well-informed lawmakers can establish objective regulations for offshore aquaculture. Once state governments recognize the economic benefits of developing environmentally safe open ocean aquaculture regulations, the industry will have a greater opportunity to expand. Government support must also include funding for research and agencies to regulate the aquaculture industry.

6.4 Permit Process

A state that ranked high in the permit process category also ranked high in government support, education, or both. It is evident that a streamlined permitting process can not exist

without support from the government. Even though the movement to offshore aquaculture may not reflect the ease of the particular permitting processes, states that ranked high in this category are interested in developing their coastal waters.

Five states (CA, LA, ME, NH, and WA) ranked low in the permit process category. These states tend to have a lower value for government support and education compared with states that ranked high in the permit process. Permitting processes that rank low usually contain multiple regulatory agencies, time-consuming processes, and regulations that are not clearly defined. Permit processes that contain these types of problems can restrict the growth of aquaculture through the costs imposed on emerging aquaculture businesses.

Streamlined permitting processes are necessary for developing offshore aquaculture. High business startup costs make it especially difficult to establish a business in a state where the permitting process is long or expensive. A simple and clearly defined permit process makes it easier for offshore aquaculture applicants to start a business. Permits are a form of regulation and can help prevent unnecessary environmental pollution.

6.5 Movement Offshore

There is interest in moving offshore in many states (FL, HI, LA, MA, ME, NH, RI, WA, PR), but the majority of them have no commercially owned and operated facilities. Puerto Rico and Hawaii are the only states or territories that ranked high for movement offshore. Puerto Rico and Hawaii have begun offshore aquaculture work on a commercial scale (Bridger & Costa-Pierce, 2003, p. 267).

California and Alaska were classified as low for offshore movement. California's Hubbs Sea World Research Institute is interested in using abandoned oil platforms in the ocean to develop coastal offshore aquaculture, but no work has actually been started on these

facilities. There will be no offshore aquaculture in Alaska until legislation is amended, since it is currently prohibited.

Movement for offshore aquaculture in the United States is primarily research-based. States such as New Hampshire are conducting research offshore in an effort to study what kinds of environmental impacts occur and determine whether or not they should continue to pursue the development of this industry. Government research programs are a step in the right direction for the U.S. to extend its aquaculture industry offshore.

6.6 Aquaculture Production Value

Two states fall into the high category for aquaculture production value and neither of these states have any open ocean aquaculture. With an aquaculture production of 120 million dollars, Louisiana is the largest aquaculture producer of the eleven states we sampled, yet this amount is still very small when compared to the 11 billion dollars of yearly seafood imports (Lutz & Romaine, 2003, p. 1). A high aquaculture production value indicates that Louisiana has progressed with meeting the demand for seafood through aquaculture. Florida's aquaculture production value is approximately 100 million dollars, and primarily consists of tropical ornamental fish (Florida Agriculture Statistics Service, 2004, p. 1).

Approximately half of the states (CA, LA, ME, NH, WA) we investigated have low aquaculture production values. Each of these states generates less than ten million dollars a year in revenue from aquaculture. The sum of the aquaculture production values in all the low states is far lower than the value produced in a single state that ranked high in aquaculture production. This illustrates the considerable difference in production values between states. However, the fact that some states are smaller geographically and by population must be

taken into account. The states with low production values all have a relatively small size and coastline.

The total value of aquaculture produced in the United States is one billion dollars per year (Economic Research Service, 2004, p. 1). For aquaculture to make a significant impact on the 11 billion dollars worth of seafood imported every year in the U.S, the value of aquaculture production must dramatically increase.

7.0 Recommendations

Federal regulations and legislation for offshore aquaculture in the EEZ need to be developed further. The United States' Exclusive Economic Zone is the largest in the world, which provides a substantial opportunity for offshore aquaculture. The United States should take advantage of the resources the EEZ can offer. Our recommendations to NOAA address the following issues concerning offshore aquaculture: regulatory agency, permitting process, and government support. These recommendations will also serve as a resource for states to use in establishing aquaculture policies.

We recommend that:

7.1 Recommendation 1: The Federal Government Make a Definitive Determination of Which Agencies Have Permitting and Enforcement Authority in the EEZ

A topic that federal aquaculture legislation will need to address is which agencies are responsible for permitting and enforcement of regulations in the EEZ. For the aquaculture industry to grow, it is necessary for the agencies with enforcement authority to be clearly designated to ensure that regulations are followed. The government must also be clear about which agencies are responsible for permitting in the EEZ to avoid confusion. This determination will be important in any future aquaculture legislation.

7.2 Recommendation 2: The Federal Government Designate a Lead Agency for Marine Aquaculture

The number of federal agencies with regulatory power over aquaculture in the EEZ should be as small as possible. It would be preferable to have one lead agency to create regulations based on the advice of other government organizations, such as the Army Corps of Engineers and the Environmental Protection Agency, as opposed to multiple agencies that could create contradicting regulations.

7.3 Recommendation 3: Permits Be Site and Use Specific

The permitting process should be straightforward, thorough, and efficient. A permitting process that is quick, but does not provide adequate protection for the environment, is not acceptable. It would be preferable to have a longer permitting process that contains all of the required environmental controls over one that is short and may cause problems in the future.

Permits should have an appropriate level of detail. A typical permit should include the type of species to be cultured, the water area to be utilized, and the type of cage or process to be used. Since no aquaculture establishments are identical in operation and location, permits should be site specific. The permitting agency needs to provide adequate time for other agencies, government officials, and the public to voice their opinions about each aquaculture application. There should be no more than three hearings for the interested parties to address their concerns. Each permit should be reviewed within 90 days and hearings should be scheduled at regular intervals throughout this time.

7.4 Recommendation 4: Environmental Regulations Be Fashioned to Protect the Environment without Placing Excessive Obstructions on Industry Growth

We recommend that the government create more clearly defined regulations and legislation pertaining to aquaculture to allow the industry to have a better opportunity to grow. Regardless of whether or not the federal government is interested in supporting offshore aquaculture, it needs to create more clearly defined legislation and regulations.

Environmental regulations for offshore aquaculture need to minimize pollution and allow the industry to progress. Having strict environmental regulations can make starting a business very difficult. Properly regulated aquaculture facilities can minimize pollution

through the use of best management practices. The enforcement of these regulations also needs to be addressed. We recommend that a government agency or a third party contractor conduct site inspections to make sure that regulations are being properly followed.

7.5 Recommendation 5: State Governments Address Aquaculture in Their Policy Making

We are forming our recommendation for state policy frameworks in the outline of a model state. In this state, a lead agency for aquaculture coordinates the permitting process and environmental regulations. Its existence removes communication problems inherent with multiple agencies. Issues that arise with aquaculture regulation and permits are easily identified and resolved. The goal of the agency is to coordinate the permit process with the aquaculture industry while ensuring environmental and public safety. This is accomplished through periodic inspections, required environmental protection plans, and the use of best management practices. Utilizing a lead agency allows that agency to notice and document any industry problems or extensive environmental impacts.

The permit process in the model state is “one-stop”, since one lead agency is coordinating it. Permits are site and species specific, since different establishments and species have varied management requirements. A detailed, single-permit application allows for all information on a proposed facility to be stored in a central location. A single permit application is beneficial for both the state and the applicant, since it avoids potentially repetitive applications. Regulations for the industry are clearly defined and easily accessible via published documents in addition to a website for interested parties. This process saves time for both parties and makes it easier and more cost-effective for businesses to be established.

Environmental monitoring is required to ensure that aquaculture sites operate in an environmentally safe way. Monitoring is scheduled at regular intervals to prevent unnecessary environmental damage. An accredited third party contractor or a representative from the lead aquaculture agency performs the actual monitoring.

7.6 Conclusion

We hope that these recommendations will be useful to NOAA and other state and federal agencies in establishing regulations for open ocean aquaculture in state waters and the Exclusive Economic Zone. Establishing proper regulations for offshore aquaculture is crucial to the environment and the industry.

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Appendices

Appendix A – Sponsor Description

The National Oceanic and Atmospheric Administration is a federally funded government agency established by President Richard Nixon in 1970. NOAA provides scientific and technical services to other federal agencies, private research establishments, and the general public (NOAA, August 2004b, p. 2). One part of NOAA’s mission is “to enhance the sustainable use and conservation of ocean, coastal, and Great Lakes resources to benefit the economy and the environment” (p. 5). NOAA administers the Sea Grant Program, the National Marine Fisheries Service, the National Ocean Service, and the NOAA Central Library.

NOAA manages the Sea Grant program to develop university partnerships across America. One of Sea Grant’s goals is to “identify the most pressing research needs in aquaculture...and to develop a research and outreach agenda aimed at prioritizing and addressing those needs” (p. 9). Sea Grant is composed of thirty university-based colleges and 300 contributing institutions (NOAA, August 2004a, Structure). Figure A.1 shows a detailed organizational diagram of NOAA.

The Sea Grant program has requested an operating budget of 58 million dollars. The National Sea Grant Office has a staff of approximately twenty employees. Sea Grant has the resources to communicate with state aquaculture coordinators throughout the coastal states (NOAA, August 2004b, p. 17). Sea Grant’s collaboration with NOAA also has the benefits of being able to share research information and industry databases which can help analyze state policies and regulations.

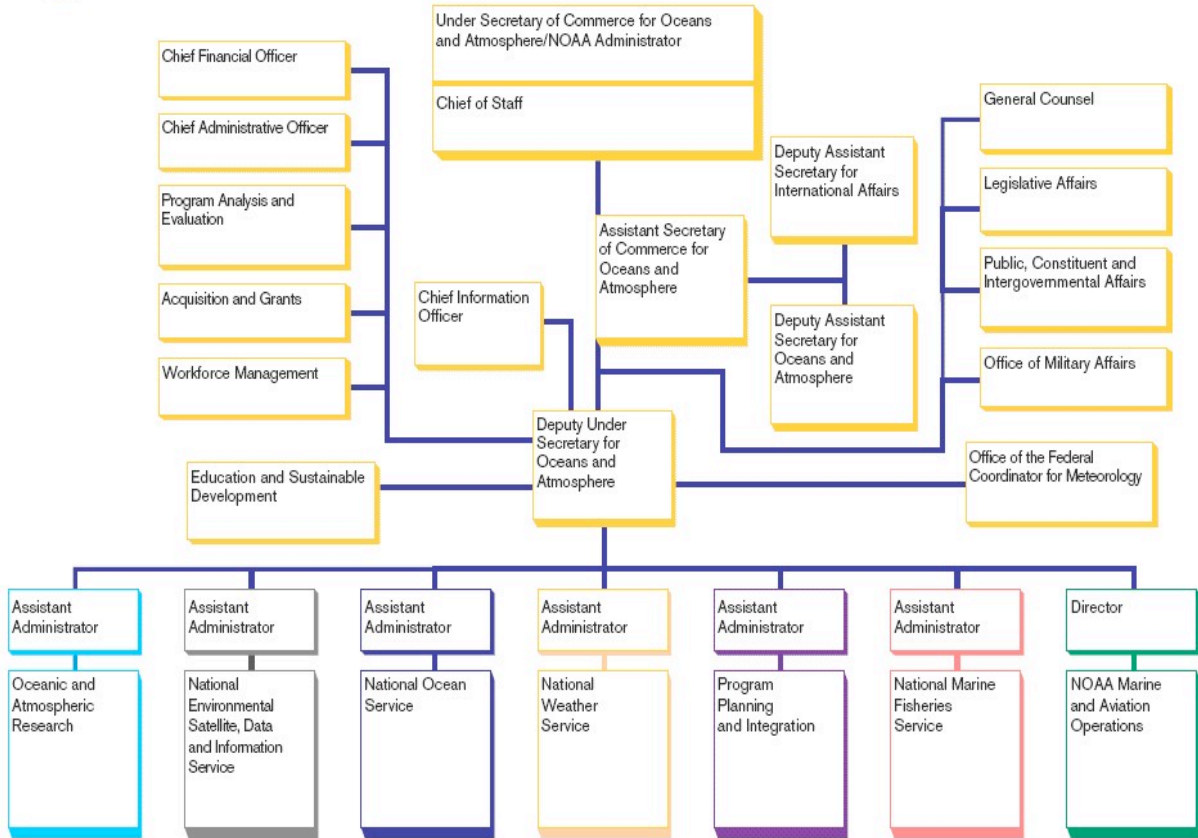


Figure A.1: NOAA Organizational Structure
 Source: NOAA, August 2004a, Structure

Appendix B – Interview Questions

Interview Questions for State Aquaculture Coordinators

Alaska

In our research, we learned that finfish aquaculture is prohibited in Alaska, with a few exceptions such as non-profit salmon hatcheries. What state permits are required for these salmon hatcheries?

What state permits are required for shellfish aquaculture?

Do you see any move towards realizing finfish aquaculture in Alaska?

If finfish aquaculture were permitted in Alaska, what type of permit process would you require for it?

California

How effective, in your opinion, are the Aquaculture Development Committee and Aquaculture Disease Committee? Have recommendations that these committees presented been implemented? What is their role in setting policies on aquaculture?

The Aquaculture Development Committee created an Aquaculture Permit Guide to be a resource for industry. What was the response to the Aquaculture Permit Guide?

Florida

Does Florida have a one-stop permit process at the state level? If yes, what is the process to obtain the federal permits once the state permit is obtained?

Hawaii

Hawaii is clearly a leader in the development of offshore aquaculture. While development has begun within two miles of the shoreline, are there any appropriate sites in non-state water or are all sites in very deep water?

