Aquaculture
Strategy for Engaging in Comprehensive Ocean Planning

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Faux position statement and strategy for Aquaculture Farmers

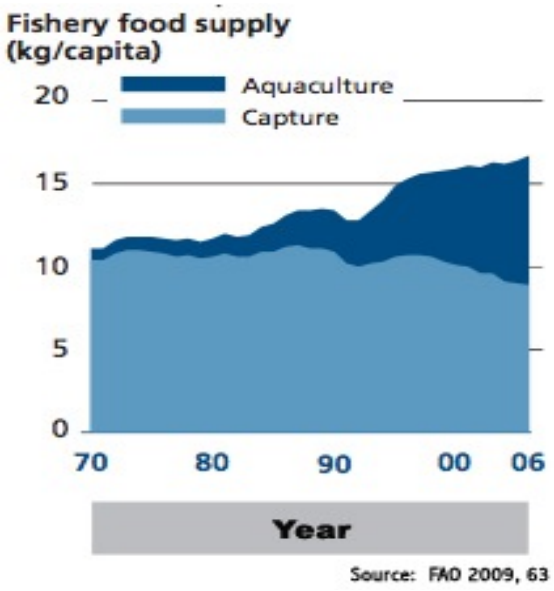
Overall discussion of use

Aquaculture refers to the cultivation or rearing of any aquatic organism including finfish, crustaceans, molluscs and aquatic plants. Whereas capture fisheries can be likened to terrestrial hunting, aquaculture is akin to farming. Aquaculture may be practiced in fresh or salt-water conditions, on land, inland, coastally, or at sea. Mariculture is the specific term for marine aquaculture. Raising seafood commercially is the main purpose of aquaculture, but it is practiced to augment wild populations as well (NOAA).

As human populations continue to grow, demand for protein increases, and wild fish stocks collapse, aquaculture has and will continue to swell. In 1970, aquaculture contributed 3.9% of world seafood production by weight. By 2006, aquaculture had increased to 36%, and it exceeded wild-caught production in 2009 (Figure 1, FAO 2009). Growth is expected to continue at a rate of 5-10% for the foreseeable future.

Fig. 1: Relative contribution of aquaculture and capture fisheries to food fish consumption

Actors and Stakeholders



Federal governmental agencies responsible for managing aspects of aquaculture in the United States are numerous and varied. They include the Departments of Commerce, Agriculture, Interior, as well as the FDA, EPA, Army Corps of Engineers, Coast Guard, NMFS, and Minerals Management Service. The Joint Subcommittee on Aquaculture, made up of representatives from several of the following federal agencies meet to discuss productivity of and research related to aquaculture.

Regional and State stakeholders include Regional Fishery Management Councils and State Coastal Zone Management Programs.

Local organizations supportive of aquaculture and research include such groups as the Hawaiian Fisheries Development Project, the Atlantic Marine Aquaculture Center from the University of New Hampshire, and the Pacific Aquaculture Caucus. Industry entrepreneurs include Kona Blue Water Farms, Hawaii Ocean Technology, Hubbs-SeaWorld Research Institute (OC 29).

Public concern for the environmental and human health associated with aquaculture has encouraged the Ocean Conservancy, while not opposed to aquaculture, to suggest "rigorous planning and regulatory framework that uses the best available science to protect public resources." Other NGOs interested in ocean conservation such as Ocean Champions, World Wildlife Fund, Monterey Bay Aquarium Seafood Watch, and others stay abreast of aquaculture developments, and actively try to affect policy or public awareness regarding aquaculture.

Location and Jurisdiction

The majority of aquaculture in the United States today is inland (in ponds and tanks) or coastal, and is especially robust in the states that border the Gulf of Mexico: Florida, Louisiana, and Alabama (FAO b). Aquaculture in shallow water is less challenging and cheaper than deep water aquaculture due to ease of access, protection from weather, and the ability to anchor tanks easily. Therefore, until recently, shallow water aquaculture has been the only form of aquaculture. As technology improves, deep water aquaculture has begun to be explored. Currently, offshore mariculture only exists in Hawaii, Puerto Rico and New Hampshire (NOAA offshore). The state presides over each of these projects as coastal waters include anything within three miles from shore. Federal waters exist between 3 and 200 miles of the coast (Exclusive Economic Zone, EEZ), but a single federal agency does not currently have the authority to permit ocean aquaculture entrepreneurs to build enclosures in the EEZ. The National Offshore Aquaculture Act of 2007 allowed NOAA to "develop legislation that would authorize the Department of Commerce to establish a regulatory structure for offshore aquaculture in the United States," but this legislation was not finalized due to concerns about its lack of environmental protection, deficient enforcement and liability regulations, and lack of ability for states to opt out (NOAA offshore, and FWW).

