Achieving Sustainable Sea Farming

> "We must plant the sea and herd its animals using the sea as farmers instead of hunters. That is what civilization is all about - farming replacing hunting."
> ~Jacques-Yves Cousteau

The National Aquaculture Association[1] is a U.S. producer-based, non-profit association incorporated in 1991 that supports the establishment of governmental programs that further the common interest of our membership, both as individual producers and as members of the aquaculture community. For over 27 years NAA has been the united voice of the domestic aquaculture sector committed to the continued growth of our industry, working with state and federal governments to create a business climate conducive to our success, and fostering cost-effective environmental stewardship and sustainability.

The NAA offers the following recommendations with respect to drafting U.S. marine aquaculture legislation to support the creation of a commercially viable framework for U.S. aquaculturists to grow, handle, transport and sell marine finfish, shellfish (clams, oysters, mussels or scallops) and seaweed from farms located in the Exclusive Economic Zone of the United States.

Advancing Public Health, Food Security and Sustainable Economic Growth

Offshore marine aquaculture in the Exclusive Economic Zone holds tremendous potential for advancing the public health, food security and economic interests of Americans, but those interests can only be served if government provides the legal authorities for the private sector to fulfill that mission without unwarranted regulatory obstacles. Large-scale marine aquaculture production in the United States would create the ability to:

- Close a significant gap in U.S. food security (availability) through the farming of seafood products in U.S. waters rather than relying as the United States currently does on foreign seafood sources for 90% of the seafood consumed by our citizens.
- Create ancillary equipment and service businesses and new jobs within coastal and inland communities.
- Accelerate technological development to reduce production costs and minimize adverse environmental effects.
- Maintain working waterfronts and build upon the existing and unique knowledge, skills and abilities possessed by commercial fishers.

[1] The National Aquaculture Association (NAA) represents farmers across the United States that raise aquatic animals and plants destined for food, bait, ornamental, recreational fishing markets and as fertile eggs, larvae, fingerlings or shellfish seed to stock farms for grow-out. We are a U.S. producer-driven, non-profit association incorporated in 1991 that for 27 years has worked ensure the aquaculture industry's sustainability, profitability and development occurs in an environmentally sustainable manner. For more information, visit http://thenaa.net/.

This commentary was provided to the Senate Committee on Commerce, Science and Technology following a committee hearing on marine aquaculture held January 30, 2018.

While these projections are well-documented,[2] the United States has yet to make any significant advances in U.S. marine aquaculture production in the 38 years since passage of the National Aquaculture Act of 1980. Aquaculture production is approximately 45,500 tons valued at $327 million and supplies about 3% of U.S. seafood consumption. Federally managed waters beyond coastal state boundaries, termed the Exclusive Economic Zone, encompass 4.4 million square miles (11.3 million square kilometers). A U.S. study estimated that 195 square miles (500 sq. km) of ocean, managed under existing regulations, could produce 1.3 billion pounds (600,000 metric tons) or more of high quality seafood.[3] Theoretically, the farming of 970 sq. miles (2,500 sq. km), an area representing .0002% of the Exclusive Economic Zone, less than half the size of Delaware, would double U.S. edible seafood production or an area the size of the Pentagon could produce 220 million pounds (100,000 MT). A doubling of U.S. aquaculture production to about 1 million tons could create an estimated additional 50,000 farm and non-farm jobs.[4]

Fish Farming is Inherently Efficient

Farmed and wild-caught fish, shellfish and sea vegetables have been recognized as critical components to achieving global food security and nutrition. Farmed and wild fish production have been the main contributor to the 61 percent increase in world protein consumption, fish are very efficient converters of feed into protein, and aquatic animal production systems have a lower carbon footprint, lower nitrogen and phosphorus losses and in the case of shellfish and sea vegetable production remove carbon, nitrogen and phosphorus from the environment. The inherent energy and feed advantages of fish are derived from the "cold-blooded" nature, meaning they expend little to no energy to maintain a constant body temperature, and the physical support water provides to directs growth to protein and not a bony muscular-skeletal structure that is always fighting gravity.[5]