It appears aquaculture education is important in Hawaii and much has been done to educate those who are willing to learn. What advice would you give to other aquaculture policy makers to further education in their states?

Even though many of the permit application requirements are easy to find and some are easy to accomplish, what could be done to make the permit application process more streamlined?

It seems that environmental regulations in Hawaii used to be very strict. What major changes in environmental policies have allowed aquaculture to develop to where it is today?

Louisiana

We noticed that Louisiana does not have an aquaculture coordinator. Is the Louisiana Aquaculture Task Force an attempt to replace this position? How is the Louisiana Aquaculture Task Force involved with current offshore aquaculture policies in the state? How is the Aquaculture Task Force connected to the Gulf Fisheries Council?

We were unable to find any policies for offshore aquaculture. Are there any plans to setup a permit process for offshore aquaculture in public waters (3 to 200 miles offshore)?

Massachusetts

The Massachusetts aquaculture White Paper and Strategic Plan identify regulatory streamlining as a priority and important to the development of aquaculture in Massachusetts. As a means to facilitate the industry expansion, Massachusetts has created the Massachusetts Aquaculture Permit Guidance Document. In your opinion has this document been helpful in streamlining the permit process? Do you have any suggestions on how improvements could be made to the Guidance Document?

Public concerns on the subject of offshore aquaculture in the 0-3 mile zone appear to be restricting the establishment of aquaculture businesses. Do you believe that by allowing towns to make their own decisions concerning the establishment of an aquaculture business contributes to the difficulty of starting an offshore aquaculture business in Massachusetts?

Maine

The Finfish Aquaculture Monitoring Program carries out third party inspections of aquaculture sites. How effective is this program?

According to your permit process we saw that the aquaculture administrator could recommend a permit, but then the commissioner could deny the permit, has this happened? If so what were the circumstances?

New Hampshire

Through the University of New Hampshire and Sea Grant, there has been a lot of research conducted since 1997. How does this research affect offshore aquaculture policies?

The permitting process for offshore aquaculture appears to be lengthy and involves many hearings from both government and non-government agencies. What can New Hampshire do to streamline this process?

Aside from education at the university level, what else is being done to educate citizens about New Hampshire's coastal development?

How many more years do you think it will be before offshore aquaculture becomes commercially viable?

Rhode Island

It is clear that Rhode Island is making great strides in the progression of its aquaculture industry. Currently there are 61 acres devoted to 20 aquaculture farms, but these farms are all tidal waters. Is there any interest from local aquaculture industries to use offshore and coastal waters?

The aquaculture permitting process seems very straightforward. Do you feel this process works well? What else could be done to streamline the process even further? Why isn't finfish included in the application? Is there any interest in developing finfish aquaculture?

Aside from college education through Sea Grant, what is being done to educate the public about offshore aquaculture?

Washington

It is our understanding that Washington has strong concerns regarding the protection of their indigenous species, which is evident in its Marine Finfish Aquaculture Policy. What is your opinion about the Escape Prevention Plan that is required by aquaculture business owners? It reduces the risk of escaped fish, but does it impede the ability of aquaculture businesses to open?

In Puget Sound, the Canadian side seems to have more offshore aquaculture establishments than the American side. Do you believe that getting an aquaculture permit on the American side is more difficult than on the Canadian side? How are the policy and permits different between the two countries?

By establishing the Aquaculture Marketing Act, Washington encourages the development and expansion of aquaculture. Juan De Fuca has been a strong interest for offshore aquaculture. What policy rights do the Native Americans have for aquaculture in Juan De Fuca?

In the face of declining wild stock fisheries do you see aquaculture as a mean of providing jobs and improving wild fish stocks?

Puerto Rico

Each state in the U.S. has many of their own offshore aquaculture policies. Is there a specific state or states which Puerto Rico based its regulations on, or are the regulations based solely on Puerto Rican issues and priorities?

It appears that Puerto Rico has a simple, one step permitting process. Can this be streamlined further? Do you have any recommendations for other aquaculture regulators?

Common Questions

Is there any interest for developing offshore aquaculture in the Exclusive Economic Zone?

What are the procedures for obtaining offshore aquaculture permits in your state?

How would you describe the permit process for offshore aquaculture, if there is one?

How would your state respond to an application for offshore aquaculture?

What role would you expect your state to have in relation to offshore aquaculture regulations for the Exclusive Economic Zone, what major issues would they address?

What are the socio-economic concerns and benefits of aquaculture in your state?

Are there any other comments you would like to add?

Appendix C – Answers to Interview Questions

Alaska

Name and title of person interviewed: Sheila Martin, Alaska Department of Fish and Game, Division of Commercial Fisheries

Contact information: Email: sheila_martin@fishgame.state.ak.us Phone: 907-465-6149

I have been asked to address your questions as to offshore aquaculture permitting and regulations in the state of Alaska. As the only allowable "aquaculture" in the state is shellfish and salmon hatcheries (ocean farming) and other finfish permitting has not been explored very far, the answers are not terribly specific. I hope that they give you enough information for your research.

The State of Alaska Comments and Recommendations to the U.S. Commission on Ocean Policy Preliminary Report (<http://www.state.ak.us/local/oceansreport.htm>) may provide much of the information you are seeking. I have also included the name and email of Sue Aspelund in our Commissioner's office who has been working with the feds on the idea and policy of offshore finfish farming in our area.

In our research, we learned that finfish aquaculture is prohibited in Alaska, with a few exceptions such as non-profit salmon hatcheries.

What state permits are required for these salmon hatcheries?

A state permit for a Private Non-Profit Hatchery would be required. The application process takes approximately 2 years, which includes extensive review by the Regional Planning Team in the area.

What state permits are required for shellfish aquaculture?

This would require a Mariculture permit. The mariculture application is a tri-agency application that includes all information required for the Alaska Department of Fish and Game, Department of Natural Resources, and the Department of Environmental Conservation. Depending on the permit type requested and the area, a permit from the Army Corp of Engineers and/or the USDA Forest Service may also be required.

Do you see any move towards realizing finfish aquaculture in Alaska?

The State of Alaska's position on offshore aquaculture development is outlined in the "State of Alaska Comments and Recommendations to the U.S. Commission on Ocean Policy Preliminary Report" dated June 3, 2004. In the report, the State supports a five-year moratorium on all permitting, leasing, or development of ocean pen-reared shell and finfish in federal waters, which are located from three to 200 miles offshore. The State recommends

conducting scientific research to address environmental and economic concerns, including socio-economic impacts to fisheries-dependent communities.

What are the procedures for obtaining offshore aquaculture permits in your state?

Offshore aquaculture is not currently allowed in the State of Alaska, therefore, no permitting process is in place.

How would you describe the permit process for offshore aquaculture, if there is one?

Offshore aquaculture is not currently allowed in the State of Alaska, therefore, no permitting process is in place.

How would your state respond to an application for offshore aquaculture?

If an application or petition was received by the Alaska Department of Fish and Game it would, undoubtedly, find it's way into the Commissioner's office. From there, it would be discussed with the Governor's office since this is not an allowed activity at this time and no permitting procedures are in place.

What role would you expect your state to have in relation to offshore aquaculture regulations for the Exclusive Economic Zone, what major issues would they address?

Because the aquaculture activity would occur in the EEZ, the jurisdiction for permitting would be federal, not state. NOAA might have someone who could speak to that, but I don't know who it would be.

What are the socio-economic concerns and benefits of aquaculture in your state?

Usually the feds and the state work together to ensure any negative affects (disease, pollution, habitat destruction, biological or genetic interference with natural populations, etc.) are minimized or avoided altogether. Proposals for new activities such as offshore aquaculture would require public hearings and opportunities for the state and the public to comment. The state would likely comment on any perceived or potential problems or benefits with the resource, habitat, economic effects, etc., after analyzing the proposal.

Are there any other comments you would like to add?

It is hard to say how the state would react to an application for offshore aquaculture without knowing the specifics of the activity being applied for. Sue Aspelund in the Commissioner's Office is the department person working on this issue. She is out of the office this week (I think), but she might answer her e-mail (sue_aspelund@fishgame.state.ak.us) if you want to ask her some questions.

California

Name and title of person interviewed: Bob Hulbrock, California Aquaculture Coordinator

Contact information: Email: RHulbrock@dfg.ca.gov Phone: 916-445-4034

How effective, in your opinion, are the Aquaculture Development Committee and Aquaculture Disease Committee? Have recommendations that these committees presented been implemented? What is their role in setting policies on aquaculture?

The Aquaculture Development Committee has been underutilized, and except for specific products it has produced, has not generally been effective. The Aquaculture Disease Committee is reactionary, and has been very effective in disease management. Advice offered by the Committee is almost always accepted by the Department. The Disease Committee also makes recommendations for regulatory listing of specific diseases.

The Aquaculture Development Committee created an Aquaculture Permit Guide to be a resource for industry. What was the response to the Aquaculture Permit Guide?

The Permit Guide was well received by the industry and is particularly useful to those contemplating, or engaged in, new project development.

Is there any interest for developing offshore aquaculture in the Exclusive Economic Zone?

Very little. We have a steep continental shelf that makes offshore projects more difficult. Currently, at least one project utilizing decommissioned offshore oil platforms as "anchors" is being discussed. We have also, for some years, had active aquaculture production and harvest of shellfish from some of the active platform legs.

What are the procedures for obtaining offshore aquaculture permits in your state?

Application for a State Aquaculture Registration is required and includes environmental review of the project.

How would you describe the permit process for offshore aquaculture, if there is one?

It is not well established. The only currently active project is the harvest of shellfish from oil platform legs. The required permits are the Aquaculture Registration from DFG and the bivalve shellfish growing water certification by the Department of Health Services. For projects that would involve "new facilities," the US Army Corps of Engineers would likely be a permitting authority.

How would your state respond to an application for offshore aquaculture?

Objectively.

What role would you expect your state to have in relation to offshore aquaculture regulations for the Exclusive Economic Zone, what major issues would they address?

I would expect the State to have an active role in development and implementation of regulations in regard to the potential for project impacts to native fish and wildlife resources.

What are the socio-economic concerns and benefits of aquaculture in your state?

I will leave this question unanswered except to state that they are probably more heavily weighted toward concerns than benefits by an uninformed population.

Are there any other comments you would like to add?

After practical systems (both technically and economically viable) for deep water, exposed ocean conditions are developed, there is likely great potential for offshore aquaculture in California, as elsewhere. To a large degree both legitimate concerns for environmental impact and "viewshed" issues may be more easily resolved by moving offshore. Nonetheless, I anticipate an uphill battle, even then.

What is a recent farm gate value or some sort of production value for aquaculture in the state of California?

As you are probably already aware, reliable figures for US aquaculture production have been hard to come by. There is no formal reporting of production in California. For a previous project, three sources were cited to give a range of possible production numbers. The figures are for 1998-1999 but I do not believe production has changed a large amount since then.

The USDA NAS survey reported California production value at \$44 million. Because it was the first survey of aquaculture production, it likely under represented by some amount. The Western Region Aquaculture Center (WRAC) reported production value of \$71 million. The California Aquaculture Association reported production at \$83 million.

I personally would have the most confidence in the WRAC figure.

Bob Hulbrock
California Aquaculture Coordinator

Florida

Name and title of person interviewed: Wilhelm Sherman, Florida State Aquaculture Commissioner

Contact information: Email: wilhels@doacs.state.fl.us Phone: 850-488-4033

Does Florida have a one-stop permit process at the state level? If yes what is the process to obtain the federal permits once the state permit is obtained?

Florida has one stop process, they issue permit EPA does not have authority
1999 legislator consolidated that all other agencies taken out of the loop Legislature created process for certification Mandatory compliance with BMPs Citing of farm, construction, operation, within farm what happens, how much, thresholds followed, water that comes off the farm.

Does Florida help with federal permits?

Florida does try to help but it is the applicant's permit, on federal. EPA only comes in when more then 100,000 lbs Florida delegated state so Florida Environmental PA has authority for NPPES permits.

Florida mainly tropical fish farms, so usually never met... 97% of farms never exceed that Only 5 farms that do it exceed the criteria. No one has done net pens, in FL, Florida mainly deals with uplands aquaculture issues....

What are the procedures for obtaining offshore aquaculture permits in your state?

Offshore aquaculture permit in state waters:

1 application package for permit process to them

West coast of FL has 9 miles.

Atlantic coast it is 3 miles.

Keys split down middle southern side 3 miles, northern side 9 miles...

Issues in EEZ would be same as open ocean:

Placement of cage

Species

Water quality around

Benthic quality around cage

Treatment of cages/pens relative to bio-fouling

Feed how/what

Chemicals used

Mortalities

Escapes

What are the socio-economic concerns of aquaculture in Florida?

Generally no care but not specific to aquaculture same to agriculture

No threat / benefit general apathy

Segments that care very much

Care about genetics problems, and water pollution, sitting (aesthetic eyesore) cut in to favorite places or obstacle in waterway that would cause boating problems.

Once permit a permit is granted who regulates it?

Send them directly to us, field staff see farms twice a year unannounced.

Offshore same, if permit required monitoring then they would submit to them.

If offshore benthic on bottom for populations of coco pods and worms on bottom, water samples inside, at, and distance off from the cage.

Inshore: <100000lbs of fish and discharge more than 30 days consecutively in a year. Do not require monitoring on land, do own monitoring and, so saw what was happening on terrestrial farms.