Key Issues

Technologic and economic factors have historically limited ocean aquaculture, but federal regulatory uncertainty has constrained aquaculture to coastal waters since the recent advent of ambitious aquaculture projects. Thus, several projects remain untried, awaiting federal permission.
Growing in notoriety are the many environmental issues associated with conventional net-pen aquaculture. Chief among these are continued overfishing in order to feed the farmed species, pollution due to detritus, and escaped farmed fish which could be disastrous for native and/or wild species. Allaying worries regarding environmental issues will be a key part of our strategy as we move forward.

Because aquaculture displaces most other ocean uses, we will face strong opposition. It will be in our best interest to collaborate with other ocean uses upon which we can build (literally).
Should regulation within federal waters become permissible, the growth potential for aquaculture is immense since few mariculture ventures currently operate. Growth in this industry is our current trajectory, and will continue to be the case in the foreseeable future, due to current overfishing, increasing human population and their need for protein, and technological advances. Therefore it is imperative that we convince CMSP planning officials to take our value and requirements seriously and allot plenty of space for future aquaculture ventures.

Requirements of use: Logistical Parameters & Emerging Approaches

Definitions

Intensive- decreased dependence on natural food sources, increased dependence on commercial feeds, high stocking densities

Extensive- based on the use of organic food sources; fish feed on phytoplankton, zooplankton, plants, invertebrates and shellfish as well as smaller fish.

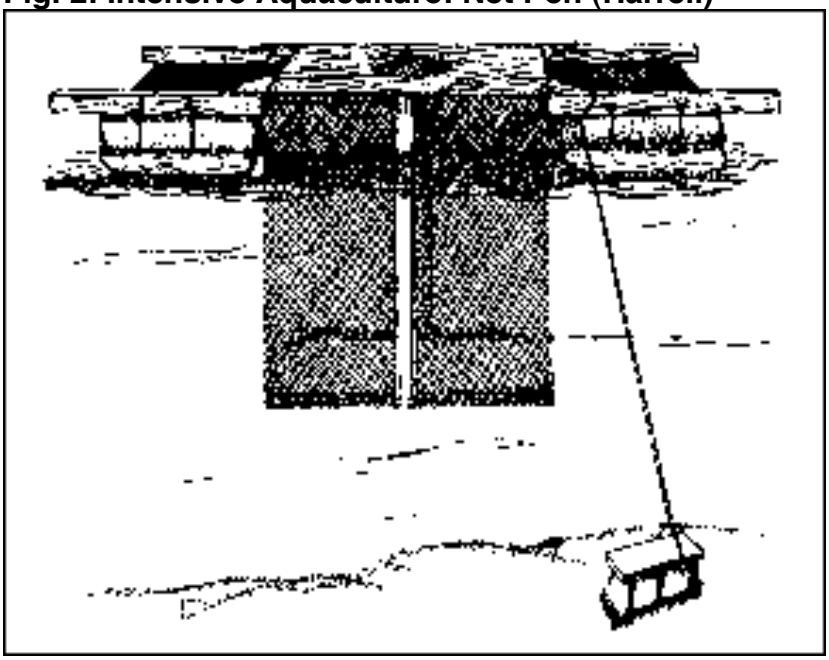
Multi-trophic- incorporation of several species at different trophic or nutritional levels within a system, and therefore synergistic

Polyculture- may include multitrophism but can also be co-culture of species at the same trophic level

Intensive Aquaculture

Almost all current aquaculture exists inshore, coastally, or nearshore. Coastal and nearshore intensive farms usually take the form of monoculture, floating, moored net pens for finfish (or floating, monoculture, 'hanging' racks for algae, seaweed, and shellfish). Feed and medications are administered by tossing pellets into the pens, either manually or mechanically/automatically. Water flows freely through these nets, concentrating detritus from the pens (dead creatures, extra feed, chemicals and drugs administered for increased productivity) in the area as well as increasing the possibility for disease to spread from pens to wild populations. The concentration of farmed seafood can attract predators.

