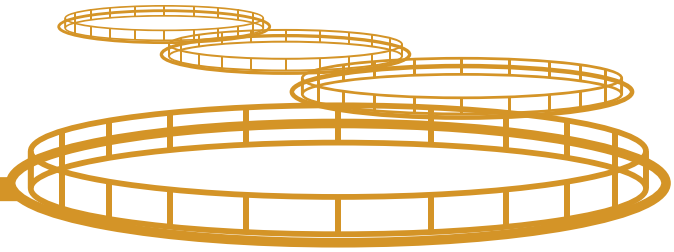
The **Consortium for Ocean Leadership**, in collaboration with **Meridian Institute**, convened the **2018 Industry Forum**



PROCEEDINGS DOCUMENT

CONSORTIUM FOR Ocean Leadership

Meridian Institute
Connecting People to Solve Problems

U.S. OFFSHORE AQUACULTURE:

WILL WE FISH OR CUT BAIT?

2018 Sponsors

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COL's Industry Forum has benefited from the generous sponsorship gifts of several of our member institutions, federal agencies with responsibilities in this area, industry partners, and other non-governmental organizations. All involved see the collective benefit of bringing together diverse stakeholders to discuss the future of U.S. offshore finfish aquaculture and of working together to advance the science that guides decision-making in all sectors. Please join us in thanking them for their generous support, which allowed us to bring this group together.

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Proceedings of 2018 COL Industry Forum

U.S. Offshore Aquaculture: Will We Fish or Cut Bait?

October 26, 2018

Dear Forum Participants,

Thank you, again, to everyone who participated in the 2018 Industry Forum — **U.S. Offshore Aquaculture: Will We Fish or Cut Bait?** — convened by the Consortium for Ocean Leadership (COL) in collaboration with Meridian Institute. The Forum was well attended and included stakeholders and experts representing multiple sectors engaging around the benefits and challenges of potential development of an offshore aquaculture industry in the United States. We took great care in listening to and working with you to accurately capture the range of views and outcomes of discussion, which are laid out in this proceedings document (without attribution).

Due to the complexity of developing an offshore aquaculture industry in the U.S., science and technology must serve as the foundation for the path forward. From a science-based understanding, decision-makers in all sectors will be equipped with the best-available information to make wise decisions that ensure our ocean remains healthy and productive for all. This is the goal of our work, and we at COL look forward to working with you as our partner stakeholders on next steps.

We are grateful for the collaboration with Meridian Institute in convening the Industry Forum. The event has also benefited from the generous sponsorship (and time) of several of our member institutions, federal agencies with responsibilities in this area, industry partners, and other non-governmental organizations that see the collective benefit of bringing together diverse stakeholders to discuss how we can work together to advance a science-based, sustainable, economically-viable offshore aquaculture industry. Thanks to their support, we were able to bring this group together to address this important topic.

Sincerely,

RADM Jonathan W. White, USN (ret.)

President and CEO
Consortium for Ocean Leadership

Meeting Agenda

8:30 a.m. **Welcome Remarks** (Jonathan White, Consortium for Ocean Leadership)

8:45 a.m. **Opening Remarks: Offshore Finfish Aquaculture as a Means of Advancing Multiple U.S. Priorities** (Paul Doremus, NOAA)

9:00 a.m. **Keynote Remarks: Status of Offshore Finfish Aquaculture Globally and Major Opportunities and Challenges for the United States** (David Fredriksson, United States Naval Academy)

9:15 a.m. **The Science and Technology of Finfish Aquaculture: Past, present, and future advancements and challenges**

Moderator: Jerry Schubel, Aquarium of the Pacific
Sebastian Belle, Maine Aquaculture Association
Sarah Lester, Florida State University
Neil Sims, Kampachi Farms, LLC
Michael Tlusty, University of Massachusetts Boston

10:30 a.m. Break

10:45 a.m. **What Would It Take?: Environmental and regulatory components of a successful offshore finfish aquaculture enterprise**

Moderator: Michael Rubino, NOAA Fisheries
Leigh Habegger, Seafood Harvesters of America
Robert Jones, The Nature Conservancy
David Kelly, InnovaSea
Kevan Main, Mote Marine Laboratories

12:00 p.m. Break to get lunch

12:30 p.m. **What Would It Take?: Identifying investment concerns, economic impacts, and innovation needs for success**

Moderator: Dane Klinger, Conservation International
Antonius Gagern, California Environmental Associates
Max Holtzman, Pontos Aqua Advisory
John C. Molina, Pacific6 Enterprises

1:45 p.m. Break

2:00 p.m. **Survey Says...: Are public perception and science aligned?**

Moderator: Scott Nichols, Food's Future, LLC
Roger Berkowitz, Legal Seafoods
Linda Cornish, Seafood Nutrition Partnership
Bill DiMento, High Liner Foods
Kim Thompson, Aquarium of the Pacific

3:15 p.m. **Spotlight on Recommended Actions**

Moderator: Jonathan White, Consortium for Ocean Leadership
Megan Davis, FAU Harbor Branch Oceanographic Institute
Paul Doremus, NOAA
Don Kent, Hubbs-SeaWorld Research Institute
Aaron McNevin, World Wildlife Fund