Any other comments?

Florida takes a different approach, Who actually owns the water, and who issues the permit, state of Florida owns the water and bottom, only people lease are governor and cabinet. Certificate only gives right to sell undersize fish anytime in the year, otherwise restricted to size season and bag limits. Also need lease (through us, and then placed on agenda) only comes from governor and cabinet. Before get the right to farm offshore need public meeting (governor + cabinet meet twice a month), do deal with these kinds of issues. Then governor and cabinet would vote. Governor and cabinet could issue lease, but agency has to do monitor and has proprietary and legatorial.. Very open with the process, 10 years leases with one automatic renewal after 1 renewal then have to reapply for same area (20 years at minimum)..... I approvals renewals, cabinet does not get involved it is automatic.

Hawaii

Name and title of person interviewed: John Corbin, Manager of Hawaii State Aquaculture Development Program

Contact information: Email: info@hawaiiaquaculture.org Phone: 808-587-0030

1) Hawaii is clearly a leader in the development of offshore aquaculture. While development has begun within two miles of the shoreline, are there any appropriate sites in non-state water or are all sites in very deep water?

Hawaii does have some suitable sites within its Exclusive Economic Zone particularly on and around seamounts near the main Hawaiian Islands. Whether any specific site would be available would be subject to input from other users, such as commercial fishermen. As you know, Hawaii has no continental shelf, so depth does drop off fast as you move offshore and we look at the 300-foot depth contour as a limit for current technology.

2) It appears aquaculture education is important in Hawaii and much has been done to educate those who are willing to learn. What advice would you give to other aquaculture policy makers to further education in their states?

Education of decision-makers at all levels and the general public is very important on-going task because offshore aquaculture in many states is a new activity though there are some old sectors (oyster culture) in some states, and there is an increasing amount of misinformation out there. At the state level, there needs to be a lead agency for offshore aquaculture development, which includes an education component. That agency needs to partner with educational institutions that have offshore aquaculture missions/interests and the industry to tell decision-makers and the general public about the industry and its benefits. In other words, there should be an active, formal education program for offshore aquaculture somewhere in the state and the private sector needs to be closely involved in developing and delivering the message.

3) Even though many of the permit application requirements are easy to find and some are easy to accomplish, what could be done to make the permit application process more streamlined?

The permit process for state marine waters has been defined in Hawaii and is well defined in most coastal states that have nearshore aquaculture. Eliminating steps in the process is something that should be considered a state-by-state basis and at this early stage I would not recommend eliminating any steps in the Hawaii process, though we can greatly improve its implementation.

In general, a government permit process can be streamlined (meaning reduce time and cost) by: 1) having an entity (advocate) tasked with working with applicants to facilitate the process, package applications and solve problems; and 2) publishing descriptions of the permit process with particular attention to requirements, time and cost. Hawaii uses both these approaches.

4) It seems that environmental regulations in Hawaii used to be very strict. What major changes in environmental policies have allowed aquaculture to develop to where it is today?

If you track the development of offshore aquaculture you will see we carried out a federally funded demonstration in 1999-2000. This was significant because we got the regulatory agencies to allow the temporary research project with temporary approvals/permits – demonstrating a policy of adaptive management to learn about offshore aquaculture from experience. This approach allowed proponents of ocean leasing for aquaculture to present real data and information concerning cage operation and environmental impacts to the Governor and Legislature when legislation was being considered. In addition, the Governor and State Administration were actively educated about offshore aquaculture, accepted ocean leasing for aquaculture as good, in the public interest and environmentally friendly, and legislation was submitted by

the Governor to allow commercial aquaculture leases. This is the strongest political position to be in.

5) What are the procedures for obtaining offshore aquaculture permits in your state?

6) How would you describe the permit process for offshore aquaculture, if there is one?

5.& 6. The process to obtain the permits for open ocean aquaculture in State marine waters and ultimately a lease for commercial culture is as follows:

- a) Department of Land and Natural Resources, Conservation District Use Permit for use of State marine waters for commercial aquaculture. Requires an Environmental Assessment and perhaps an Environmental Impact Statement at the discretion of the agency.
- b) U.S. Army Corps of Engineers, Section 10 Permit for structures in navigable waters. Requires reviews by the U.S. Fish and Wildlife Service for endangered species, the National Marine Fisheries Service for protected species, a Section 106 review for historic sites and a Coast Zone Management Consistency review.
- c) County Special Management Area review. Required by usually no impact.
- d) Department of Land and Natural Resources, Land Division issues State lease disposition.

7) How would your state respond to an application for offshore aquaculture?

Regulatory agencies understand that the Governor and the State Legislature have decided it is State policy to develop commercial offshore aquaculture. The policy is incorporated into State law, Chapter 190D, HRS, Ocean and Submerged Lands Leasing. Therefore, each application is accepted and reviewed on an individual site basis based on the requirements of the law and leasing decisions are made based on a wide variety of input from in-house expertise, sister agencies, and the affected public.

8) What are the socio-economic concerns and benefits of aquaculture in your state?

Offshore aquaculture, like aquaculture in general, is being supported in part because it will expand and diversify our economy. This means it will create primary and support jobs, produce tax revenues and increase supplies of local fish for local consumption and export.

Concerns raised by various communities have been dealt with on a project-by-project basis. Multiple use conflicts with such groups as recreational and commercial fishermen have been noted. Commercial fishermen fear competition in the marketplace and recreational fishermen fear lack of access to a part of the ocean where they can fish. Thus far, projects have been able to address these issues by using submerged technology, growing non-competitive species and locating farms outside of fishing lanes. Also, some fishermen see farms as being positive and utilize them as a fish-aggregating device.

There also was a concern raised over social equity, meaning farms only can be developed by large companies who could afford to go through the process. Thus far no community-based projects have come forward to attempt the process. This is like others will be dealt with on a case-by-case basis.

I would say that Hawaii has been successful in implementing open ocean aquaculture legislation in large part because:

- a) The law required an Environmental Assessment and did not try to minimize this concern.
- b) The law required a study of existing uses of a site to clearly frame potential multiple use conflicts.
- c) The law required applicants to go out and talk to stakeholders before they prepare their applications and Environmental Assessment, so that potential concerns can be addressed.
- d) The law allows a direct lease for aquaculture.
- e) The policy is only native species can be used.
- f) The law allows for public notification and public input into the process through publication of information in media, a required public hearing and several public Board Meetings for decision-making.
- g) The law requires a bond such that projects will be removed if necessary.
- h) The regulatory agencies have allowed government research projects to go forward with temporary approvals to gather information and experience.
- i) Open ocean aquaculture has an agency, the Aquaculture Development Program, charged with facilitating permits and working with applicants and the industry as an advocate.

Louisiana

Name and title of person interviewed: John Roussell, Assistant Secretary for the Office of Fisheries, Louisiana Department of Wildlife and Fisheries

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We noticed that Louisiana does not have an aquaculture coordinator. Is the Louisiana Aquaculture Task Force an attempt to replace the position of aquaculture coordinator? How is the Louisiana Aquaculture Task Force involved with current offshore aquaculture policies in the state? How is the Aquaculture Task Force connected to the Gulf Fisheries Council?

There is currently no position entitled “aquaculture coordinator” for the state. The Louisiana Aquaculture Coordinating Council (LACC) was established under Act 865 entitled the “Louisiana Aquaculture Development Act of 2004”. Under the Act, the LACC is empowered to appoint a director and assistant director who will be under the direction and supervision of the Louisiana Commissioner of Agriculture.

The Act provides “a regulatory framework for the orderly development and maintenance of a modern aquaculture segment of Louisiana’s agriculture industry and for the promotion of aquaculture and aquaculture products.”

“Aquatic Livestock”, as defined by the Act to be managed in part by the LACC, is finfish species and crawfish produced, raised, managed, or harvested within or from a constructed impoundment on private waterbottoms with no outlet to public waters. The LACC therefore has no authority in the EEZ off the coast of Louisiana.

The Louisiana Aquaculture Coordinating Council has no affiliation with the Gulf Council, other than that the Louisiana Department of Wildlife and Fisheries (LDWF) is a member of each.

We were unable to find any policies for offshore aquaculture. Are there any plans to setup a permit process for offshore aquaculture in public waters (3 to 200 miles offshore)?

The Gulf of Mexico Fishery Management Council (Council) uses the Fishery Management Plan process to develop rules, regulations and policies for management of fisheries in the Federal Exclusive Economic Zone (EEZ) of the Gulf of Mexico. The Council recognizes the significance of consistent, science-based policies on offshore mariculture, and is currently drafting a generic amendment to the appropriate Fishery Management Plans to provide for regulation of offshore mariculture.

In 2004, the Louisiana House of Representatives by House Concurrent Resolution established the “Platforms for Mariculture Task Force” chaired by the Louisiana Department of Natural Resources (LDNR). Currently the task force is drafting a report to assess the economic feasibility, environmental impacts and legal/regulatory considerations of utilizing

decommissioned oil and gas platforms for culturing marine organisms in the development of a Gulf of Mexico industry in both State and Federal waters. The task force must provide a written report of relevant findings and policy recommendations to the Louisiana governor and legislature by January 31, 2005.

Is there any interest for developing offshore aquaculture in the Exclusive Economic Zone?

Yes, there is interest in Louisiana and elsewhere in the Gulf of Mexico. As stated above, Louisiana is looking at the feasibility of utilizing decommissioned platforms in the EEZ for mariculture.

What are the procedures for obtaining offshore aquaculture permits in your state?

There are no specific regulations for the permitting of offshore facilities. Such facilities in state waters would fall under the purview of the Louisiana Department of Natural Resources Coastal Zone Management permitting program for coastal activities, while licenses to possess, transport and sell fish would fall under the authority of LDWF. R.S. 56:412.A(5) specifically bans use of public water bodies to propagate, raise, feed or grow any species of fin fish. The use of cages, pens, and fenced-off portions of such (public) water bodies for propagating, raising, or growing any species of fin fish is prohibited. Discharges in state waters would be regulated by the Louisiana Department of Environmental Quality.

Permits are only issued for mariculture operations located inside the territorial state boundary in the coastal zone on privately owned property and water bottoms (R.S. 56:579.1).

How would you describe the permit process for offshore aquaculture, if there is one?

N/A

How would your state respond to an application for offshore aquaculture?

Since Louisiana has no regulations or permitting process for offshore aquaculture in place, we would request that the applicant provide the Department with a written description of the project including species of interest, operational plan, and facility description. Per R.S. 56:412.A(5) use of public water bodies for propagating, raising, or growing any species of fin fish is prohibited.

What role would you expect your state to have in relation to offshore aquaculture regulations for the Exclusive Economic Zone, what major issues would they address?

As the state entity with the authority and responsibility to manage fisheries in the state, the Department of Wildlife and Fisheries would comment on any offshore aquaculture regulations as they relate to biological, enforcement and economic issues of fisheries and the coastal environments that support those fisheries.

Major issues with permitting mariculture in the EEZ are species to be cultured (per Gulf Council Mariculture Policy, native species are preferred), location of facilities, escapement and its potential to affect the population of native fish, the effects of the operation on local biodiversity, fish diseases, fish feed and fecal waste, operational waste, use of wild caught fish as fish feed, enforcement issues related to the harvest, transport and possession of species with size limits and harvest quotas, and development of BMP's.

What are the socio-economic concerns and benefits of aquaculture in your state?

We expect there would be effects on commercial fisheries depending on the species cultured and the magnitude of aquacultural production. Effects on commercial fisheries may also affect the economies of coastal communities. Benefits would be related to economic development.

Are there any other comments you would like to add?

The Department currently has authority to permit mariculture within state territorial boundaries under R.S. 56.579.1. Projects must be located in the coastal zone of the state on privately owned property and water bottoms.

Permits may be issued exempting the permittee from statutory limitations as to the kind, number, or size of fish which may be harvested or taken, or as to the method of harvesting or taking, or seasons or other limitations, restrictions, prohibitions, or regulations governing the management and harvesting or taking of fish. This includes hatchery breeding, spawning, transportation, implantation, propagation, growout, and harvesting of domesticated fish and other aquatic species when produced under a permitted rules and regulations.

Massachusetts

Name and title of person interviewed: Scott Soares, Aquaculture Program Coordinator
Massachusetts Department of Agriculture Resources

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The Massachusetts aquaculture White Paper and Strategic Plan identify regulatory streamlining as a priority and important to the development of aquaculture in Massachusetts. As a means to facilitate the industry expansion, Massachusetts has created the Massachusetts Aquaculture Permit Guidance Document. In your opinion has this document been helpful in streamlining the permit process?

SJS: The permit guidance document has been a useful tool for my efforts to better define what regulations may impact a particular aquaculture project. The development and use of the document has also provided an important bridge between multiple agencies that may have regulatory authority over activities that may be a part of different types of aquaculture. In short the Guidance document provided an aquaculture permitting nexus for Massachusetts

regulatory agencies. Nonetheless, it has been used infrequently as the majority of our industry's growth has been associated with the shellfish culture sector. Fortunately, the regulatory and project review process for shellfish aquaculture in Massachusetts is relatively straight forward and handled almost entirely through one agency. (Massachusetts Division of Marine Fisheries). Although lagging development in aquaculture sectors other than shellfish may be a result of technology, species and capital shortcomings, it is my opinion also that when single point contact and permitting reside in the same agency there is much greater opportunity for industry growth.

Do you have any suggestions on how improvements could be made to the Guidance Document?