Fig. 2: Intensive Aquaculture: Net Pen (Harrell)



Extensive multi-trophic polyculture

Extensive multi-trophic polyculture aquaculture farms exist in Asia on a small scale level, and in the south of Spain on a commercial level. The waste of the predators (bird guano) feeds molluscs which feed the fish; thus the multi-trophic nature of this farm eliminates pollution factors and need for external feed. These examples impact the environment least, but generally require coastal wetland area so that lower trophic level organisms have habitat in which to grow (mud substrate). Where appropriate sites exist, this form of aquaculture should be looked to as an ideal alternative. There, health of the predators indicates health of the farmed creatures, and therefore encouraged.

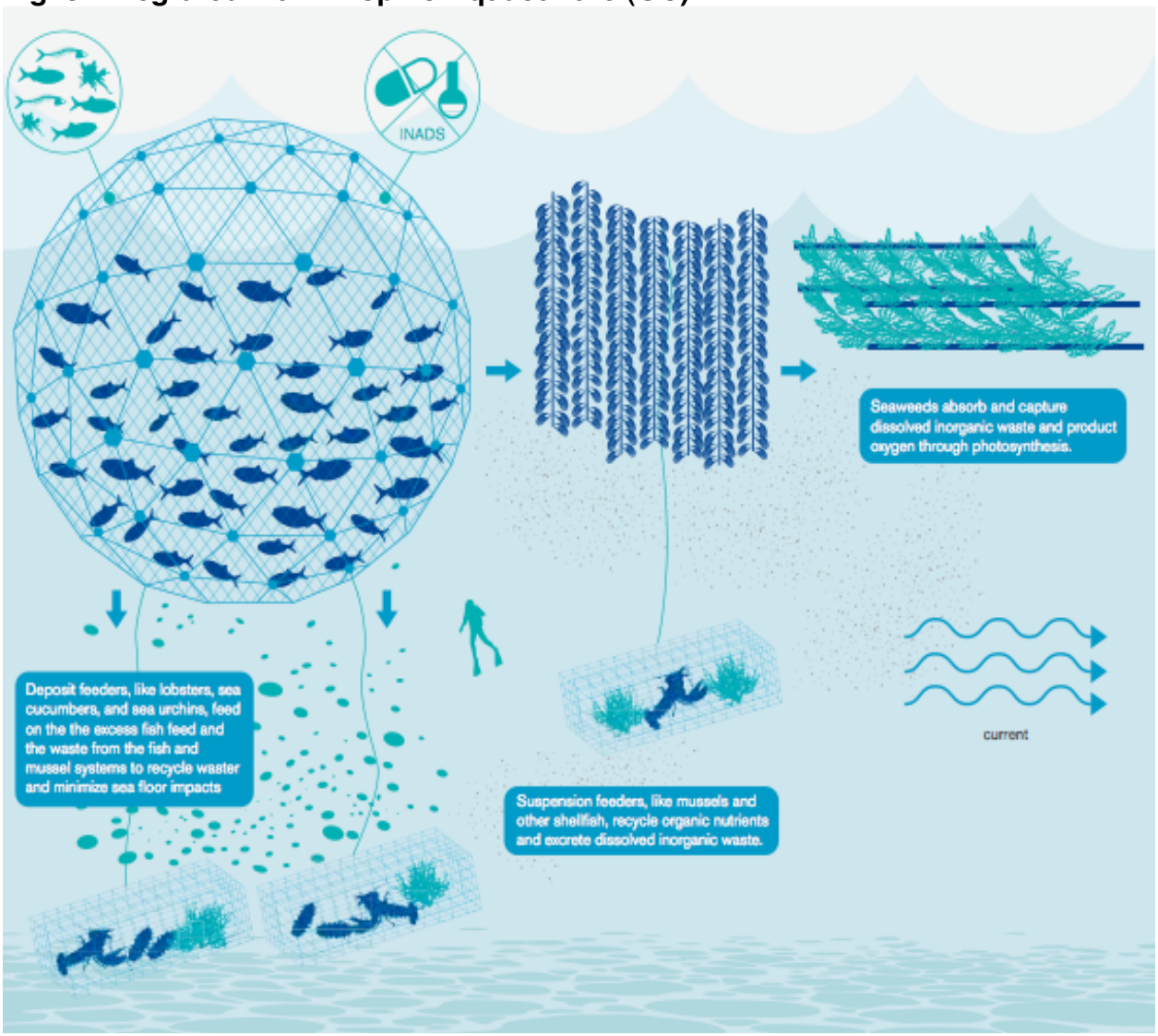
Integrated Multi-Trophic Aquaculture

Integrated Multi-Trophic Aquaculture (IMTA) is a hybrid of intensive monoculture and polyculture methods (image below from OC). Specifically, it typically involves caged finfish whose effluents feed nearby shellfish, and/or bottom-feeding fish or crustaceans, and/or seaweeds. One commercial benefit is a varied species portfolio from which to profit, decreasing the likelihood of disease or disaster wiping out the entire operation. For instance, if sea lice decrease the quality or quantity of finfish one season, the producer still may profit from the sale of shellfish or seaweed. Ecological benefits include decreased nutrification by finfish because the shellfish and seaweed raised nearby filter the effluents in the water. However, with open net cages, rates of effluent

Product	Input	Output
Finfish	commercial feed, drugs	effluent
Shellfish	effluent from finfish	effluent, filtered water
Seaweed	effluent from finfish and shellfish	filtered water
Deposit Feeders (lobsters, sea urchins, sea cucumbers)	effluent from finfish and shellfish	minimized floor impact

filtration by other species are not high.

Fig. 3: Integrated Multi-Trophic Aquaculture (OC)



Offshore aquaculture

Most offshore aquaculture designs are conceptual or in trial phases. They include IMTA, as well as moored and free-floating monoculture cage structures like SeaStation and Aquapod (trial), Ocean Globe, drifters, and cageless ranching (conceptual) (Kite-Powell). Such designs need to be able to withstand strong currents, waves, and winds. Traditionally, large cage structures have been anchored to the seabed, but Hawaiian Ocean Technology has recently designed a free-floating, submerged, out of sight cage, kept in place by currents and jet propulsion. This untested design would be out of reach of storms, coastal pollution, and shipping traffic (FTAI). As it relates to CMSP, mariculture will usually require that no other ocean use take place in the area, with the possible exceptions of collaborating with oil rigs and/or wind turbines. Acknowledging and dealing with these tradeoffs will be a key point in our negotiating strategy.