4:00 p.m. **Summary and Closing Remarks** (Jonathan White, Consortium for Ocean Leadership)

4:20 p.m. **Sponsor Showcase**

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Executive Summary

On October 26, 2018, the Consortium for Ocean Leadership, in partnership with Meridian Institute, hosted its third annual Industry Forum in Washington, D.C., entitled *U.S. Offshore Aquaculture: Will We Fish or Cut Bait?*

The objectives of the Forum were to:

- Develop a clear, shared understanding of the current state of offshore finfish aquaculture globally and the present opportunities and challenges for establishing such an industry in the United States.
- Illuminate the scientific and technical capacities, environmental safeguards, and investment opportunities needed for responsible offshore finfish aquaculture to be deployed in the U.S.
- Identify specific areas of action that the science and technology community, government, aquaculture industry, and civil society organizations can implement to advance informed decision making in this emerging industry.

This topic was selected because of the potential benefits of an environmentally responsible and sustainable domestic aquaculture industry to society, the industry's potential for growth, the political salience of the issue, and the need for development of any emerging industry to be grounded in science and technology. This multi-stakeholder dialogue aimed to identify information gaps and needs for development of the offshore aquaculture industry in the U.S., and the 115 participants represented a robust cross-section of over 60 stakeholder institutions in the scientific community, government (executive and legislative branches), the aquaculture industry, and environmental and conservation interests. A full list of participants can be found later in this report.

The Forum resulted in a number of key ideas and outcomes regarding challenges and opportunities for advancing the development of the offshore aquaculture industry in the U.S. These ideas and outcomes are summarized below:

Overarching

- Globally, offshore aquaculture is growing rapidly and will likely continue to grow significantly in many countries, but its development in the U.S. remains uncertain.
- It is uncertain whether the U.S. can be a competitive offshore producer, though there may be competitive advantages for the U.S. in niche markets like sashimi-grade fish. On the one hand, U.S.-based production would benefit from its proximity to a large market, from high-quality research institutes, investor interest, and a large and productive Exclusive Economic Zone (EEZ) with ample space and oceanographic conditions to support diverse types of marine aquaculture. On the other hand, shoreside infrastructure (e.g., labs, hatcheries, specialized logistics industries, etc.) is almost inexistent, and specialized skillsets would have to be built nearly from scratch.
- The United States is competing with countries that have a decades-long technological head start (Norway); are making large investments in the sector (China); and are operating with lower capital requirements, labor costs, and environmental standards (Southeast Asia and Latin America).
- Development of the industry in the U.S. could serve as a driver for further innovation that leads to lowered costs, increased sustainability, more jobs (especially in coastal communities), increased local seafood supply, enhanced seafood security, and a reduced seafood trade deficit (currently $15 billion per year).

- Current regulatory processes in the U.S. are complex, unpredictable, and lengthy, which can discourage investment. If the sector is to grow, focused conversations are needed to create a more predictable permitting process without compromising the integrity of our strong environmental, social, and health regulations.
- It is important to consider the impacts and potential benefits of aquaculture in the context of the need for greater and more efficient protein production. By 2050, it is estimated that there will be another two billion people on Earth who will require additional nutritious food sources. At the same time, wealth is increasing globally, and more people can afford to add animal protein to their diets. Sustainable marine aquaculture offers a compelling solution that, if properly designed, executed, and regulated, can produce more nutritious protein that is far less impactful to our planet than terrestrial animal protein production.

Legislation/Regulation

- For the U.S. offshore aquaculture industry to develop sustainably and to succeed, developer and investor confidence must be assured through a clear and predictable regulatory environment. A lead federal agency should be designated to orchestrate the process to authorize permits or leases to farmers.
- Discussions need to proceed expeditiously and collaboratively to capitalize on support from a variety of stakeholders, including the federal sector and investors, to develop legislation that addresses outstanding needs and concerns. It was further suggested that the bipartisan Advancing the Quality and Understanding of American Aquaculture (AQUAA) Act (first introduced in the 115th Congress) could serve as a viable starting point, with modifications, especially those focusing on environmental safeguards, which would not only ensure sustainability and viability but also attract the necessary bipartisan support.
- Marine spatial planning processes and tools are important in identifying sites appropriate for offshore finfish farms. The U.S. has these tools and is already using them to identify the most appropriate sites for proposed farms. Interagency leadership in identifying optimal siting locations for offshore finfish aquaculture that meet National Environmental Policy Act (NEPA) criteria would be beneficial.

Research

- There is an outstanding need for a stronger and more vibrant base of accessible research and technology for the industry to draw upon concerning animal health, alternative and novel feed, aquatic epidemiology, entanglement, genetic selection, ocean engineering, and modeling to help with the regulatory process and supply chain analysis. The AQUAA Act would authorize a much larger science program for all of marine aquaculture (not just offshore aquaculture) to address these needs.
- Investments in research and development should be based on the science, management, environmental, and information challenges faced by both operational and experimental farms.
- Deployment of pilot demonstration farms that are conceived as public-private partnerships and are scalable is crucial to enhancing our understanding of areas of growth and to ensuring the industry develops in the right way.