SJS: much of the work undertaken and accomplished as a result of the Guidance document was more a result of relationship development between agency personnel rather than the document itself. With this in mind, the loss of key agency contacts through retirement, reassignment etc. can also result in a loss of "institutional memory". Accordingly, the document and it's use could be stronger if accompanied by a strong and formal policy statement from an overarching authority. In Massachusetts's case, the Executive Office of Environmental Affairs is the overarching entity that has sanctioned the use of the document and accompanying policies. Nonetheless, nearly a decade after the release of the Strategic Plan, there are occasional snags between agencies as a result of each agencies specific mandate and philosophy (e.g. wildlife agencies primary aim to protect wild/natural resources, agricultural agencies primary aim to protect and promote agricultural development).

Public concerns on the subject of offshore aquaculture in the 0-3 mile zone appear to be restricting the establishment of aquaculture businesses. Do you believe that by allowing towns to make their own decisions concerning the establishment of an aquaculture business contributes to the difficulty of starting an offshore aquaculture business in Massachusetts?

SJS: Absolutely. Assuming a "pro-aquaculture" attitude from the State...If we compare our (Commonwealth) approach to that of state's such as CT and FL where the State policy is the primary determinant for aquaculture development...we will see industries that have existed for nearly the same amount of time yet much more development in states where state policy, rather than municipal, guides industry development. In my experience the greatest concern of municipal bodies is the real and/or perceived taking of "public" resource for private business development. This coupled with the many and varied competing uses for our coastal waters, can make the process to obtain marine based aquaculture sites very difficult if not impossible in towns that prohibit aquaculture development.

Is there any interest for developing offshore aquaculture in the Exclusive Economic Zone?

SJS: There have been two proposals that I am aware of over the last decade for development of "off-shore" aquaculture. As I suggested previously, beyond regulatory and policy guidance for off-shore aquaculture there remains a great deal of biological,

engineering and economic research that must be accomplished to identify appropriate species, adequate equipment and delivery systems and economic feasibility for aquaculture that is conducted in off shore environments. There has also been some speculation that off-shore wind farm development may provide an opportunity for aquaculture development that will be associated with the wind farm platforms.

What are the procedures for obtaining offshore aquaculture permits in your state?

SJS: Not yet established. Infact the only off-shore aquaculture project (Seastead, experimental sea scallop aquaculture operation) that existed off of the Massachusetts coast required (literally) and act of congress to close the area to fishing and allow the intended aquaculture activities.

How would you describe the permit process for offshore aquaculture, if there is one?

SJS: The process should be transparent and reside in one regulatory agency. Guidance should be developed that facilitates project development that is consistent with the prescribed regulatory concerns.

How would your state respond to an application for offshore aquaculture?

SJS: Currently our Office of Coastal Zone Management would have some oversight through a consistency review process. For fish landed in Massachusetts there would likely also be permit requirements from our State's Division of Marine Fisheries. Although new aquaculture regulations are being promulgated by the Division, currently permitting for marine aquaculture would be accomplished through a letter permit issued by the director of DMF.

What role would you expect your state to have in relation to offshore aquaculture regulations for the Exclusive Economic Zone, what major issues would they address?

excerpt from letter Governor Romney to Admiral J. Watkins (Ret) re the U.S. Commission on Ocean Policy...."Regarding aquaculture, for more than a decade the Commonwealth has worked toward a streamlined regulatory process and engaged in research and industry assistance activities that promote Massachusetts aquaculture. We recognize the great potential of this industry to provide employment opportunities and to enhance our fisheries resources and harvesting capacity. To that end, I concur with the Commissions suite of recommendations that are aimed at facilitating development of this industry and encourage adoption of recommendations 22-1 through 22-4 as they each represent components that are each important for a comprehensive effort. I further recommend that emphasis be placed on recommendation 22-3 regarding expansion of research and development opportunities that partner state and federal agencies with industry and work toward the establishment of economically and environmentally feasible aquaculture enterprises."

What are the socio-economic concerns and benefits of aquaculture in your state?

The Commonwealth of Massachusetts views aquaculture as an agricultural sector that is important to the state's economic and social fabric. Concerns that have emerged include potential interaction with wild populations, potential habitat impacts and water use/discharge issues (primarily inland facilities). Nonetheless, as practiced in Massachusetts, aquaculture represents an agricultural sector that blends with the rural characteristics of many of our coastal communities. The industry provides commercial and recreational opportunities for Commonwealth residents and for visitors to our state.

Are there any other comments you would like to add?

Other important components toward aquaculture development in Massachusetts...the Massachusetts Aquaculture Centers Network...a statewide initiative that includes 3 regional aquaculture technology transfer, research and education centers. Each center is hosted by a previously existing entity in each region that has worked toward industry development (i.e. Southeastern Center = a collaborative of Woods Hole Sea Grant, Massachusetts Maritime Academy and Barnstable County Cooperative Extension who administers the center, Northeast Center at Salem State College and Western Center at University of Massachusetts Amherst)

Memorandum of understanding between Massachusetts Aquaculture Association (primary trade group for the state's industry), aquaculture centers and the Massachusetts Department of Agricultural Resources strong, collaborative working relationships between agencies that are responsible for regulating (i.e. Massachusetts Department of Fish and Game) and promoting (i.e. Massachusetts Department of Agricultural Resources) aquaculture in Massachusetts.

Thanks for the opportunity to comment. Please let me know if I might be of further assistance to your effort.

What is a recent farm gate value or some sort of production value for aquaculture in the state of Massachusetts?

Good question...and one that we have also had some difficulty nailing down...the most recent estimate that I have been using comes from the USDA NASS New England Agricultural Statistics (www.usda.gov/nass). The most recent #s are from 2003 and for MA are estimated to be \$5.7 million...many, including myself, think that this number is grossly (3-4 times) underestimated but unfortunately we do not have a better number to work with.

Maine

Name and title of person interviewed: Samantha Horn-Olsen, Aquaculture Policy Coordinator, Maine Department of Marine Resources

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The Finfish Aquaculture Monitor Program carries out third party inspections of aquaculture sites. How effective is this program?

Many changes have occurred over the last year The Department of Environmental Protection has taken over the Finfish Aquaculture Monitoring Program (FAMP) program. It was handed off monitoring to DEP based on lawsuit that challenged the salmon companies for clean water act permit. Authority got delegated to a state hearing process. Some requirements to FAMP program although DMR is involved to help interpret data (chemical results and such).

Very effective, state hired FAMP third party contractor, who is well qualified. They reported everything to DMR. Changing so now companies can hire other contractors to report to companies the results that are then reported to state. This is like many other industries such as paper mills and water treatment plans, that do hire their own contractors to do their monitoring. A model is needed for how to qualify contractors. How do we qualify contractors? Review resumes? Standard operating procedures and hire anyone you want? How to proceed with new system? Past program worked very well, but it is going to change.

According to permit process we saw that the aquaculture administrator could recommend a permit, but then the commissioner could deny the permit, has this happened? If so what were the circumstances?

Have not seen that happen yet. Hearings officer will deal with questionable issues. It might be caused by some kind of change in circumstances for a drastic change or overruling.

Is there any interest for developing offshore aquaculture in the Exclusive Economic Zone?

There is some interest that is limited to a few individuals. No interest has been shown from large companies. In other countries large companies play an important role. The experimental project in New Hampshire is very close. There is limited interest in the state. However, there is no offshore aquaculture in the state now. The permit process for offshore aquaculture would be very similar to inland aquaculture.

Are there any other comments you would like to add?

Maine Task Force has done some work permitting process. Aquaculture in Maine has the strength of having been evolved in such a way that all the tough issues have already surfaced. Important issues include: disease, environment that are already addressed and apparent in Maine. Main difference in offshore is the social and residential concern, large fishing equipment, marine mammal, and ecological concerns. Less issues are raised about coastal residents, new set of social issues are raised. Public issues will be a bigger concern because most other issues have already surfaced and been discussed. Streamlining, huge issues with multiple conflicting regulations, number of agencies is large, huge expenses in dealing with each other as regulators. There should be clear distinctions about who the permitting authority is going to be and that advisory committees should exist as opposed to each having veto power. Currently too much power to be distributed, which is a recipe for stagnation.

New Hampshire

Name and title of person interviewed: Rollie Barnaby, Extension Educator, Sea Grant & Marine Resources

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Through the University of New Hampshire and Sea Grant, there has been a lot of research conducted since 1997. How does this research affect offshore aquaculture policies?

We have applied for and received permits to grow finfish and shellfish in an open ocean environment in State waters. We also helped four commercial fishermen obtain permits to grow blue mussels on submerged longlines in the open ocean 2 and half miles offshore.

The permitting process for offshore aquaculture appears to be lengthy and involves many hearings from both government and non-government agencies. What can New Hampshire do to streamline this process?

The State of New Hampshire process to obtain an aquaculture permit was not a process for open ocean, it was a process for any marine aquaculture so there were some requirements that didn't make sense like requiring a wetland permit offshore in 130 feet of water. We did make it work and the State agencies involved were helpful. Only one public hearing was required.

Aside from education at the university level, what else is being done to educate citizens about New Hampshire's coastal development?

Sea Grant and Cooperative Extension offer educational programs on marine issues to K-12, general public, public officials, recreational and commercial fishermen, and the media.

Is there any interest for developing offshore aquaculture in the Exclusive Economic Zone?

If open ocean aquaculture is going to be a viable business then it will have to expand into the EEZ. State waters on the New England coast have heavy usage by many different groups including recreational boaters recreational fishermen, lobster and groundfish harvesters, and shipping interests.

What are the procedures for obtaining offshore aquaculture permits in your state?

New Hampshire Department of Fish and Game has a process and application to obtain an aquaculture permit, it is not an open ocean permit. (I hope they will develop a process just for open ocean)

How would you describe the permit process for offshore aquaculture, if there is one?

Time consuming because of all the different agencies that are part of the process, some of which really don't need to be part of the process.

How would your state respond to an application for offshore aquaculture?

They were helpful for us, but they are very concerned about public reaction. When there weren't any negative comments at the public hearing they were very helpful.

What role would you expect your state to have in relation to offshore aquaculture regulations for the Exclusive Economic Zone, what major issues would they address?

I don't think they would have any role.

What are the socio-economic concerns and benefits of aquaculture in your state?

We hope it will help commercial fishermen survive by giving them another business opportunity.

Are there any other comments you would like to add?

The person who did all the work for us to obtain the permits is Tom Shevenell. You should contact him:

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Rhode Island

Name and title of person interviewed: Dave Alves, Aquaculture Coordinator, State of Rhode Island

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Finfish (permit for shellfish only)

Would love to develop offshore finfish aquaculture because there are problems with inshore finfish culture, mainly nutrient based. Narragansett Bay is loaded with nutrients, so it would be beneficial for Rhode Island to develop aquaculture offshore.

Has anyone applied for an offshore aquaculture permit?

No one has ever applied, although a few years ago mariculture technologies became semi-interested we were hoping to attract them, but it didn't work out.

Does Rhode Island have any interests in developing finfish aquaculture?

Rhode Island is looking to do develop offshore aquaculture, but no interest has been shown. A number of reasons for the lack of interest including: biology very northern end of cool water regime, anything that grows here would be better off in NC/SC area same species that grow here grow down there, cost of business labor/land/energy is expensive in New England. Close to markets, but transportation is inexpensive, like fresh tilapia coming from Central America.

Is there a particular kind of finfish Rhode Island would be interested in developing?

Researchers have done research on summer flounder, and it was of interest few years ago. No *specific* finfish interests, although it would be nice to see finfish aquaculture development. Would love to get some stuff going on freshwater fish but have not had any interest, although Rhode Island would be open to just about anything. The CRMC will work with anybody who wants to try doing anything.

What about the application process for finfish?

It would be the same as the application for shellfish aquaculture. Since all aquaculture is currently shellfish the form is geared toward shellfish. Basically the same thing, need to know what/how/where stuff will be done and go from there. RI would not have any problem, would love to have applicants. First applicant is always a little tough, since we need to get other state agencies knowledgeable about it, and there is a learning curve for the first person, but it would be welcomed. Totally open to it, programmatic general permit. Aquaculture in Rhode Island has a good reputation, and trying to build it. If aquaculture is done correctly it is positive development for the state.

Washington

Name and title of person interviewed: Dan Swecker, Washington State Senator

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It is our understanding that Washington has strong concerns regarding the protection of their indigenous species, which is evident in its Marine Finfish Aquaculture Policy. What is your opinion about the Escape Prevention Plan that is required by aquaculture business owners? It reduces the risk of escaped fish, but does it impede the ability of aquaculture business to open?

All of the plans approved for net pen farming in Washington State are species specific. For example some of the older net pen permits stipulated Atlantic salmon only because it was believed they would not interbreed with native stocks. This is true of course and has been validated by a NOAA Fisheries risk assessment. Marine stocks may not have this advantage and so escapement of stocks that would interbreed would be viewed as possibly harmful. A project proponent would have to deal with this impact in their environmental analysis when the project goes to the lead agency for SEPA or NEPA review.

I believe it would be a difficult sell for the Washington State Department of Fish and Wildlife which issues the Hydraulics permit. I really believe that this is an important area for further research. The research should also address the impact of supplementation of wild stocks with hatchery stocks.

I believe some marine species are not particularly mobile but remain in a local area. This would help mitigate the impact of accidental escapes or intentional releases of hatchery stocks on wild fish. In addition, hatchery stocks selected for their minimal impact on wild stocks can also help mitigate any possible problems. If they are identical the problem pretty much goes away. Fisheries strategies that target escaped fish are potentially effective measures if the escapees are a relatively localized species.