General Parameters

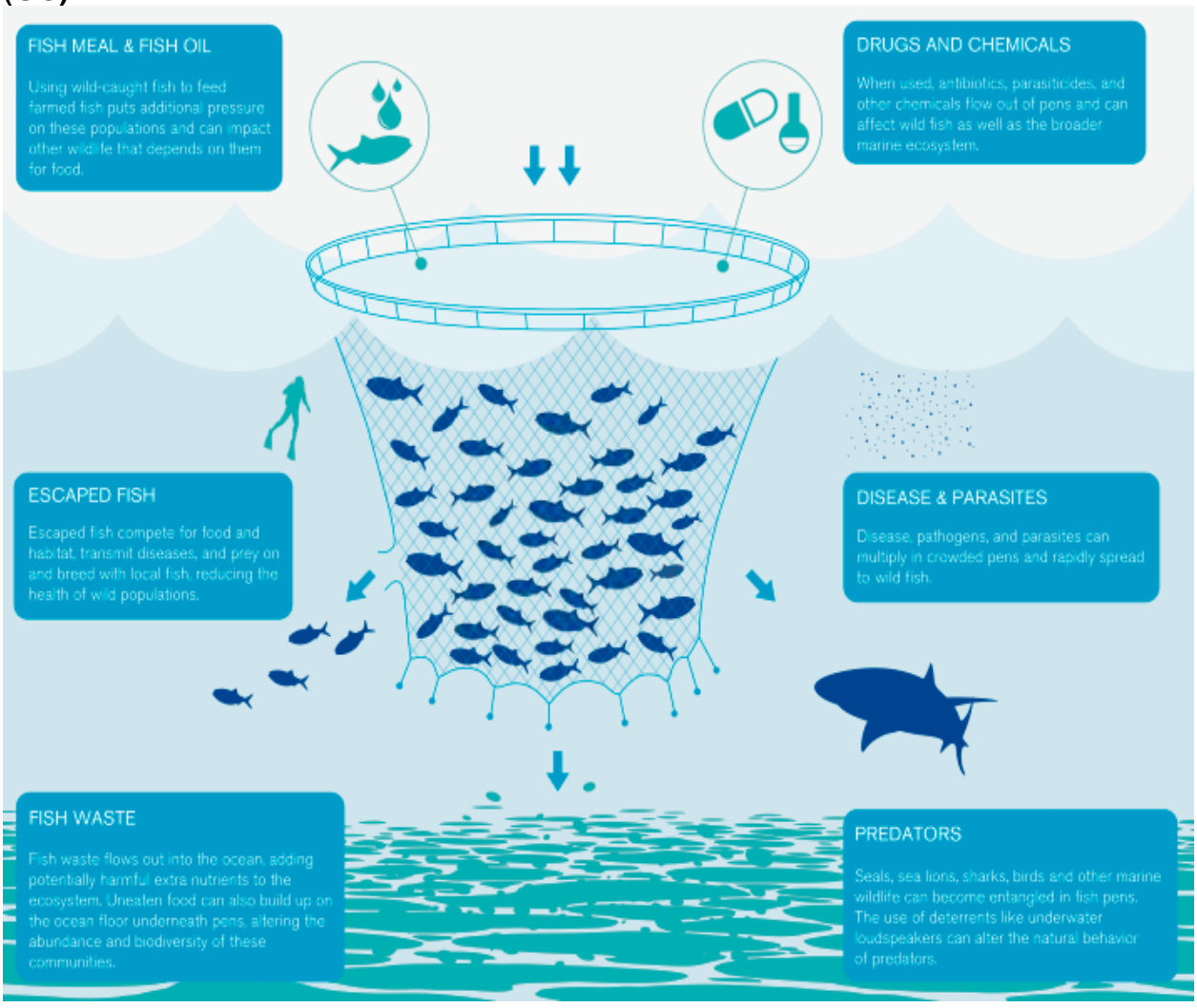
All of these methods require and on-land operation base and humans to check on the health of the system regularly. Extensive aquaculture requires land-based electricity and food for their fry and fingerlings (baby fish), but neither for their adult animals, while every other operation-type currently requires external feeding, and electricity if automatic feeders are involved. Harvesting the species requires human labor, equipment (usually boats) to bring the goods inland, often a refrigeration system and a distributor pick-up area.

Constraints on current and future use

Ecological Impacts

Kona Blue Water Farms claim that maricultured fish have “60 times less of an ecological footprint than wild-caught fish” due to decreasing reliance on wild-caught fish meal and fish oil, lack of bycatch, and a more efficient life cycle. That is, fish are harvested immediately after their most efficient growth to adult size, and do not spend energy on reproduction or surviving in the wild (Loubet). This figure is misleading, however, as there are several significant direct and indirect environmental and health concerns related to aquaculture, including threats to biodiversity and health, poor land and resource use, and pollution (see Figure 4).

Fig. 4: Environmental Threats from Aquaculture (OC)



Threats to biodiversity include conversion of habitats (including mangroves, wetlands or even open water), eutrophication due to algal blooms from the increased nitrogenation

of waters, and escaped non-native species which can mate with or crowd out native species. In addition, predators attracted to the density of prey may be killed or injured as they accidentally become entangled in pen nets or purposefully discouraged to investigate. Choosing to raise animals that have a large conversion factor regarding pounds of ocean-caught fish, fish meal, or fish oil to pound of aquaculture-raised fish is considered a poor usage of natural resources, and contributes to overfishing. Threats to the health of nearby natural habitats include the excessive use of drugs, antibiotics, and other chemicals for disease control, as well as the possibility of transmitting or transferring disease and parasites to native populations, a problem due in part to the high density of farmed species. Pollution due to salinization, effluents and sedimentation remain other environmental concerns (Boyd, et al). Many present-day aquaculture farms do not address these key environmental concerns.