Current Regulations are Proven and Effective

Over the last 20 years, rather than acknowledging the many advances in marine aquaculture production practices and successful management strategies for adverse environmental impacts, many in the environmental community continue to attribute a variety of potential adverse environmental effects to aquaculture based on outdated production methods and standards.[6] We note that the U.S. Environmental Protection Agency (EPA) has held authority to regulate discharges from fish farms (nutrients, chemicals and solid waste) under several iterations of the Clean Water Act since the 1970s. More recently, environmental groups sought EPA reevaluation of the Clean Water Act standards applied to aquaculture. During a four-year period, 2000-04, the agency completed a detailed technical review of its then current standards, and modern aquaculture methods, including those used for marine aquaculture. Formal rulemaking was

[2] Rubino, M. (ed). 2008. Offshore Aquaculture in the United States: Economic Considerations, Implications & Opportunities. U.S. Department of Commerce; Silver Spring, MD; USA. NOAA Technical Memorandum NMFS F/SPO-103

[3] Nash, C.E. 2004. Achieving Policy Objectives to Increase the Value of the Seafood Industry in the United States: The Technical Feasibility and Associated Constraints. Food Policy 29:621-641.

[4] Knapp, G. and M.C. Rubino. 2016. The political economics of marine aquaculture in the United States. Reviews in Fisheries Science and Aquaculture 24(3): 213-229.

[5] Béné, et al. 2015. Feeding 9 billion by 2050 – Putting fish back on the menu. Food Security 7(2): 261-274 (https://link.springer.com/article/10.1007/s12571-015-0427-z accessed February 1, 2018).

[6] Goldburg, R. and T. Triplett. 1997. Murky Waters: Environmental Effects of Aquaculture in the United States. Environmental Defense Fund, New York NY

conducted to ensure that Clean Water Act regulations for aquaculture met all standards of environmental protection mandated by Congress. In that process, the EPA determined, contrary to the position of environmental groups, that the proposed and adopted revised regulations assured environmental protection.

Other current federal regulatory authorities, unilaterally or in partnership with the states, exist to protect navigation and navigational aids, water and benthic quality, food safety, drug and chemical use, aquatic animal health, endangered species, wild fishery stocks (with respect to potential aquaculture impacts to those populations), essential fish habitat, and the opportunity for coastal states to comment on proposed federal permits and leases associated with offshore marine aquaculture. Existing law include, but are not limited to, the Animal Health Protection Act, Animal Medicinal Use Drug Clarification Act, Coastal Zone Management Act, Endangered Species Act, Federal Food Drug and Cosmetic Act, Federal Insecticide, Fungicide and Rodenticide Act, Federal Water Pollution Control Act (Clean Water Act), Lacey Act, Magnuson-Stevens Fishery Conservation and Management Act, Marine Mammal Protection Act, Migratory Bird Protection Act, National Environmental Policy Act Outer Continental Shelf Lands Act, and Rivers and Harbors Act. Through rulemaking, judicial rulings and an opportunity to comment on significant federal permitting by other federal agencies, the U.S. Environmental Protection Agency, National Oceanic and Atmospheric Administration, U.S. Department of Agriculture, U.S. Army Corps of Engineers, U.S. Coast Guard, U. S. Department of Defense, Federal Aviation Administration, U.S. Fish and Wildlife Service, Bureau of Ocean and Energy Management, and state agencies (agriculture, natural resources, and environmental protection) have an important regulatory role relative to offshore aquaculture and, in particular, the coastal states are provided an opportunity to comment on proposed federal permits and leases associated with offshore marine aquaculture.[7]

Current regulatory authority exists to appropriately protect marine water quality and benthic environmental systems, manage fish escapes, require responsible drug and chemical use, insure safe navigation, and assure consumers that they will have access to safe foods; although, it has been argued, and we agree, that:

> The stringency of the regulatory environment in the United States has increased in recent years in terms of both the number and complexity of regulations that affect U.S. aquaculture. Especially difficult is the common lack of a lead agency at both federal and state levels to effectively coordinate and streamline regulatory and permitting processes that result in timely decisions and more certainty for investment in new enterprises and expansion of existing operations. The overall cumulative effect has been continued increases in the regulatory costs and risk faced by aquaculture growers in the United States.[8]

Atlantic Salmon in Puget Sound

The potential environmental effects of the escape of Atlantic salmon in Puget Sound on Pacific salmon as a result of a net pen system that collapsed has created intense public and media

[7] Engle, C.R. and N. M. Stone. 2013. Competitiveness of U.S. aquaculture within the current U.S. regulatory framework. Aquaculture Economics and Management 17(3): 251-280.
[8] Ibid at 274.

speculation. Fortunately, several publications have examined this risk and other risks and reported that those risks are manageable or unlikely to be realized.[9]

We believe that when the potential effects associated with this escape are thoroughly analyzed this prior work will be confirmed. We are also hopeful that enough time will have passed to then allow a dispassionate discussion and reassessment of Atlantic salmon culture to occur. We are confident that this assessment will recognize that potential risks are being adequately managed under existing state and federal regulations. It is also unfortunate, that currently little to no recognition of public and private investment to improve Atlantic salmon production characteristics (e.g., weight gain, feed efficiencies), human diet and nutrition, fish health, and reduced environmental effects through fish husbandry, domestication and technology gained by the global production of Atlantic salmon production has not been made known to the public.[10]

As summarized by Ganesh and Engle (2016) (internal citations deleted):

> The Atlantic salmon industry overcame several biological, ecological, and disease constraints throughout its history. Advanced automated feed monitoring systems provided greater resource and environmental management efficiency. Commercialization of genetic and vaccination programs improved growth and survival while nutritional developments reduced the use of fishmeal and oil while improving performance. Such continued technological advances resulted in continuous growth in Atlantic salmon production with significant reductions in cost of production. The Atlantic salmon industry is one of the leaders in terms of biological knowledge and production technology, raising a very resource-efficient species that is often termed "the super-chicken of the sea."[11]

Research with Significant ROI

Research supported by governmental agencies and the private sector has led to continuing improvements in reducing the use of essential fish meal and fish oil components in pelleted aquaculture feeds. Research programs within NOAA and USDA that focus on marine aquaculture are critical to US aquaculture and to national efforts to reduce our trade deficit, create jobs and increase national security through the provision of wholesome domestic food sources. These aquaculture research efforts have benefited U.S. aquaculture by resolving complex biological, environmental, chemical, or public relations constraints to increase aquatic animal or plant production or sales. Research funds are not wasted public monies. An

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[9] Nash, C.E. (ed). 2001. The net-pen salmon farming industry in the Pacific Northwest. U.S. Department of Commerce. NOAA Tech. Memo. NMFS-NWFSC-49 (http://www.westcoast.fisheries.noaa.gov/publications/aquaculture/noaa_memo_net_pen_salmon_farming_sept2001.pdf accessed January 28, 2018).
Waknitz, F.W., T.J. Tynan, C.E. Nash, R.N. Iwamoto, and L.G. Rutter. 2002. Review of potential impacts of Atlantic salmon culture on Puget Sound chinook salmon and Hood Canal summer-run chum salmon evolutionarily significant units. U.S. Department of Commerce. NOAA Tech. Memo. NMFS-NWFSC-53 http://www.westcoast.fisheries.noaa.gov/publications/aquaculture/waknitz.2002.nwfsc_tm53.reviewofpotentialimpacts.pdf accessed January 28, 2018)

[10] Kumar, G. and C. R. Engle. 2016. Technological advances that led to growth of shrimp, salmon, and tilapia farming, Reviews in Fisheries Science and Aquaculture, 24(2): 136-152

[11] Ibid at 145.

independent analysis focused on public investment in aquaculture research found an estimated 37-fold return for each research dollar spent since 2000.[12]