Washington's current policy on escapement does not anticipate the problems that applicants will encounter when we go to inter-breeding populations. It works well for Atlantic salmon but maybe not for marine species. This is an area for a lot more work. Original project proponents will probably assume using local stocks and that can be problematic if the stocks are fragile or depleted from over harvesting. The bottom line is, yes, I think escapement will be a barrier to new project proponents.

Do you feel there are any state policies that have hindered the establishment of aquaculture businesses?

Washington State has a huge problem with the complexity of its permit process. There are too many agencies with jurisdiction with overlapping authorities and conflicting regulatory strategies. Multi-agency programmatic permits are the solution to this problem, hopefully on-line.

Also, Washington has an endless appeal process which allows individual appeals on all permits and sometimes multiple appeals on the same permit. A single consolidated administrative appeal should be allowed and then it goes to court. This would all be much easier if a single agency such as NOAA had jurisdiction.

By establishing the Aquaculture Marketing Act, Washington encourages the development and expansion of aquaculture. Do you feel there are any other significant policies that promote offshore aquaculture in Washington? We do have a programmatic permit for Upland Finfish facilities (hatcheries.) We have standards for siting marine net pens that is very good and have issued NPDES permits with these standards which have stood up in court and have been updated twice at the end of the 5 year cycle of the permits. We are in our third generation of NPDES permits.

Washington also has a joint private/public disease policy that both private and public hatcheries adhere to. The state has additional policies which they enforce on themselves such as the movement of fish between watersheds which the private sector does not have to abide by. However, whenever we want to move fish from one place to another we must get a Washington State Department of Fish and Wildlife transfer permit. One of the things they look at is escapement and interbreeding with wild stocks. They also look at disease history of the source and the certification of the fish.

Is there any interest for developing offshore aquaculture in the Exclusive Economic Zone?

Local interest has pretty much waned because of the restriction put on marine aquaculture by the state. The perception is that there is still a lot to be learned with marine fish species. Also there is some question about the efficacy of off-shore technology. Finally it remains to be seen if we can be competitive with lower labor cost areas like Chile and Asia.

With that said we do have current project proponents who are proposing developing a marine fish operation in the Straits of Juan de Fuca using off-shore technology. The environment is a little less harsh and the proximity to staging areas is better.

I believe off-shore technology will only pay off in Washington on a very large scale because of economies of scale. A very large operation could be accommodated in the Straits of Juan de Fuca and that is inside state waters. We could easily double the size of the meat fish industry in WA just by using the Straits.

What are the procedures for obtaining offshore aquaculture permits in your state?

I don't think they exist in the EEZ and I think we would be severely challenged in court if anyone tried to site such a facility. That is why we need NOAA with consolidated jurisdiction over off-shore technology at least in the EEZ.

All other floating marine operations must get the following permits in WA:

Hydraulics Permit - WSDFW

NPDES Permit - Department of Ecology

Conditional Use Permit and SEPA review by the County

Corp of Engineer Permit for navigation

Aquatic Bedland Lead from the Department of Natural Recourses

At this time we would probably need a review under the ESA as well. (NOAA)

How would you describe the permit process for offshore aquaculture, if there is one?

Very burdensome, expensive, duplicative, unpredictable, not economically viable. As a result we haven't had any permit applications for floating marine fin fish aquaculture for 15 years or more in State waters.

How would your state respond to an application for offshore aquaculture?

In State waters see above. In the EEZ agencies would challenge the existing authorities of anyone to issue such a permit. Anti-aquaculture forces would have a field day in court and administrative appeals until they wore the applicant down. No project would ever be built.

What role would you expect your state to have in relation to offshore aquaculture regulations for the Exclusive Economic Zone, what major issues would they address?

The appropriate role for state and local government in the EEZ is to be reviewers of applications and make comments to a single agency such as NOAA Fisheries which has the final authority to issue the permits

What are the socio-economic concerns and benefits of aquaculture in your state?

As with any state with rural coastline, we have employment problems exaggerated by declining fisheries and timber harvest restrictions. At the same time these communities tend to oppose aquaculture because they cling to the hopes of a revitalized commercial fishing industry. As long as a commercial fishing season exists on a particular species they will oppose growing it by aquaculture as an attack on their traditional way of life. What they forget is if we don't do it some other country will. Look at Chile and farmed salmon. Alaska, with lots of salmon has a difficult time competing.

We have to remember that this is a free country. We must compete to survive. If we want to employ people and continue to produce some of our own seafood than anti-aquaculture forces must be challenged and subdued with good science and public policy.

Are there any other comments you would like to add?

I am attaching a letter that I sent off today to our new prospective governor which will give you some context for my comments.

Appendix D – State Ranking Algorithm

This appendix contains the algorithm we used to determine if a category was a high, medium, or low based on the criteria used to rate that category. The input to the algorithm is the number of criteria in a given category and the rankings for each subcategory (high, medium, or low). The program assigns a one to low values, a two to medium values, and a three to high values. The rounded average of this set of numbers is then computed, with 2.5 being rounded up and 1.5 being rounded down. We used this rounding convention to elicit a greater contrast between categories by reducing the number of mediums. If the result is a one, then the category is ranked overall as a low. If the result is a two, then the category is a medium, and if the result is a three, then the category is a high.

Java code of algorithm:

```
import java.io.*;
public class Rank {
    public static void main(String[] args) throws IOException {
        String numinputs; // records number of inputs
        String valinput; // records value of input
        double total = 0; // records total of inputs for average
        BufferedReader bufReader; // Declare a BufferedReader variable.
        bufReader = new BufferedReader(new InputStreamReader(System.in));
        System.out.print("Enter number of inputs: ");
        numinputs = bufReader.readLine(); // receive input
        System.out.println("Below enter value of inputs using low/medium/high or L/M/H");
        // loop and collect all the inputs
        for (int x = 1; x <= Integer.parseInt(numinputs); x++) {
            System.out.print("Enter value of input " + x + ": ");
            valinput = bufReader.readLine();
            // convert character to number and then add to total
            if (valinput.equals("low") || valinput.equals("L")
                || valinput.equals("1")) {
                total = total + 1;
            } else if (valinput.equals("medium") || valinput.equals("M"))
```

```

        || valinput.equals("m")) {
            total = total + 2;
        } else if (valinput.equals("high") || valinput.equals("H")
            || valinput.equals("h")) {
            total = total + 3;
        }
    }
    // calculate average
    total = total / Integer.parseInt(numinputs);
    // specific roundings
    if (total == 2.5) {
        total = 3;
    }
    if (total == 1.5) {
        total = 1;
    }

    total = Math.round(total);
    // see final outcome
    if (total == 1) {
        System.out.println("Final value is LOW");
    }
    if (total == 2) {
        System.out.println("Final value is MEDIUM");
    }
    if (total == 3) {
        System.out.println("Final value is HIGH");
    }
}
}
}

```

Table D.1 shows the inputs to our algorithm. The algorithm computed the average of each criteria to determine the overall rating for each category. The outputs of each run of the algorithm are found in Table D.2.

Table D.1 – Algorithm Input

Category:	Criteria:	AK	CA	FL	HI	LA	ME	MA	NH	RI	WA	Puerto Rico
Permit Process:	Time	L	M	M	L	L	L	H	L	H	L	M
	Paperwork	M	L	M	L	L	L	H	L	H	M	
	Easy to find what you are looking for	H	L	H	H	L	L	H	L	H	L	H
	Number of state agencies	L	M	H	H	L	L	M	L	H	L	
Aquaculture Production Value:	Value relative to state size and population	L	M	H	M	H	M	L	L	L	M	M
Education:	Public education	L	M	H	H	M	M	M	L	L	M	H
	College education	H	H	H	H	M	M	M	H	H	M	M
Fishermen Support:	Fishermen support	L	M	M	M	M	M	H	M	M	M	H
Movement Offshore:	Attitude towards development	L	L	H	M	M	M	H	H	H	M	H
	Research in aquaculture	L	M	M	H	M	M	L	H	L	L	M
	Commercial aquaculture	L	L	L	H	L	H	M	L	L	M	H
	Past successes	L	L	L	H	L	M	L	M	L	M	H
Government Support:	Guidance in starting a business	M	M	H	L	L	L	H	L	H	H	M
	Agency created for aquaculture	L	L	M	H	L	L	H	M	H	L	L
	Plans for aquaculture development	L	L	H	H	H	H	L	H	H	H	H

Table D.2 – Algorithm Output

OVERALL	AK	CA	FL	HI	LA	ME	MA	NH	RI	WA	Puerto Rico
Permit Process	M	L	H	M	L	L	H	L	H	L	H
Aquaculture Production Value	L	M	H	M	H	M	L	L	L	M	M
Education	M	M	H	H	M	M	M	M	M	M	H
Fishermen Support	L	M	H	H	M	M	M	M	M	M	H
Movement Offshore	L	L	M	H	M	M	H	M	M	M	H
Government Support	L	L	H	H	M	M	H	M	H	H	M

Appendix E – Detailed State and Federal Research Findings

The states that were sampled are presented in alphabetical order, followed by Puerto Rico. These sections contain the major topics that were investigated and the opinions of the interviewees.

Alaska

In the state of Alaska, finfish farming is strictly prohibited by Alaska statute 16.40.210. The only exceptions to this rule are in cases of ornamental fish and non-profit salmon hatcheries. These hatcheries are only allowed to breed salmon for the purposes of releasing them into the wild for fishermen to harvest (State of Alaska Legislative Affairs Agency, 2004, Current Alaska Statutes). Shellfish and sea plant aquaculture are permitted, and these parts of the industry are growing in Alaska.

Permit Process

Alaska does not have a one stop shopping process for aquaculture. The Alaska Department of Fish and Game (ADFG), the Department of Natural Resources(DNR), the Division of Governmental Coordination (DGC), and the Department of Environmental Conservation (DEC) all developed regulations on aquatic farming in Alaska. The DNR maintains a multi-agency aquatic farm and hatchery application, which contains permit applications for the Alaska state agencies and the U.S. Army Corps of Engineers (ADNR, 2004, Part 3).

The DNR is the agency that issues the actual Aquatic Farmsite Lease, which is valid for ten years. There is a 120 day window, open once every two years, within which an aquaculture business can apply for the necessary permits. The next available time window is

January-April 2005 and no new businesses can apply for permits until then. Once the permit applications are received, it takes at least eight months for them to be reviewed. The aquaculture business is also required to submit a minimum bond of \$2,500 to cover the cost of site cleanup and restoration, should the site be abandoned or an environmental accident occurs. The ADFG issues the Aquatic Farm Operation Permit, and, if applicable, the Special Area Permit. The DGC issues the Alaska Coastal Management Program Consistency Determination. The DEC is concerned with general environmental concerns applicable to aquaculture (ADNR, 2004, Part 3).

Regulations

Aquaculture regulations are established by the ADFG, DNR, DEC, and DGC. The DGC regulates the process of transporting aquatic plants as well as acquiring seed and brood stock. The Environmental Health Division of the DEC sets the state water quality standards. The DNR's regulations require that once an aquaculture lease is issued, it must be used for commercial purposes within five years of the lease to ensure that the land is put to work (ADNR, 2004, Part 3). As mentioned above, the ADFG has permitting powers and if any permits are not granted, then the aquaculture business can not begin work.

Environmental Controls

Aquaculture businesses must fulfill all DEC requirements for water quality. A DEC water quality classification is required in order for aquatic farm products to be sold from an aquaculture site. Samples of water quality must be taken periodically and sent to the DEC's Seafood and Safety Lab to test for fecal coliform, paralytic shellfish poison, and other pollutants. The DNR also has its own set of environmental standards and reporting requirements and helps oversee compliance with federal regulations, such as the FDA's hazard analysis and critical control point requirements (ADNR, 2004, Part 3).

Education

Alaska has little formal aquaculture education in its public school systems. The Alaska Sea Grant Program, however, provides funding for marine research at the graduate level. Even though it provides no formal public education on aquaculture, Alaska establishes other means for promoting shellfish aquaculture. For example, Alaska's Department of Natural Resources maintains a joint-agency application packet listing the authorizations necessary to operate an aquatic farm in the state of Alaska (Part 3). The DNR has also developed a list of more than 50 "over-the-counter" aquatic farm sites that have already been approved for farms (Alaska Department of Natural Resources, 2004, Overview and Instructions). However, the citizens of Alaska are still against finfish aquaculture because of the threat to their fishing industry. Alaska supplies half of the seafood produced in the U.S. and its fishing industry "provides nearly all of the employment in about half of Alaska's coastal communities" (State of Alaska, 2004, p. 5). For these reasons, Alaska is strongly supportive of its fishing industry and is hesitant to embrace aquaculture.

Types of Aquaculture

Finfish aquaculture is prohibited in the state of Alaska, with the exception of non-profit Salmon hatcheries. These hatcheries release \$18 million worth of Salmon hatchlings into the wild each year (National Agriculture Statistics Service, 2002, Table 58). Salmon fishing in Alaska is valued at \$125 million annually, \$29 million of which is attributed to the Salmon enhancement program (ADFG, 2003, p. 3). Shellfish aquaculture is allowed, once the permission from the appropriate state agencies is received.