Collaboration and Connection

- There is an opportunity for all stakeholders (i.e., researchers, government, investors, fishermen, and environmental and conservation organizations) to contribute to developing solutions through a new level of collaboration, founded on mutual respect and civility, and on peer-reviewed science.
- There was a request from environmental and conservation groups for further dialogue about the justification for focusing limited resources on promoting development of offshore aquaculture in the U.S. when there are pressing issues about how to prevent environmentally damaging aquaculture practices in other parts of the world.
- Further science-based dialogue between environmental and conservation organizations and proponents of a viable domestic aquaculture industry is necessary to develop confidence that legislation and the resulting regulatory structure adequately addresses their concerns and safeguards ocean health.
- Partnerships across maritime industries could offer novel learning opportunities, including dialogue between the wild harvest and fish farming communities as well as information exchange with offshore energy developers.
- Practitioners need a centralized repository for aquaculture entrepreneurs to contribute and locate information facing the industry, including best practices, start-up strategies and challenges, technology, and more.
- Some public perception of aquaculture remains negative, despite scientific and technological advancements that have addressed or mitigated many of the concerns of the past. When communicating with the public about offshore aquaculture, it was suggested that proponents need to "meet people where they are" and find the language, stories, and experiences that help them see the value and potential of this industry.

Forum Overview

The Industry Forum is an annual meeting designed to bring together academia, industry, nonprofits, and the government to explore pressing issues of mutual concern that involve ocean industries. The 2018 Forum was convened on October 26 to focus on the sustainable development of U.S. offshore finfish aquaculture. It was designed to consider many aspects of the offshore aquaculture industry, including ocean science, research, and technology needs and how collaboration can help address challenges and opportunities to improve scientific understanding and decision making around offshore aquaculture. The Forum was not designed to generate precise and actionable consensus agreements but rather to encourage the exchange of information and perspectives to generate insights and momentum for addressing key challenges and opportunities for advancing the development of the offshore aquaculture industry in the U.S.

Objectives of the 2018 Forum were to:

- Develop a clear, shared understanding of the current state of offshore finfish aquaculture globally and the present opportunities and challenges for establishing such an industry in the United States.
- Illuminate the scientific and technical capacities, environmental safeguards, and investment opportunities needed for responsible offshore finfish aquaculture to be deployed in the U.S.
- Identify specific areas of action that the science and technology community, government, aquaculture industry, and civil society organizations to advance informed decision making on this emerging industry.

The Forum consisted of keynote presentations and panel discussions designed to encourage robust dialogue and exchange on science and technology needs, environmental and regulatory issues, finance and investment, and public perception. During the last panel, recommended actions were identified based on discussion during previous panels.

Introductory Remarks

The Forum opened with selected speakers giving brief remarks to set the stage for the day's discussion.

Offshore Finfish Aquaculture as a Means of Advancing Multiple U.S. Priorities

Dr. Paul Doremus, National Oceanic and Atmospheric Administration (NOAA)

Dr. Doremus offered framing comments emphasizing that the U.S. is well positioned to engage on aquaculture to expand seafood capabilities. While the U.S. is the second largest seafood consuming country, we are importing 80-90 percent of the seafood we consume (by value), half of which is farm raised. Accordingly, there is great potential to grow the U.S. market and the question at hand is not whether to do so, but how. Harnessing U.S. ingenuity, the potential of our Exclusive Economic Zone (EEZ), and our technological capacity to develop the industry in the U.S. (rather than abroad) are key to our competitiveness, as aquaculture remains the most sustainable way to meet the growing demand for seafood. The U.S. must have a predictable regulatory environment, including known timelines and costs, to incentivize development while also meeting the high sustainability standards that characterize U.S. wild-capture fisheries. NOAA is working to bring people together around economic, environmental, and public health imperatives to find a way for the U.S. to fish, not to cut bait.

Status of Offshore Finfish Aquaculture Globally and Major Opportunities and Challenges for the United States

Dr. David Fredriksson, U.S. Naval Academy

Dr. Fredriksson presented a case for offshore aquaculture with a focus on ocean engineering and technology development. He stated that there is a major discrepancy in market share between the U.S. and other countries, with the U.S. representing $1 billion in production and China representing $73 billion. Coupled with the $14 billion seafood trade deficit, there is a major opportunity for the U.S. to engage in the aquaculture market. Much of the U.S. aquaculture industry currently takes place in nearshore waters utilizing relatively simple technology, such as PVC pipes, ropes, and buoys, similar to fishing or harbor-like technology. Moving offshore into the EEZ will require new systems that address engineering challenges in high-energy environments. Offshore oil and gas technology evolved from fixed jacketed structures to major engineering breakthroughs in the development of floating semisubmersible and tension leg platforms to expand operations into deeper water. Similarly, aquaculture system designs should be advanced enough to ensure they can withstand offshore conditions. The U.S. needs to invest in efforts to quantify design risks and validate both the overall concept and the modeling techniques, thereby developing cost-effective design and technical guidelines that will help overcome risk. In addition, clear regulatory authority for NOAA is needed along with a collaborative support structure involving industry, government, and academia.