States Are Managing Aquaculture

Over the last 20 years, responsible environmental stewardship has become the proven business model in the state or territorial waters of Maine, Washington, Hawaii and Puerto Rico where commercial scale net pens have been operated to farm Atlantic salmon, Almaco jack or cobia and in the state waters of Alabama, Alaska, California, Connecticut, Florida, Hawaii, Louisiana, Maine, New Hampshire, New Jersey, New York, Maryland, Massachusetts, North Carolina, Oregon, Rhode Island, Virginia, South Carolina and Washington where shellfish farms have farmed abalone, clams, oysters, mussels or scallops. These farms have been managed in compliance with state and federal regulations and the provisions of lease agreements with the states or territory. All such operations are conducted with regulatory transparency supported by environmental monitoring data and periodic reporting for these operations in publicly available documentation required by state and federal agencies.

Creating Security of Tenure is Critical

The limited scope of today's U.S. marine aquaculture industry simply will not substantially expand without access to the majority of offshore waters that are controlled by the federal government. However, access alone is not sufficient, and will not create the fertile environment for investment in U.S. marine aquaculture. What is needed is security for tenure (e.g., a lease) to allow U.S. aquaculture operations to operate in the Exclusive Economic Zone in compliance with existing regulatory programs that will provide a viable financial model (private investment and insurance) that will survive in the free market.

Marine aquaculture facilities in the Exclusion Economic Zone must be provided security of tenure to occupy a location to the exclusion of other conflicting uses by means of a recognized and commercially understood legal agreement such as a lease granted by an appropriate federal agency on behalf of the U.S. government. Property rights in marine waters are typically available under state laws in state waters where marine aquaculture is recognized as a being in the public interest. This is typically done by means of a lease. The leasing of a public resource for commercial use appropriately requires payment for use of public space (i.e. rental payments). However, this use of public trust lands (offshore "spaces") must be not be confused with business models for industries that actually consume public trust resources (e.g. oil and gas resources that are owned in trust by the U.S. government for the people).

A viable offshore aquaculture operation will require the same level of commercial certainty and property rights available to land-based agricultural enterprises or those aquaculture farms located in state waters. Offshore aquaculture operations are complex and expensive facilities that require reasonable business planning and construction periods and phased development to provide economies of scale necessary to internalize the regulatory and operation costs. Offshore aquaculture leases should be renewable and should have initial terms of at least 25 years in order to secure financing on commercially-viable terms. Leases should also be transferrable to support potential sale or other transfer of a farm operation.

[12] Love, D.C., I. Gorski and J.P. Fry. 2017. An analysis of nearly one billion dollars of aquaculture grants made by the US federal government from 1990 to 2015. Journal of the World Aquaculture Society 48:689-710.

Regulatory Burden and Costs Stifle Small Business Innovation

The majority of U.S. aquaculture producers are small business entities. The USDA Census of Aquaculture conducted in 2012 showed that 86% of all aquaculture businesses had sales less than $500,000. The costs of regulatory compliance for small businesses are having devastating effects on the ability of these businesses not only to exist, but to expand or add capacity. Additionally, these same burdens are prohibiting new businesses from starting up, further exacerbating the issue.

As a specific example, the average total regulatory cost on U.S. baitfish/sportfish farms was $148,554 per farm, or $2,989 per acre of production. The regulatory cost burden composed 25% of total costs of baitfish/sportfish farms, making it one of the largest cost components in their businesses. Total cost to the U.S. baitfish/sportfish industry was estimated to exceed $12 million. On 38% of the farms, the cost of regulations exceeded the value of profits on baitfish/sportfish farms.