California

California's large coastline provides it with an opportunity for growth in open ocean aquaculture. Hubbs-SeaWorld Institute is trying to utilize California's decommissioned

offshore oil platforms as possible sites for underwater aquaculture cages (Hubbs-SeaWorld, 2004, Research). However, environmental preservation is of particular concern to California and its aquaculture regulations are very protective of the environment.

Permit Process

A permit guide was created by the Aquaculture Development Committee to aid aquaculturists (Conte, 2003, Aquaculture Guide). Titled “A Guide to California State Permits, Licenses, Laws and Regulations Affecting California’s Aquaculture Industry,” the purpose of the guide is to compile regulations from state agencies. Each aquaculture facility must be registered on a yearly basis (State of California, 2004, Title 14 Chapter 9). Permits in the state of California are issued on a temporary basis until the environmental impact of the facility is fully determined. Through public hearings, the Fish and Game Commission can alter the conditions of a permit if the facility is harming public interests.

Regulations

Through the California Aquaculture Development Act of 1979, the California Department of Fish and Game (CDFG) was named the lead agency for aquaculture (Conte, 2003, Agency). Legislation passed in 1982 provided guidelines and authority for aquaculture regulations to be created by CDFG. The regulations created can be found in the California Code of Regulations, Title 14, Natural Resources: Division 1. Department of Fish and Game, and are regularly referred to as “Title 14.”

Regulations on aquaculture in the State of California are in Fish and Game Code Section 15000 and Title 14 of the California Code of Regulations (Conte, 2003, Fish and Game Code). As described in Title 14, aquaculture enterprises must be licensed each year (State of California, 2004, Title 14 Chapter 6). Details of the inspection system are explained

in the Fish and Game Code. Section 15003 explains that fees are based on the price per pound of product sold from public land or water.

Environmental Controls

Two aquaculture committees exist in the state. The Aquaculture Development Committee's main goal is to facilitate better communication between state agencies and the aquaculture industry (Conte, 2003, Agency). The committee consists of twelve representatives from industry, two representatives from the University of California (science and outreach), and one member from each of the following agencies: Department of Food and Agriculture, California Coastal Commission, State Lands Commission, State Water Resources Control Board, State Department of Health Services, and the Joint Legislative Commission on Fisheries and Aquaculture.

The Aquaculture Disease Committee was created to advise the director of the California Department of Fish and Game on aquaculture related aquatic issues, which affect the industry and natural resources of the state (Conte, 2003, Agency). Membership of this committee consists of six industry representatives, CDFG Fish Hatchery Director, CDFG Director of Pathology, two representatives from U.C. Davis (pathology and outreach), and an aquaculture advisor from the California Food and Drug Administration. This committee provides recommendations to the CDFG; however, the CDFG is not required to follow its recommendations.

Robery Hulbrock, the state aquaculture coordinator, believes that the Aquaculture Development Committee is underutilized except for specific products it has produced such as the permit guide (personal communication, November 10, 2004). Additionally, his opinion is that the Aquaculture Disease Committee is mainly reactionary in disease management, and that advice offered by the committee is almost always taken.

Education

Through the University of California system, aquaculture research is being performed (Conte, 2003, Education). U.C. Davis has the largest concentration of aquaculture research in the University of California system. The center for Aquatic Biology and Aquaculture is a program created for conserving the California coast. Several other colleges in the state have programs in aquaculture that conduct research and outreach programs.

Types of Aquaculture

In California, there are few active open ocean aquaculture facilities (Conte, 2003, Subjects). There are plans for using decommissioned offshore oil platforms as research locations and for possible future development of open ocean aquaculture. In the past, there has been some aquaculture production through the harvesting of shellfish from active platform legs. All other aquaculture in the state is not performed offshore. Because of its steep continental shelf, California has difficulties in developing coastal aquaculture establishments. (R. Hulbrock, personal communication, November 14, 2004).

Florida

Aquaculture is considered a type of agriculture in Florida, and the Florida Department of Agriculture and Consumer Services (DACS) is the lead aquaculture agency. The Florida Department of Environmental Protection (DEP) and the Florida Fish and Wildlife Conservation Commission (WCC) also have regulatory authority over the industry. The majority of aquaculture in Florida consists of tropical ornamental fish and plants (Florida Department of Agriculture and Consumer Services, 2003, November, Ornamental Fish and Aquatic Plant). The DACS requires the use of best management practices for aquaculture facilities.

Permit Process

The Department of Agriculture and Consumer Services has been the sole state aquaculture regulatory agency since 1999 (W. Sherman, personal communication, November 9, 2004). An aquaculture business submits its application to the DACS, and the department reviews the application, which can last from six months to over a year.

According to Florida state law, the state owns all of its coastal water and the water bottom. Only the governor of Florida and his cabinet are allowed to lease these areas. The state territorial waters extend to three nautical miles on the east coast of Florida, and three marine leagues (nine nautical miles) on the west coast. Once the DACS approves the permit, the coastal aquaculture application is taken to a public hearing in front of the governor. The aquaculture applicant presents his case and the public is allowed to comment before the governor makes his decision (W. Sherman, personal communication, November 9, 2004).

An aquaculture certificate is required by the Department of Agriculture and Consumer Services to identify aquaculture producers and products. In order to obtain the certificate, aquaculture producers are required to comply with the industry's BMPs. The certificate exempts the facility from the regulatory authority of the DEP, WCC, and Water Management Districts in exchange for compliance with the best management practices (Florida Department of Agriculture and Consumer Services, 2003, Aquaculture Certification).

Regulations

The Florida Department of Agriculture and Consumer Services is the primary regulatory agency involved with aquaculture. Aquaculture sites are subject to two unannounced physical inspections per year. Coastal aquaculture sites are required to periodically send in water samples to the DACS to test for negative environmental impacts of the aquaculture site (W. Sherman, personal communication, November 9, 2004).

Environmental Controls

Aquaculture facilities must submit water samples periodically and the DACS randomly inspects facilities two times per year. The facilities are also required to adhere to BMPs established by the industry in order to minimize their impact on the environment (W. Sherman, personal communication, November 9, 2004).

Education

The DACS has put in place a system for aquaculture education program in Florida public schools. Programs are also set up at several universities in Florida for students to study aquaculture, including the University of Florida. The Florida Sea Grant Program also provides funding for aquaculture education, particularly at the graduate level (Florida Sea Grant, 2004, Education).

Types of Aquaculture

Finfish and shellfish aquaculture are allowed in Florida, once the approval from the Department of Agriculture and Consumer Services is obtained. Currently, there is no open ocean aquaculture in the state; however businesses are allowed apply for coastal aquaculture permits.

Hawaii

Since Hawaii is an island far from any large landmass, it is understandable that this state has become dependent on seafood. The concept of farm fishing in Hawaii dates back over 1000 years, although Hawaii is only now beginning to develop open ocean aquaculture (Aquaculture Development Program (ADP), 2004, Introduction). Today, Hawaii consumes three times the amount of seafood (a total of about 50 million pounds per year) as the United States mainland and 75 percent of what it consumes is imported (ADP, 2004, Introduction).

Permit Process

There are currently two open ocean aquaculture developments and they are both located within two miles of the coast. The short distance from the coastline is made possible by the deep waters surrounding the Hawaiian Islands (Bridger & Costa-Pierce, 2003, p. 285).

To establish an aquaculture business in Hawaii, an applicant has to submit proper paper work and attend several public hearings. These hearings allow government agencies and the public to discuss their concerns. The appropriate paper work must include a management plan and a construction permit (ADP, 2004, Introduction). If the applicant is granted the permit, a lease for the property will be given. The lease will give the applicant permission to use the ocean bottom, the water column, and, if needed, the water surface of the area applied for. Once all fees are determined, the applicant needs to pay a bond to cover environmental hazards and other risks, such as business failure.

The extensive permitting requirements are mainly a result of Hawaii's location. With complicated ocean conditions, weather patterns, and port access, it is crucial for the government to make sure the applicant understands all of the factors involved (Bridger & Costa-Pierce, 2003, p. 286). Even with its complicated permit process, Hawaii has completed the "first successful demonstration in the U.S. of offshore grow-out of a tropical marine fish species in a single, commercially sized sea cage, operated completely under submerged conditions" (Bridger & Costa-Pierce, 2003, p. 285).

Recently, the Hawaiian government has provided the industry with a lead agency, the Hawaii Aquaculture Association, and the permitting process has been well defined (John Corbin, personal communication, December 5, 2004). Hawaii has joined Puerto Rico in the establishment of commercial coastal aquaculture. Cates International Inc produces Moi two miles off the coast of Hawaii.

Regulation

Environmental regulations in Hawaii have been stringent. The environmental regulations hinder the development of offshore aquaculture, although “most aquaculturists now realize that reasonable, science-based guidance and regulations are essential to maintain water quality and limit disease spread” (University of Hawaii Sea Grant College Program, 2004, Themes: Aquaculture). All startup aquaculture companies in Hawaii are restricted to 45 metric tons of production until “requirements are established for compliance with natural pollution discharge elimination system regulatory standards” (Bridger & Costa-Pierce, 2003, p. 289). Even with these strict regulations, Hawaii recognizes the need to develop aquaculture to reduce its dependence on imported seafood. With the creation of a single lead agency, it has been possible for the Hawaiian government to create updated environmental regulations that are not as stringent on the environment as they have been in the past (J. Corbin, personal communication, December 5, 2004).

Environmental Controls

There are extensive environmental controls in place in Hawaii. In fact, “all offshore lands in Hawaii are classified as a conservation district” (Bridger & Costa-Pierce, 2003, p. 286). Without a large landmass, the Hawaiian government must be very careful about how it allocates available land. As more aquaculture research information becomes available, it will be important for Hawaii to minimize the level of environmental monitoring (Bridger & Costa-Pierce, 2003, p. 289).

Education

With such a large dependence on seafood, it is difficult for Hawaii to ignore aquaculture. Public education is done through workshops, technical reports, tip sheets, site visits, and other means (University of Hawaii Sea Grant College Program, 2004, Extension).

Through Sea Grant, Hawaii makes great efforts to educate the public on the different types of aquaculture. In Hawaii, aquaculture is part of society and can not be ignored. Hawaii Aquaculture Development Program Chair John Corbin stated that the “education of decision-makers at all levels and the general public is very important on-going task because open ocean aquaculture in many states is a new activity” (personal communication, December 5, 2004).

Types of Aquaculture

Both finfish and shellfish are produced in local fisheries and offshore to help supplement the large demand for seafood in Hawaii (ADP, 2004, Introduction). Oysters and Moi are examples of the major types of fish that are produced. Most aquaculture is done at inland fisheries, although there are two open ocean aquaculture cages being used for research.

Louisiana

Louisiana has a well-developed inland aquaculture industry; however its open ocean aquaculture industry is still in a phase of growth (Louisiana State University AgCenter, 2004, Introduction). The state has established the Platforms for Mariculture Task Force to investigate the current status of aquaculture and create a recommendation on state policy changes. The state realizes the importance of offshore aquaculture and is attempting to improve the industry through task force recommendations.

Permit Process

Louisiana has established a clear hierarchy of state agencies required to obtain an inland aquaculture permit. The permitting process includes the following state organizations: Louisiana Department of Wildlife and Fisheries, Louisiana Department of Natural Resources, Louisiana State Land Office, and Louisiana Department of Environmental Quality (Fletcher, 2004, Louisiana). Depending on the location of the site, a coastal use permit will be issued by the Louisiana Department of Natural Resources. The Louisiana State Land Office has

authority over the water bottoms and airspace above water and therefore it issues leases for space on the sea floor. The cost is \$0.02 per square foot for water bottom for commercial ventures, but there is no cost for public and scientific ventures. Additionally, the Louisiana State Land Office requires an indemnification agreement to cover any damages that might be caused by the facility, such as ships colliding into the structure and the Louisiana State Land Office is to be held harmless for any damages. A mariculture permit can be issued by the Louisiana Department of Wildlife and Fisheries after a use permit from the Department of Natural Resources and a lease from the State Land Office are obtained. No regulations or permitting process for offshore aquaculture are currently in place (J. Roussel, personal communication, November 16, 2004).

Regulations

Aquaculture in Louisiana is defined as part of agriculture in Louisiana Statutes §3:263(2000). In the same section, agriculture loans are defined to include, “financing conversion to aquaculture production.” As part of §56:327 (2000), the general provisions for Wildlife and Fisheries states that any seafood sold in the state that is produced through aquaculture processes must have the appropriate permits as described above. Act 865 titled the “Louisiana Aquaculture Development Act of 2004” created the Louisiana Aquaculture Coordinating Council (LACC) (J. Roussel, personal communication, November 16, 2004). The act created the position of director and assistant director, who are both under the supervision of the Louisiana Commissioner of Agriculture. Also, the act provides “a regulatory framework for the orderly development and maintenance of a modern aquaculture segment of Louisiana’s agriculture industry and for promotion of aquaculture and aquaculture products.”

In 2004, the Platform for Mariculture Task Force was established. The task force is creating a report that assesses the economic feasibility, environmental impacts, and regulatory considerations of using decommissioned oil and gas platforms in the Gulf of Mexico (J. Roussel, personal communication, November 16, 2004). The task force is to provide a written report to the Louisiana governor and legislature by January 31, 2005.

Environmental Controls

Environmental policies in Louisiana are based around the hierarchy of state departments. Each department has jurisdiction over a specific aspect of environmental regulation.

Education

The Louisiana State University (LSU) AgCenter is conducting aquaculture research (Louisiana State University AgCenter, 2004, Introduction). It has received numerous grants funding aquaculture research. Working with the state agriculture community groups, the LSU AgCenter is creating a set of BMPs for the different agriculture communities in the state, including aquaculture.