Panel Summaries

The majority of the Forum was structured into a series of five panels in which diverse panelists reflected on the state of the industry in the U.S. Panels were organized as discussions, including engagement with participants in question-and-answer sessions to identify challenges and opportunities. Perspectives from panelists and participants are summarized below.

The Science and Technology of Finfish Aquaculture: Past, present, and future advancements and challenges

Jerry Schubel, Aquarium of the Pacific, Moderator
Sebastian Belle, Maine Aquaculture Association
Sarah Lester, Florida State University
Neil A. Sims, Kampachi Farms, LLC
Michael Tlusty, University of Massachusetts Boston

As the moderator, Dr. Schubel opened by noting that for aquaculture, it is often said that public perception does not match current science. This poses a challenge because public perception can drive policy. This panel took on several controversial topics regarding the perceived impacts of offshore aquaculture and presented their perspectives on the state of the science, noting at the outset that, in their opinion, it is important to put environmental impacts of aquaculture in the context of the need for greater food production, given that aquaculture has the potential to be the least environmentally impactful form of animal protein production.

Nutrient impacts on water quality and benthic (bottom-dwelling) communities

Panelists reflected that one of the most important lessons from 40 years of research and monitoring on this issue is that an aquaculture farm should be thought of as a part of the ecosystem in which it is embedded. Since each site is unique, the farmer must manage to the carrying capacity of that site to achieve and maintain performance at the level that will avoid negative environmental impacts. Accordingly, tracking environmental monitoring data to carefully evaluate the state of the ecosystem is key to maintaining its capacity to process the nutrient inputs from aquaculture systems. In addition, panelists shared that moving further offshore may reduce impacts on water quality and the benthos. Panelists also suggested that with proper siting, stocking, and monitoring, nutrient impacts and impacts on benthic communities can be managed to avoid disruptions to the ecosystem.

Development of alternative feedstuffs for scalability

Currently, wild-caught fisheries supply the majority of fish meal and fish oil for farmed fish and for domestic terrestrial livestock, the pet industry, and for fish oil pills. Annual production of fish meal has remained flat for several decades, but the allocation to aquaculture has increased while the amounts to other forms of animal feed have decreased. Given the limited availability of fish meal and fish oil from wild caught fish, stress on wild fisheries, and the rising cost of fish meal, panelists underscored the need to develop alternative feed types and to build a feed innovation network. Work on this topic is being conducted around the world, and development of the aquaculture industry in the U.S. could serve as a driver for innovation from U.S.-based research institutions and companies. Promising areas include processing fish trimmings, fermentation of single cell protein, bacteria meal, and soybean meal.

Escapees and wild stock interactions

Panelists stressed that conducting a risk assessment up front is key to preventing escapes so engineering and design can address any weaknesses, especially as aquaculture moves into higher energy offshore environments. The International Organization for Standardization will be coming forward with equipment standards for aquaculture; insurance markets will likely drive the adoption of those standards. One panelist reflected that applying the principles of the Hazard Analysis and Critical Control Points system to containment management can also help minimize escapes.

In addition, simple solutions like behavioral conditioning of fish, such as using a bell to train fish to come for feeding, should be considered to help manage impacts in the event of escapes. Panelists suggested that, in many cases, escapes are the result of inadequate or ineffective management oversight of gear and processes; additional scrutiny on auditing of standards to ensure they are properly applied could help in this area.

Viewpoints differed on the risks, benefits, and value of cultivating native versus non-native species, with some participants expressing the view that either could be done with various levels of management to reduce, or even eliminate, impact. In the case of non-native salmonids, some shared that even if you have escapees the environmental impact is low. However, if the U.S. were to take a policy position regarding cultivation of only native and naturalized species, the impact to growth of the industry would likely be minimal.

Fish health management

Panelists reflected that while health challenges are somewhat inevitable with monoculture, there are ways to minimize the incidence of diseases caused by pathogens and parasites, especially in the offshore environment where animals are less stressed due to less exposure to pathogens and parasites and higher quality water. Advancing the industry may help to drive innovations in health management, such as vaccination or use of copper alloy mesh materials that have antimicrobial properties. The use of antibiotics in the U.S. is highly regulated and very limited, the use of hormones is not permitted, and the industry does not want to be reliant on these drugs. Good husbandry practices need to take precedence to avoid disease outbreaks. More research in aquatic epidemiology is needed to help understand pathology in offshore farms.

Aesthetic impacts

Impacts on viewsheds from aquaculture will vary greatly depending on the type and size of the farm, its distance from shore, and the receptivity of the community to aquaculture more broadly. Panelists shared that there is a lack of data on viewshed impacts for aquaculture; accordingly, impacts from other structures like offshore wind and oil rigs could be used as a guide to better understand and approach stakeholder concerns. Research in Europe has shown that while property values have not gone down due to the presence of visible offshore wind farms, people are willing to pay more to have turbines sited further offshore. NOAA has a Geographic Information Systems (GIS) tool to help stakeholders visualize the viewshed impacts of aquaculture, which can be helpful when siting new farms, but in reality, it is unlikely that any farm beyond three miles will be visible from shore. Additionally, submerged farms will present only the minimal impact of buoy markers.