The data also revealed that only 1% of total regulatory costs were those of the fees for permits and licenses. The real burden of the regulatory environment was found to be the indirect costs associated with increased manpower costs for record-keeping, reporting, and applying for permits, farm changes to remain in compliance, and lost sales (that could not be replaced or re-directed to other markets) that were lost directly due to regulatory actions. Environmental management regulations composed 61% of the total regulatory cost burden in spite of representing only 17% of the total number of regulations with which farms had to comply. The regulatory burden was substantially greater on smaller farms ($5,533 per acre) than on larger farms ($321 per acre), and very likely has contributed to the 29% decline in the number of small baitfish/sportfish farms in the United States as compared to no decline in the number of large farms from 2005 to 2012.[13]

Seafood Safety from Farm to Plate

The U.S. domestic aquaculture industry is committed to supplying consumers with consistent, high quality, safe products that are produced in an environmentally sound manner. Numerous federal and state agencies are involved with maintaining the wholesome attributes of farm-raised seafood. The U.S. Food and Drug Administration works with state departments of agriculture, the Association of Food and Drug Officials, and the American Association of Feed Control Officials to regulates aquaculture food handling and processing and the manufacture of feeds to ensure that they are safe and do not contain contaminants or illegal substances. The U.S. Department of Agriculture inspects the processing of catfish and tests catfish products, foreign and domestic, for contaminants.

The Interstate Shellfish Sanitation Conference in cooperation with the U.S. Food and Drug Administration and state agencies administers a certification program requiring all shellfish dealers to handle, process, and ship shellfish under sanitary conditions and maintain records that the shellfish were harvested from approved waters. State agencies establish standards for

[13] van Senten, J. and C.R. Engle. 2017. The cost of regulations on US baitfish and Sportfish producers. Journal of the World Aquaculture Society. 48(3): 503-517.

shellfish growing areas and regularly monitor water quality to make sure that growing waters meet those standards.

Fish and shellfish packers, warehouses, and processors must comply with the mandatory requirements of the Hazard Analysis Critical Control Point (HACCP) Program administered by the U.S. Food and Drug Administration. The program identifies potential food safety hazards and develops strategies to help ensure that they do not occur. New rules by the U.S. Food and Drug Administration authorized by the Food Safety Modernization Act have added additional regulations for the processing, handling and transportation of animal feeds and human food. All of these controls help to make farm-raised seafood products safe and wholesome foods.

The United States as a World Leader in Marine Aquaculture

The United States is not a world leader in sustainable aquaculture production by volume or value but we are in the thoughtful and rigorous development of regulatory and nonregulatory production practices, animal nutrition and health management, and the efficient processing and distribution of high-quality, wholesome foods. A recent global analysis of global marine aquaculture potential concluded with a statement that is very relevant to U.S. marine aquaculture in highlights the unlimited potential of the United States to be a global leader in sustainability, technology and production (citations deleted):

> Given the significant potential for marine aquaculture, it is perhaps surprising that the development of new farms is rare. Restrictive regulatory regimes, high costs, economic uncertainty, lack of investment capital, competition and limitations on knowledge transfer into new regions are often cited as impediments to aquaculture development. In addition, concerns surrounding feed sustainability, ocean health and impacts on wild fisheries have created resistance to marine aquaculture development in some areas. While ongoing and significant progress has been made in addressing sustainability issues with marine aquaculture, continued focus on these issues and dedication to ensuring best practices will be a crucial element shaping the future of marine aquaculture. Both the cultural and economic dimensions of development and the management and regulatory systems are critically important to understanding realistic growth trajectories and the repercussions of this growth. Our results show that potential exists for aquaculture to continue its rapid expansion, but more careful analysis and forward-thinking policies will be necessary to ensure that this growth enhances the well-being of people while maintaining, and perhaps enhancing, vibrant and resilient ocean ecosystems.[14]

The National Aquaculture Association requests the U.S. Senate Committee on Commerce, Science and Transportation create, introduce and shepherd national legislation to lead the world and benefit the nation. It would be our honor and privilege to assist in this effort as fish, shellfish and sea vegetable farmers with the experience, knowledge, skills, scars and persistence to make this happen.

[14] Gentry, et al. 2017. Mapping the global potential for marine aquaculture. Nature Ecology and Evolution 1:1317-1324.