Types of Aquaculture

No open ocean aquaculture is present in the Louisiana. However, in the state there has been development of onshore aquaculture. The major types of onshore aquaculture are: crawfish and oysters. Inland aquaculture in Louisiana has been developed and is a \$120 million industry (Lutz & Romaine, 2003, p. 1).

Maine

The state of Maine has no offshore aquaculture; however, it does have a permitting process setup for it. The process allows for interaction between the parties that will be

affected by the facility through a series of meetings. This process has created a fair environment for aquaculture business development.

Permit Process

Maine has a permit process for opening an aquaculture business as defined in Subchapter II §6072 of Maine General Statutes. The exact applications differ, depending on the type of operation that is proposed. Despite the different applications, the process has the same general steps (Department of Marine Resources, 2004, Applications). There is a pre-application meeting with the Department of Marine Resources (DMR). The company applying for the permit completes the application and submits it to the Aquaculture Administrator, who determines if the permit is complete. The DMR and Maine Sea Grant may elect to hold an informal public meeting to allow public comments in the process. If a public meeting does not occur, a meeting that includes nearby landowners, municipalities, and other affected parties will be held. The aquaculture environmental coordinator conducts a site visit. The aquaculture administrator solicits comments from local, state and federal agencies and a public hearing is held for all standard lease applications. For special lease applications, public hearings will occur only if requested by five or more people. The aquaculture administrator prepares a draft of the decision for the commissioner. The commissioner has the final decision on issuing the lease. If the lease is granted, the applicant must provide a bond to the DMR before receiving the lease (Department of Marine Resources, 2004, Applications).

Regulations

The importation of marine organisms is controlled through §6071 to protect natural ecosystems (Department of Marine Resources, 2004, Aquaculture Laws). §6072 describes the permit process for obtaining an aquaculture lease. Definition of further requirements on leased

areas occurs in §6073. Special licenses can be granted by the commissioner, as defined in §6074, for research or educational purposes, which exempts the holder of the permit from specified marine resource laws. Public health concerns are addressed through §6075 and §6076. The monitoring program for aquaculture operations is defined in §6077.

When antibiotics are released into an aquaculture lease site, a public notice is required. As defined in §6079, the notice must be posted where normal town meeting notices would be posted in the nearest town. The notice would include the following information: name and address of aquaculture lease holder, persons responsible for applying the antibiotic, name of antibiotic, dosage to be applied, duration of treatment, and date of posting. The Aquaculture Advisory Council, as created in §6080, consists of the commissioner or an appointed representative and four individuals from the industry who are appointed by the commissioner. No more than two of the appointed members from industry may represent similar segments of the state's aquaculture industry (Department of Marine Resources, 2004, Aquaculture Laws).

Environmental Controls

In Maine, the DMR works with the Department of Environmental Protection to prevent environmental problems from arising in aquaculture facilities. The Finfish Aquaculture Monitoring Program (FAMP) existed for monitoring all finfish farms in the state (Department of Marine Resources, 2004, Monitoring). This program was established in 1991 and is funded by the finfish industry production tax. In 2004, the program was entirely handed over to the Maine Department of Environmental Protection, and the program no longer uses the FAMP name. Instead, the program is the Maine Pollution Discharge Elimination System (MPDES), which has the same requirements and monitoring system as FAMP had (S. Horn-Olsen, personal communication, November 18, 2004). A unique component of this program is

that an independent third party contractor completes the actual inspection of the aquaculture site. Maine Aquaculture Policy Coordinator Samantha Horn-Olsen believes that the third party contractor system is very effective (personal communication, November 18, 2004). A single outside company, apparently well qualified and respected, has won most of the inspection bids.

Twice a year, during the spring and fall, a video survey is taken of all active farms. The video survey provides information on the benthic (bottom) conditions. Dissolved oxygen readings are taken in late summer since high temperature problems would be more evident at that time. Every other year, a benthic survey of organisms is completed to check that the diversity of organisms is within acceptable limits. Data from these inspections are available to anyone who is interested. A committee of state and federal organizations including the Maine Departments of Marine Resources, Environmental Protection, Inland Fisheries and Wildlife, U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, National Marine Fisheries Service, and U.S. Fish and Wildlife Service reviews the data for any problems. Additionally, these organizations make suggestions periodically on how to improve the program (S. Horn-Olsen, personal communication, November 18, 2004).

In Maine, there is a move to change how the third party monitoring contractor is hired (S. Horn-Olsen, personal communication, November 18, 2004). The move is to allow the individual business owner to choose a state approved inspection contractor. This would make the inspection of aquaculture facilities the same as other industries, such as paper production and water treatment. There is still confusion as to how to designate state-approved inspection contractors.

Education

At the state level, §6081 established the Aquaculture Research Fund (Department of Marine Resources, 2004, Legislation). The commissioner can use any money in the fund towards research and management related to the aquaculture industry. The University of Maine has a Sea Grant program that is researching methods to improve aquaculture. The program has thirteen clearly set priorities with individual sub goals.

Types of Aquaculture

A sizeable aquaculture industry exists in Maine, where many finfish aquaculture farms operate. These farms primarily produce Atlantic Salmon and Steelhead Trout, and most of these establishments are vertically-integrated corporations that control the entire production and distribution process (Maine Aquaculture Innovation Center, 2004, About). Additionally, shellfish and sea vegetable aquaculture have grown in the state. Shellfish farms mostly produce Eastern Oysters, Calms, Bay Scallops, Surf Calms, and Mussels. Most shellfish farms in the state are family owned and operated.

Massachusetts

With 2000 miles of coastline, Massachusetts has the potential to develop open ocean aquaculture. Massachusetts' inland and marine aquaculture industry produces \$8.6 million dollars of seafood yearly. The marine aquaculture industry in Massachusetts primarily produces hard clams, oysters, scallops, soft shelled clams, and mussels. The potential for aquaculture to flourish in Massachusetts has been constrained by several factors, including the regulatory framework, business climate, and public acceptance (Soares, 1998, p. 1). To overcome these constraints, the Massachusetts Coastal Zone Management (CZM) began a strategic planning process.

In October of 1995, the Massachusetts CZM released the Aquaculture White Paper and Strategic Plan. This plan describes the aquaculture industry in Massachusetts, identifies the existing barriers to development, and proposes recommendations to promote the industry. Many of the recommendations have been fulfilled, including the designation of the Department of Food and Agriculture as a lead agency and establishing an Aquaculture Coordinator. Other recommendations implemented include the formation of an industry advisory group, the establishment of a grants program, and regulatory streamlining (Massachusetts Coastal Zone Management Office, 2004, p. 1). In Massachusetts, aquaculture is considered a type of agriculture.

Permit Process

A confusing and often difficult permitting process hinders the development of aquaculture businesses in Massachusetts (Massachusetts Coastal Zone Management Office, 2004, p. 1). The White Paper and Strategic Plan identified regulatory streamlining as a priority “central to the development of aquaculture” (Soares, 1998, p. 1). To simplify the permit process, the Massachusetts Department of Food and Agriculture created the Permits Guidance Document in April of 1998. This document considers the different types of aquaculture and breaks them down into four categories: species cultivated, source of water/location, water/waste discharge, and structures that will be necessary to support the facility. The document provides permit descriptions, agency contacts, and other important permit information and is one of the important steps taken by Massachusetts to streamline the permit process.

The Division of Fisheries and Wildlife (DFW) in Massachusetts has the authority to oversee activities such as fishing, hunting, and aquaculture. The DFW has developed a standard process for issuing aquaculture permits in Massachusetts. All permit applicants must

submit proposal information to the DFW. The DFW reviews the information and issues or denies the appropriate permit. The DFW divides the different aquaculture facilities into “Types A, B, and C” to organize the different requirements for each facility. Types A, B, and C describe different aquaculture establishments and allow the applicant to classify his/her proposed aquaculture facility. The DFW created a decision process that is consistent and fair in its approach to issuing permits. The permit system applies to many different aquaculture interests (Massachusetts Coastal Zone Management Office DFW, 1994, p. 1).

Massachusetts has taken steps to streamline the permit process, but further improvements need to be made. The number of permits required is large and the time required to acquire these permits can be long. Aquaculture regulation is fragmented among several agencies, including the Department of Fisheries, Wildlife, and Environmental Law Enforcement and the Department of Environmental Protection. If Massachusetts had one designated agency to regulate coastal aquaculture, its regulatory procedures would be simplified (Massachusetts Coastal Zone Management Office, 2004, p. 3). There is no specific procedure for obtaining coastal aquaculture permits in Massachusetts.

Regulations

Businesses desiring to use public and private resources in the coastal zone encounter a confusing mix of federal, state, and local requirements and rules governing aquaculture. Massachusetts’ aquaculture regulations reflect its concerns pertaining to the protection of coastal wetlands, endangered species, ocean sanctuaries, and the enhancement of state coastal zones.

In Massachusetts, towns are allowed to make their own decisions concerning the establishment of aquaculture businesses, which contributes to the difficulty of starting coastal aquaculture businesses. Aquaculture Coordinator Scott Soares compared Massachusetts to

Connecticut and Florida, which only allow state policies to govern the industry, rather than the municipal bodies. The concerns of the municipal bodies can make the process to obtain marine based aquaculture sites very difficult because the bodies have the authority to deny an establishment from being built (personal communication, November 10, 2004).

Environmental Controls

Massachusetts requires each proposed aquaculture business to file an Environmental Notification Form (ENF) that describes the project, potential for environmental impacts, and alternatives that would avoid or minimize damage to the environment. If the ENF form is not approved, further environmental information is required and an Environmental Impact Report (EIR) is required. If the ENF report is approved by Executive Office of Environmental Affairs, the appropriate state permits will be issued (Massachusetts Coastal Zone Management Office, 2004, p. 5). These forms are very important because they provide procedures that avoid or minimize damage to the environment.

Massachusetts has put great effort into protecting its environment and coastline. The Wetlands Protection Act (WPA) requires anyone who intends to alter any coastal resource area to file an application called a Notice of Intent with the local conservation commission (Massachusetts Coastal Zone Management Office, 2004, p. 5).

Education

Education is an important part of the Massachusetts Aquaculture Development Plan. Aquaculture education in an academic setting and in public forums helps the aquaculture industry develop. The state has also provided funding for technological research. Technology research can have an important role in aquaculture establishments because it can help minimize harmful environmental effects. Because public and municipal bodies have significant influence on aquaculture project developments, educating the public is also

especially important. Many town officials and residents have misconceptions about aquaculture and are unaware of the benefits it can provide.

The Massachusetts Aquaculture Centers Network establishes research and education centers. These centers are run by organizations such as the Massachusetts Maritime Academy that work toward the development of the aquaculture industry (S. Soares, personal communication, November 10, 2004).

Types of Aquaculture

Shellfish aquaculture is the most significant type of aquaculture in Massachusetts. The inland industry is comprised primarily of recirculating facilities located in the western part of the state, in New Bedford, Boston, and Cape Cod. These facilities produce hybrid striped bass, tilapia, trout, summer flounder, and other finfish (Massachusetts Coastal Zone Management Office, 2004, Species).

New Hampshire

New Hampshire began developing and researching open ocean aquaculture in 1997. Today, research is still conducted through the Sea Grant program on the only open ocean aquaculture site in New Hampshire. Future New Hampshire legislation will be based on the research conducted through Sea Grant and the University of New Hampshire (UNH).

Permit Process

Aquaculture permits are issued through the New Hampshire Fish and Game Department. New Hampshire is in the process of researching offshore aquaculture. Obtaining a permit for an open ocean aquaculture business would be difficult because a permitting process for open ocean aquaculture has not been established (New Hampshire Sea Grant Management (NHSGM), 2004, Current Offshore Activities).

The permitting process for coastal aquaculture does not exist yet, although the permit Sea Grant obtained for research work was done through New Hampshire's general aquaculture permit process (R. Barnaby, personal communication, November 5, 2004). The New Hampshire Fish and Game Department requires a hearing, but hearings with other agencies are optional. Government agencies such as NMFS or the Army Corps of Engineers have the option to hold additional hearings (NHSGM, 2004, Current Offshore Activities). With all of the required paperwork and the time it takes to complete the requested hearings, it can take more than a year for a permit to be issued or denied.

There is no permit application specifically for coastal aquaculture, but New Hampshire Sea Grant Extension Educator Rollie Barnaby hopes there will be a process solely for open ocean aquaculture in the near future. The permitting process could be streamlined by removing unnecessary agencies from the permitting process. If aquaculture is going to be a profitable business in New England, it will have to expand into the EEZ because of the heavy traffic from boaters and regional fisherman in state waters (personal communication, November 5, 2004).

Regulation

New Hampshire does not have many clearly defined regulations. The government is hoping to create coastal aquaculture regulations based on the results of scientific research, which is being conducted through Sea Grant.

Environmental Controls

New Hampshire has very few coastal aquaculture environmental controls in place. Extensive environmental research is being conducted on many types of aquatic fish and plants to determine exactly what kinds of controls would be most effective (NHSGM, 2004, Environment).

Education

Through Sea Grant, UNH is doing extensive aquaculture research. With funding and government support, this research is being conducted nine miles off the coast of New Hampshire. By researching both fish and plants, New Hampshire hopes to find a natural way to handle the waste produced from coastal fish farming (NHSGM, 2004, Environment). Sea Grant educators “disseminate this information through national and international conferences, publications, and radio and TV interviews” (Bridger & Costa-Pierce, 2003, p. 243).