Marine spatial planning and offshore aquaculture

Concerns about conflicting use of ocean areas may be addressed during the siting process to identify locations that are productive and profitable, minimize environmental impacts, and reduce use conflicts. However, panelists noted that the process of optimizing location can be costly and time-intensive depending on how many agencies are involved and the degree to which roles and responsibilities are clearly defined. There is an opportunity in the U.S. to have a proactive and comprehensive planning process using state-of-the-art tools to reduce conflicts with proper coordination, which could lower some barriers to industry development. In addition, panelists suggested that co-location of offshore activities (e.g., fish farms with wind farms and/or oil rigs) in a common use area, an approach that has worked well with terrestrial farms, may be an option that marine spatial planning could help explore. Offshore farms situated in the right locations can also attract wild fish, which could enhance recreational and commercial fishing activities nearby.

Effects on protected and endangered species

While impacts on protected species can elicit strong emotions, panelists shared that marine mammal entanglement risks from offshore aquaculture facilities are low since many animals can effectively navigate around farms. In addition, spatial planning could help avoid siting farms in aggregation areas and migration corridors where conflicts may be more likely to occur. Best practices, such as maintaining adequate tightness of ropes and lines and using gear that meets specific requirements can also reduce the risk of entanglement. Beyond this, aquaculture could have a positive impact on depleted fish stocks by using farms for captive breeding of endangered species. In the U.S., several endangered breeding runs of Pacific salmon, Atlantic salmon, and white abalone, for example, depend upon hatchery enhancement for species survival and replenishment.

Competition for space in the coastal ocean

Panelists stressed the need to define what uses are compatible or not with offshore aquaculture. Marine spatial planning could help balance offshore aquaculture with other competing uses like shipping, military zones, protected areas, and commercial and recreational fishing. Regarding commercial fishing in particular, there is a need for early outreach to that community about how aquaculture interacts with existing activities and potential positive and negative impacts on coastal communities and economies. Finally, competing use of space for shoreside infrastructure of working waterfronts should be considered more explicitly in siting decisions to support development of a robust offshore aquaculture industry in the U.S.

Additional insights from participants

Several additional points were made through questions and comments from participants. Some felt that challenges regarding the environmental impacts of aquaculture should be addressed in a pragmatic and forthright manner. For example, escapes will happen, and predicting the presence of species like the North Atlantic right whale is near impossible, complicating efforts to site farms to ensure there are no negative interactions. In the face of these challenges, better data sources and additional research are required. It was also suggested that a high bar for sustainability set by U.S. legislation would be unlikely to drive sustainability around the globe. Rather, certifications, buyers, and consumers drive the global market. Accordingly, regulatory aspirations should be balanced with the reality that if they are too high, business may be driven overseas.

What Would It Take?: Environmental and regulatory components of a successful offshore finfish aquaculture enterprise

Michael Rubino, NOAA Fisheries, Moderator
Leigh Habegger, Seafood Harvesters of America
Robert Jones, The Nature Conservancy
David Kelly, InnovaSea Systems, Inc.
Kevan Main, Mote Marine Laboratory

Legal framework

This panel addressed the "how" of key components in regulating offshore aquaculture in the U.S. Initial discussion among panelists noted that, as a result of the September 2018 federal court ruling in the Eastern District of Louisiana, without any additional statutory guidance regarding regulatory authority, the Environmental Protection Agency (EPA) and U.S. Army Corps of Engineers (USACE) are the main permitting agencies for offshore aquaculture, not NOAA. Several concerns were raised with this approach. The absence of a regulatory framework may leave the environment less protected, increase regulatory uncertainty, and make it harder to secure necessary investments for the industry. Neither USACE nor EPA permits (both typically five years in length) offer the long-term security of tenure needed by investors. Participants also stressed that the current regulatory system does not allow for innovation, which is why so many U.S. businesses have gone overseas. In addition, some participants felt that protein production through aquaculture is being held to a different standard than other forms of animal protein production.

In the absence of a clear, unifying legal framework, panelists suggested that there will be little to no growth in offshore aquaculture in the U.S. This has largely been the situation to date, with little growth after substantial investment by several companies. Success has been greater in state waters where clear, efficient processes have been laid out (like in Hawaii and Maine), and in other countries (like Mexico, which has a pilot program that reduces the permitting timeline but allows for data collection to determine whether a full permit should be issued).

While developing a streamlined and comprehensive legal framework, regulators should consider how to include representatives of the commercial fishing industry. If regulation does not proceed through the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and its associated fishery management council engagement, engagement with commercial fisheries should be replicated elsewhere to avoid conflicts. Some participants coalesced around the idea that it would be beneficial to pursue opportunities for the aquaculture industry to connect with the commercial fishing industry for continued dialogue focused on sustaining working waterfronts and the role of aquaculture in rebuilding regional seafood markets sourcing local supply (both wild and farmed). They should, of course, also incorporate perspectives from all coastal geographies.

Tools for regulators

Panelists emphasized the need for better monitoring tools to determine the impact of cage systems before and after they are sited to ensure optimal operations and to reduce impacts. More specifically, tools and management practices are needed to assist with siting and spatial planning, evaluating carrying capacity, and monitoring benthic impacts. Additionally, once farms enter the water, environmental monitoring data are needed to assess ongoing impacts and to allow for adaptive management, as well as the refinement and validation of impact models.