With the reduction in natural fish stocks, especially cod, fishermen are more willing to become educated in aquaculture. In a survey of 311 fishermen, 53 percent were willing to work in aquaculture, 83 percent desired to learn more, 73 percent said small, privately owned and financed operations were desirable, and 57 percent indicated that large, corporate owned operations were undesirable (Stickney & McVey, 2002, p. 71).

Types of Aquaculture

Research is being completed for the many types of finfish, shellfish, and aquatic plants. There is only one offshore aquaculture establishment in New Hampshire, although there are many inland fisheries (Cooperative Institute for Coastal and Estuarine Environmental Technology, 2004, Homepage). New England is working toward replenishing its natural stocks of cod, which have been depleted in the last decade.

Rhode Island

Rhode Island has an active aquaculture industry. Currently, the industry has 20 aquaculture farms spanning 61 acres, although none of them are offshore (Rhode Island Coastal Resources Management Council (RI CRMC), 2004, Publications and Regulations). Rhode Island, like many other New England states, spends most of its time and resources in the college community to promote the research and education of aquaculture. Through

experiences with inland aquaculture, Rhode Island is exploring the possibilities of open ocean aquaculture.

Permit Process

Rhode Island has what could be considered a “one stop permitting process.” The CRMC has the power to issue permits to aquaculture applicants, although many other government organizations are involved in the process (RI CRMC, 2004, Homepage). The process has been established such that all interested parties, public or governmental, have a chance to raise their concerns and the applicant can defend his or her position. However, this permit process applies only to shellfish, and anyone interested in a finfish aquaculture permit needs to contact the CRMC.

The first part of the process for starting up an aquaculture facility is to find a suitable location. Once a location is established, it is possible to do a preliminary commercial test of the site. This testing is only done once for each location, but it can provide the information needed to apply for and receive a permit. However, all permit applications within 200 feet of any Rhode Island coastal feature (for example - a beach, dune, cliff, salt pond, or wetland) have a “reasonable probability of conflicting with CRMC goals” (RI CRMC, 2004, Submit Application).

For either inland or coastal aquaculture permits, there are several forms to fill out. All of the application fees are clearly stated in the forms. These forms can easily be found online, and all of the relevant regulations are attached. Once the forms are filled out and submitted, it takes only thirty days to review the application and meet with the required government agencies and the general public at a hearing (RI CRMC, 2004, Aquaculture Application Package). While there have been no applicants for coastal aquaculture, Dave Alves says that

Rhode Island is looking to develop its coast (Personal Communication, Dave Alves, November 10, 2004).

Once the application process is complete, the CRMC will make its final decision. If the CRMC decides not to issue the permit, the applicant must choose another location for his or her aquaculture venture if he or she wants to apply again. If a permit is granted, the CRMC grants a lease for the required area, which can last as long as ten years. The leased area includes the land under the water, the water surface, and the water column (RI CRMC, 2004, Aquaculture Application Form). The permit must be renewed every ten years.

Throughout the permit process, public interaction is encouraged. The applicant is encouraged to speak with local fishermen and harbor masters before submitting his or her application (RI CRMC, 2004, Submit Application). The CRMC is very concerned with the public opinion on how to develop Rhode Island's coastline. Rhode Island welcomes the idea of offshore finfish aquaculture, although there has been little to no interest from outside companies (D. Alves, personal communication, November 10, 2004).

Regulations

The CRMC has the authority to grant and revoke aquaculture permits and is charged with the enforcement the current aquaculture regulations (RI CRMC, 2004, Aquaculture Application Form Section 20-10-6). Rhode Island regulations formerly were a major obstacle to the development of aquaculture, but in the past four years Rhode Island has revamped its regulations. The present rate of development of aquaculture, combined with the effectiveness of the regulations, has made Rhode Island a model for other states to follow (RI CRMC, 2004, Publications and Regulations).

Environmental Controls

Rhode Island's environmental controls are not a major hurdle for developing shellfish aquaculture. Once a year, each aquaculture establishment is required to submit a report which contains all of the required environmental information. Some of this information includes the change in dissolved oxygen levels, waste from excretion and excess feed, and chemicals used (RI CRMC, 2004, Publications and Regulations).

Education

The funds for aquaculture development in Rhode Island come from the Reed Aquaculture Initiative, which was created by Senator Jack Reed. The majority of this funding goes to the University of Rhode Island, Roger Williams University, and the Rhode Island Sea Grant College Program (RI CRMC, 2004, Projects). With this funding, these institutions educate students and conduct aquaculture research.

Types of Aquaculture

Currently, Rhode Island has only shellfish aquaculture. The permitting process does not account for any finfish culture, except to provide interested parties with a phone number to call. None of the aquaculture being conducted is open ocean.

Washington

With the decline of commercial fishing in Washington waters, fish processing plants have become more dependent on farmed fish to support their industry. Aquaculture is number 18 in the top 40 agricultural products produced in Washington (Washington Fish Growers Association, 2004, p. 1). The states' aquaculture industry is dominated by salmon net pen facilities in Puget Sound, oyster and clam cultivation, and mussel growing. Washington State had been the leader of the west coast states in total production of aquaculture products and was one of the top producers of oysters in the United States (Washington Department of

Ecology, 2001, April, p. 2). Since 2001, Washington's total aquaculture value has decreased from 41 million to 22 million dollars. Because of this decrease in aquaculture production, it has focused on further development of open ocean aquaculture, with projects proposed in the Strait of Juan De Fuca (Environmental Assessment Office of British Columbia, 2003, p. 2).

Permit Process

Washington has made efforts to promote aquaculture and the security of its wild stock fisheries. All aquatic farms must register with the Department of Fisheries to receive an aquatic farm registration form, which must be renewed annually. For marine aquaculture, a finfish aquaculture permit must be filed with the director responsible for that specific species.

The state has strong concerns regarding the safety of its wild fish stocks. Since the escape of farmed fish can have drastic effects on wild stocks, Washington has authorized an Escape Prevention Plan. Each aquaculture business owner must complete a document that describes best management procedures for its establishment to minimize the risk of fish escapement (Washington State Legislature, 2004, WAC 220-76110).

The Washington legislature found that the aquaculture industry has overall benefits to the state and that the state should encourage the development of the industry. They made efforts to promote aquaculture by providing aquaculture business applicants with the necessary information concerning permits. By having local government planning offices provide all the necessary permit information, it simplifies the permit process (Environmental Assessment Office of British Columbia, 2003, p. 1).

There is also a Joint Aquatic Resource Permits Application that allows the applicant to fill out one form and that will apply for multiple permits. This application is another example of steps being taken to streamline the permit process. It allows the applicant to apply for

Shoreline Management Permits, Hydraulic Project Approvals, Short-Term Modifications of Water Quality Standards Permits, and Army Corps of Engineers Permits in one simple process (Environmental Assessment Office of British Columbia, 2003, p. 2).

Regulations

Washington's legislative policy regarding the fostering and regulation of aquaculture is fulfilled in six acts: the Aquaculture Marketing Act of 1994, the Multiple Use Concept in Management and Administrations of State Owned Land Act of 1971, the Aquatic Land Act of 1984, the Shoreline Management Act of 1971, the Water Pollution Control Act, and the Growth Management Act.

The two important acts that address aquaculture are the Aquaculture Marketing Act and Multiple Us Concept Act. The Aquaculture Marketing Act encourages the development and expansion of aquaculture. The Multiple Use Concept Act states that the "...[D]epartment of [N]atural [R]esources shall foster the commercial and recreational use of the aquatic environment for production of food."(Washington Department of Ecology, 2001, April, p. 45) Many the state policies are not consistent with federal policies. Washington continually makes efforts to address these issues through local programs and the state's federally approved Coastal Zone Management Program.

Environmental Controls

The Escape Prevention Plan is an example of efforts being made to protect the environment. The plan minimizes harmful environmental effects. The Water Pollution Control Act and the Growth Management Act protect the state wildlife habitats by enforcing regulations that require specific permits.

Education

Washington's Sea Grant Program and the University of Washington School of Aquatic and Fishery Sciences provide educational programs on offshore aquaculture.

Types of Aquaculture

Atlantic Salmon and Pacific Oysters are the major contributors to Washington's aquaculture industry. Manila Clams are the most popular type of clam harvested. Also, Coho Salmon, Trout, Steelhead, and Arctic Char are cultured.

Puerto Rico

Snapper Farms Inc, in partnership with the Culebra Fishermen's Association, began commercial offshore aquaculture work off the coast of Puerto Rico in 2002 with the complete support of the government, academia, and the public (Bridger & Costa-Pierce, 2003, p. 267). Cobia and Snapper are being grown in an underwater aquaculture cage. If successful, the products produced by Snapper Farm Inc could be a "tremendous help to the island" (University of Puerto Rico Sea Grant College Program, 2002, Homepage).

Permit Process

The Joint Permit Application (JPA) for Snapper Farms Inc was submitted in September 2000 (Bridger & Costa-Pierce, 2003, p. 267). The application combines all of the agencies involved in the permit process into one application, although the application is not well organized. The permit process for Snapper Farms Inc was particularly short because of the overwhelming support from the government, academia, and the public (Bridger & Costa-Pierce, 2003, p. 267).

Regulation

Puerto Rican aquaculture laws are based primarily on those of the United States, especially laws concerning the environment (University of Puerto Rico Sea Grant College

Program, 2002, Homepage). With the development of Snapper Farms Inc, it may be possible to relax regulations and permit requirements (Bridger and Costa-Pierce, 2003, p. 264). These reductions in regulations will be dependent on the success of Snapper Farms Inc and the environmental impacts of its operation.

Puerto Rican Fishermen and Aquaculture

Unlike many cases in the United States, the fishermen of Puerto Rico completely support aquaculture activities. Most fishermen are frustrated because they can not fulfill their economic needs and they do not feel that the government supports their activities (Bridger and Costa-Pierce, 2003, p. 66). With the development of aquaculture, there are new economic opportunities for fisherman and this is why the Culebra Fishermen's Association is in partnership with Snapper Farms Inc.

Federal Legislation Research

The results of our federal research are included in this section, with the exception of federal legislation that is included in the background section. Henry McCoy (2000, p. 103) explains how difficult it is to collect information on all federal aquaculture policies in the United States. There are such a large number of legislative acts and regulations, and not all of the policies that affect aquaculture are labeled as applicable to aquaculture.

Federal Aquaculture Precedents

According to the public trust doctrine, which originates in Roman times and is presently upheld by U.S. courts, the government is required to use the nation's waters for the best public interest. In some instances, the water should be left open for shipping lanes, and in other instances the water should be set aside for activities such as aquaculture (McCoy, 2000, p. 147). However, U.S. courts have ruled that aquaculture is not a natural derivative of

public rights to fish, and therefore states still maintain the right to prohibit the practice of aquaculture (McCoy, 2000, p. 149).

There are many reasons why aquaculture has been slow to progress in the United States. In most states, aquaculture businesses are responsible for environmental damages caused by their facilities, such as escaped fish, even if the business is not negligent. Aquaculture is considered “abnormally dangerous”, and therefore even if an establishment did everything in its power to protect the environment, it still is responsible for damages, even if the damages are accidental (McCoy, 2000, p. 165). Furthermore, if external environmental hazards, such as dumped sewage, kill the fish in an offshore aquaculture facility, the facility might not have the right to sue the party that caused the damages. Offshore aquaculture establishments do not own the property, they lease it from the state, and therefore they have limited property rights (McCoy, 2000, p. 167). Lastly, all it takes is one human death from a disease such as salmonella and an aquaculture company will practically be forced out of business. McCoy (2000, pp. 258-259) states that “the greatest single legal risk to the aquaculture industry is precisely one such [food poisoning] incident.”

Proposed Legislation

The Department of Commerce and NOAA are proposing federal legislation entitled “The Offshore Aquaculture Act of 2004” that would govern the development of aquaculture in the Exclusive Economic Zone. The act, if passed by Congress, would allow the National Marine Fisheries Service to issue site permits for aquaculture in the EEZ and would clarify the role of aquaculture relative to the Magnuson Stevens Act.

Appendix F – Aquaculture Production Values

Table F.1 contains the values that were used in categorizing the aquaculture production value for each state.

Table F.1 – Aquaculture Production Values

State	Value in \$	Source	Year
Alaska	21,000,000	(National Agriculture Statistics Service, 2002, Volume I)	2002
California	71,000,000	(Western Regional Aquaculture Center, 1999, p. 1)	1999
Florida	95,500,000	(Florida Agriculture Statistics Service, 2003, pp. 1-2)	2003
Hawaii	27,700,000	(Pacific Business News, 2004, p. 1)	2002
Louisiana	120,000,000	(Lutz & Romaine, 2003, p. 1)	2002
Massachusetts	8,600,000	(Massachusetts Coastal Zone Management Office, 2004, Production)	2004
Maine	42,900,000	(United States Department of Agriculture Foreign Agriculture Service, 2004, pp. 14-16)	2000
New Hampshire	844,000	(United States Department of Agriculture, 2000, p. 1)	1998
Rhode Island	556,000	(Rhode Island Coastal Resources Management Council, 2004, p. 5)	2003
Washington	21,700,000	(United States Department of Agriculture, 2003, pp. 1-2)	2002
Puerto Rico	less than 8 million	(Puerto Rico Agriculture Statistic Service, 2004, p. 24)	2002