Programmatic approaches

Panelists reflected that implementation of programmatic aquaculture management areas with proper siting and spacing of farms, density limits, health monitoring, and feeding regimes, etc., would be a valuable asset to the development of the industry. Marine spatial planning approaches and associated GIS tools could help to implement such an approach. NOAA could consider broader permit approaches or zones where they generate information upfront about specific locations, gear types, and production methods to assign permits in a way that minimizes detrimental impacts on habitat and endangered species. Successful development hinges, in part, on the careful consideration of many data layers, which could be worked out prior to development. This type of exercise should also bring in other stakeholder communities, such as fishers.

Many participants felt strongly that there is a need for multi-stakeholder collaboration to address regulatory challenges through legislation. Some reflected that the industry would not be able to develop in the absence of such an effort. Many participants echoed the need for legislation that addresses a clear, coordinated process for regulating offshore aquaculture and the urgency for this conversation to occur in a short time span to produce results. This effort could address the need for timely data, agency coordination, decision-support tools for siting, and greater understanding of potential impacts. Ideal siting outcomes should address economic, environmental, and social sustainability.

What Would It Take?: Identifying investment concerns, economic impacts, and innovation needs for success

Dane Klinger, Conservation International, Moderator
Antonius Gagern, California Environmental Associates
Max Holtzman, Pontos Aqua Advisory
John C. Molina, Pacific6 Enterprises

This panel addressed ways to improve the industry's access to investment funds to support growth of U.S. offshore aquaculture. The following themes emerged from discussion among the panelists and with the participants.

Global context for U.S. market development

Panelists and participants reflected that, globally, offshore aquaculture is here to stay. However, there is a question as to whether it will develop in the U.S., where offshore aquaculture could offer the next big growth industry, and what associated jobs and technology would come with it. The U.S. could benefit from new sources of economic growth and has many favorable conditions for this industry to excel here, including high-quality research institutes, extensive offshore experience in state waters, a large and productive EEZ, investment capital, and proximity to a large market. However, siting and regulatory uncertainty concerns remain a challenge to economic profitability of offshore finfish aquaculture in the U.S.

In addition, panelists noted that the U.S. is competing with countries where incentives are driving innovation and currently less focus is on profitability. Panelists pointed out that our competitors also have a technological edge (Norway); are making large investments in the sector (China); and are operating with lower capital requirements, labor costs, and/or environmental standards (Southeast Asia and Latin America). This makes it harder for the U.S. to compete in a global market, though there may be specific niche markets that the U.S. could develop and excel in (e.g., sashimi-grade fish, live and fresh products, and value-added products).

Panelists and participants also reflected on the seafood trade deficit, suggesting that it is an important talking point to motivate lawmakers to support legislation that can advance the growth of the aquaculture industry. However, from an industry standpoint, panelists expressed the view that the seafood trade deficit is less consequential in terms of the economics of developing a farm.

Investment concerns

Panelists and participants expressed the viewpoint that there is a clear need for predictability (regulatory and otherwise) to lower risk and incentivize investment in offshore U.S. aquaculture. Predictability should include both a clear timeline for permitting, as well as long-term certainty (security of tenure) for operations that will withstand political change. Once risk can be adequately assessed and managed, and a proven model is developed, panelists predicted that capital will flow into this sector, giving the U.S. the opportunity to lead the world in developing a sustainable offshore aquaculture industry. Panelists who have already made investments in the industry reflected that they are motivated not only by fiscal returns, but also by the contributions this industry can make to a sustainable society. A predictable regulatory scheme in the U.S. can also help ensure the quality of a U.S. product in a global market. Some participants and

panelists suggested that U.S. businesses trying to differentiate themselves in a global space may be able to consider how a higher quality product or a domestic product could drive price differential, dependent upon consumer demand and perception.

One panelist shared the perspective that since margins in this industry are likely to be small, profitability will rely on volume. Therefore, the industry must move offshore and grow to be profitable. Panelists reflected that cost implications of moving offshore are varied as high-energy system engineering and complexity will increase costs, but there are also some cost saving opportunities offshore that include reduced need for management of parasites and the ability to reach economies of scale.

The role of U.S. government incentives and subsidies was discussed, with some disagreement on their value. One panelist reflected that while subsidies can be helpful, once an industry is "hooked" on incentives, it is difficult to discontinue them. Another panelist reflected that it is more important that the aquaculture industry have equal access to existing government funding sources and incentives as other industries (e.g., grants, disaster recovery funds, low interest loans, worker training, etc.).

Innovation needs

Panelists and participants suggested that pilot scale and demonstration projects are a critical opportunity to advance development of this industry, especially in the face of the current regulatory challenges. They suggested that getting projects in the water will help develop risk management strategies, test new models, answer questions, and incentivize investment. In addition, participants stressed the need to support research through academic extension programs and public-private-academic partnerships, since private capital cannot address all the issues. Beyond this, it was suggested that there is a need for a central knowledge hub (such as Norway's Hatch accelerator program), which could be drawn from existing resources at universities.

Panelists reflected that other sources of capital could also help address innovation. For instance, blue technology development for aquaculture, such as handheld technologies that can deliver results immediately, could attract impact investors to this space and provide aquaculture farmers new approaches to managing farms in an optimal way. In addition, participants and panelists suggested philanthropic capital (i.e., impact investors, socially responsible investment funds, foundations) could play a major role in this sector, especially since it is uninhibited by the same time horizons for returns as other types of capital. Philanthropic capital can help with research and execution of projects at a smaller scale to test species and technology concepts where private capital may not be comfortable with the higher level of risk and low returns. In addition, the advancement of offshore aquaculture in the U.S. necessitates buy-in and engagement from environmental and conservation groups. It was suggested that the philanthropic community can help bring key stakeholder voices to the table to build consensus through open discussion.

Survey Says…: Are public perception and science aligned?

Scott Nichols, Food's Future, LLC, Moderator
Roger Berkowitz, Legal Seafoods
Linda Cornish, Seafood Nutrition Partnership
Bill DiMento, High Liner Foods
Kim Thompson, Aquarium of the Pacific

This panel of diverse seafood advocates represented an array of seafood communication efforts with different stakeholder groups. They reflected on how to create the social license for offshore aquaculture. The following themes emerged from discussion among the panelists and with the participants.

Messaging

Panelists underscored the need to clarify and specify the audience being engaged by marine aquaculture communications outreach to ensure that messaging is more consistent and effective across diverse stakeholder groups. For instance, existing seafood consumers are buying farmed seafood, whereas the broader general public is less likely to do so. Panelists noted that data and science-heavy messaging about large, complex problems is not the best way to reach these consumers but rather stories that are grounded in science and connect these potential consumers to the farmers and the sources of their food are more effective. Participants echoed the value of "meeting people where they are." Messages should be kept simple and delivered by individuals or groups with credibility who can instill confidence in consumers. It was noted that public aquariums provide an excellent venue in which to reach large public audiences and educate them on the benefits of fish farmed in the sea. Educating dieticians and health providers is another way to communicate to the public the importance of eating seafood.

Regarding terminology, there was some debate as to whether there is value in using the word aquaculture, which likely does not resonate with the broader public. Alternatively, "farming" and "farmers" are concepts that most people understand well from a young age. However, some participants raised concerns that there are already some negative public perceptions with fish farming that would need to be overcome. Discussing marine aquaculture as a complement to wild harvest fisheries to support a safe, secure, and sustainable seafood supply in the U.S., was also mentioned.

Speakers highlighted several different angles that could be used in communication efforts to reach different audiences. For example, given seafood's resource efficiency compared to land-based animal proteins, the pressure on wild fisheries, and a growing population, it could be said that humans have a moral obligation to explore aquaculture as a solution to these problems. Similarly, from a public health perspective, given very high rates of healthcare spending on preventable disease and mental health issues, consuming seafood at least twice a week to prevent disease may be a message that resonates and helps increase demand. Beyond health, it was suggested that messaging around global sustainability on multiple levels may resonate in communicating the imperative to grow more seafood. One panelist noted that most seafood producers and distributors want to ensure that products are sourced in a sustainable manner, and many see aquaculture as the best way to produce a product in a responsible manner and ensure consumers are buying safe and healthy seafood.

Public perception

It was suggested that one factor in U.S. perception of aquaculture is that the U.S. does not have a culture of seafood consumption like many others do; seafood was not a mainstream protein source in the U.S. until the 1950s and 1960s. Since then, negative messaging that sensationalizes the health detriments associated with some seafood (e.g., mercury and PCBs, toxins from harmful algal blooms, additives) has reduced consumer confidence in all seafood.

Accordingly, some participants reflected that there may be a need to bring together all the major aquaculture producing countries to discuss the socio-economic benefit of aquaculture and the need to "get it right" the first time by applying best available science to development of the global industry and to the strategies on how best to communicate it importance. It was suggested that the environmental community could help with messaging by recognizing the importance and value of aquaculture and describing how concerns are being addressed with a science-based approach.

Spotlight on Recommended Actions

Jonathan White, Consortium for Ocean Leadership, Moderator
Megan Davis, FAU Harbor Branch Oceanographic Institute
Paul Doremus, NOAA
Don Kent, Hubbs-SeaWorld Research Institute
Aaron McNevin, World Wildlife Fund

This concluding panel reflected on the ideas and information exchanged during the Forum. The following themes emerged from their reflections and subsequent exchange with participants.

Value case for development of a U.S. offshore aquaculture industry

Panelists re-emphasized the urgent need for the offshore aquaculture industry to develop and persist, as well as a clear value case for development of that industry in U.S. waters. With the largest EEZ, ample ocean space with the ecological capacity to support a diverse portfolio of marine aquaculture production, and proximity to a large market, many panelists and participants expressed the view that development should occur in the U.S. In addition, one panelist suggested that given the investment the U.S. is already making in aquaculture issues like disease prevention, alternative feed diets, new species, and more, the benefits of such investments should remain in this country. However, U.S. technology and intellectual property are often moving to other countries to be utilized, then U.S. consumers are buying back the final product.

Panelists echoed the theme from previous discussions that development of the industry in the U.S. will drive further innovation to lower costs and increase sustainability. Panelists and participants also stressed the need for aquaculture as a way to enhance U.S. food security. Given estimates of another two billion people on Earth by 2050, creating new sources of sustainable seafood will be less harmful to the environment than terrestrial farming and have positive impacts on generations to come. The U.S. has the scientific knowledge, technology, and effective State-level regulatory framework models that can be adapted to address federal-level issues to support increased production of seafood to support healthy people and ocean ecosystems.

Legislation and regulation

Panelists and participants reiterated that in order for the U.S. offshore aquaculture industry to develop and succeed, there must be a predictable regulatory environment for developers and investors. Clear legislation authorizing regulatory authority is needed. Panelists and participants shared, once again, that the AQUAA Act is a good starting place, but additional collaboration will be required to build a predictable regulatory system that includes adequate environmental safeguards. Participants reflected that the timeline within which potential progress might be made might be limited, given only two years remaining in the current administration. Therefore, expeditious, collaborative action is needed to move the ball forward and to get several finfish farms in U.S. federal waters. Panelists thought that marine spatial planning processes and tools may offer some assistance, but these processes must be supported by a robust and predictable regulatory framework. Accordingly, it was suggested that agency leadership is needed to identify optimal siting locations that meet all NEPA criteria.

Research

Both panelists and participants emphasized the need to build upon existing technologies to strengthen the base of technology that can be drawn upon, particularly in the areas of animal health, alternative and novel sources of feed, genetic selection, and tools to help with the regulatory process. In addition, advancements in ocean engineering, modeling, and techno-economic analyses are required to mitigate the risk of failure and evaluate costs. Some participants reflected that as the industry learns and grows, investments in research and technology should be based on challenges that emerge as developers proceed. Deployment of demonstration farms is crucial to enhancing our understanding of needs and ensuring the industry develops in ways that balance economic, regulatory, and environmental sustainability priorities. It was suggested that demonstration farms should be conceived as partnerships where private industry bears the costs of developing and putting projects in the water, and the government assists with siting and helping to fund underlying science, monitoring, and technology needs. This includes advancing the technology and capabilities needed to build upon efforts to develop reliable novel sources of feed. In addition, it was suggested that since aquatic epidemiology is a newer field, a wholistic approach that integrates the farm with nature would be beneficial. Participants suggested that creating a sustainable supply chain, including hatchery animals, is another defined need for responsible growth of a domestic industry that will require collaboration across the supply chain.

Collaboration and connection

Many agreed that there is a clear need to collaborate across diverse interests and perspectives and to build bridges that can mitigate and/or overcome impediments if significant growth of offshore aquaculture in the U.S. is to occur. Representatives from the environmental and conservation sectors requested further dialogue about the question of why they should focus limited resources on the development of offshore aquaculture in the U.S., when there are pressing issues about how to prevent environmentally damaging aquaculture practices in other parts of the world. Some participants reflected that, given that the industry is not fully developed, there is an opportunity for all parties to be a part of developing a solution through a new level of robust and respectful collaboration.

Participants reflected that there is also a need for partnerships across industries, including dialogue between the wild harvest and fish farming communities about the future of the seafood industry. This could include an exchange on lessons learned with the offshore energy development community. It was suggested that the food-energy-water nexus may be another interesting lens and interrelated set of interests that are relevant to this conversation. Industry practitioners reemphasized the need for a centralized repository for aquaculture entrepreneurs to locate information on various challenges facing the industry, including best practices, start-up strategies and challenges, technology, and more. Finally, participants and panelists reflected on the fact that when communicating with the public about offshore aquaculture, there is a need to “meet people where they are” and find the language, stories, and experiences that will help convey the value, risk, and potential of this industry in ways that are meaningful to them.

Industry Forum Advisory Committee

The Consortium for Ocean Leadership was fortunate to have the volunteer efforts of an Advisory Committee during the development of this forum. The committee's collective expertise was brought to bear on nearly all elements of the event, and we are certain it would not have been as robust, diverse in representative perspectives, or well-attended had it not had the benefit of their exceptional thought and guidance. We all owe the committee a debt of gratitude. Please join us in thanking the following members for their foundational contribution to this event.

Dr. Megan Davis

FAU Harbor Branch Oceanographic Institute and COL Board Member

Dr. Paul Doremus

National Oceanic and Atmospheric Administration

Ms. Margaret Henderson

Henderson Strategies, Inc. / Stronger America through Seafood, Inc.

Mr. Rich Innes

Meridian Institute

Ms. Ingrid Irigoyen*

Meridian Institute

Mr. Hank Lobe

Severn Marine Technologies, LLC / Sonardyne International and COL Board Member

Dr. Jerry Schubel

Aquarium of the Pacific

** After providing critical support through the early stages of planning, Ms. Irigoyen accepted an outstanding new position with The Aspen Institute. We wish her all the best in this new opportunity and gladly welcomed Mr. Innes as her Meridian replacement on the committee.*

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(Actual attendants of the 2018 forum)

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This proceedings reflects the themes and discussion points that emerged from 2018 Industry Forum, co-convened on October 26, 2018, in Washington, DC by COL and Meridian Institute. The document was reviewed by forum participants to ensure accuracy of the proceeding's contents.

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