Conflicts with Other Ocean Uses and Constraints

Lack of suitable sites constrain growth of coastal and marine aquaculture. Aquaculture competes for space because it physically displaces most other ocean uses including on-shore ocean uses such as tourism, residential areas, municipal ports, and coastal and marine uses such as commercial and recreational fishing, shipping, military operations, boating, and marine protected areas. If the aquaculture produces significant pollution in the area, these other ocean uses are preempted for yet another reason, beyond the farm taking space. Similarly, the Endangered Species Act of 1973 hinders aquaculture growth since these farms often share the same water as endangered animals. Where deep water structures like wind farms, oil rigs, or current marker buoy structures exist, synergy may be possible. This sort of synergy and co-management is being explored in Germany (Buck). Access to, maintenance of, and choosing species that can withstand marine hydrodynamic forces for such sites remain considerations and limitations. Consideration of conflicting or tandem marine usage will be significant for aquaculture as Coastal and Marine Spatial Planning (CMSP) progresses, as these interactions will likely predict where or how aquaculture will advance.

Regulatory uncertainty has been another limitation, particularly regarding offshore aquaculture (mariculture). While coastal and inland aquaculture is regulated by state or local agencies, mariculture is not clearly regulated by any one governmental body. CMSP will eliminate a great deal of this uncertainty, allowing aquaculture to be permitted where appropriate. Despite the passage of the National Aquaculture Act in 1980, which codified the national policy of supporting aquaculture, few advances have been made to streamline regulation and permitting. While separate terrestrial agencies regulate issues such as “water supply, navigable waters, food production, and environmental protection,” a single agency might work best to coordinate all these interests in the marine realm, yet such an agency does not exist (Sea Grant). The National Offshore Aquaculture Act of 2007 would have given NOAA provision to be this single agency for permits and leasing, but the bills “faced considerable opposition” as it would have taken control away from other groups such as the National Marine Fisheries Service, Army Corps of Engineers, Environmental Protection Agency, regional fishery management councils, Department of Agriculture, Coast Guard, Fish and Wildlife

Service and Minerals Management Service (Stickney, and Fletcher). Therefore, "challenges in the form of a fragmented and often inconsistent permitting process among the federal, state, and local agencies and questions regarding leasing, siting, and property rights" still exist (Sea Grant). CMSP should resolve most, if not all of these regulatory issues.

Public opposition to aquaculture exists for two main reasons. First, some simply prefer the idea of their seafood being wild as opposed to farmed. More notably, there has been a general trend to view aquaculture as a wholly negative industry, due in part to environmental NGOs' work to educate the public about some of the aforementioned possible ecologically damaging impacts. Potential for increased pollution, added stress on fisheries that are already at or above full exploitation levels, disease and genetic welfare remain concerns that entrepreneurs would do well to mitigate at the outset of their aquaculture ventures. Certain multi-trophic operations, such as Veta la Palma in Spain, have reduced many of these concerns, and proven themselves to be purveyors of flavorful, naturally colored finfish, compared with many of their intensively raised counterparts which have a reputation for tasting bland and being artificially pigmented.

As atmospheric carbon emissions rise, ocean acidification becomes increasingly problematic for ocean life. Corals, shellfish, and certain algae are particularly affected by the acidification which leads to decalcification and death. Shellfish aquaculture could be severely and adversely impacted by climate change because of this acidification.

Finally, lack of appropriate technology for the "new frontier" (deep water aquaculture) and the high capital investment needed to invest in offshore technologies represents a third limit to development in deep water (OC 4). Technologies created for off-shore mariculture must endure extreme wind and waves.

Negotiating strategy for achieving goals

Goals & Strategies

Goals and associated strategies of the aquaculture stakeholders are as follows:

1.Engagement and consideration:

Systematically discuss our position, ideas, suggestions with CMSP officials.

Systematically discuss position, ideas, and common points with potential alliance stakeholders.

Discuss our position with and listen to other stakeholders to be sure we did not overlook a strong alliance elsewhere.

Develop two-way partnerships and collaborative approaches with alliance stakeholders.

2. Allotment:

Vigorously pursue securing space planned for aquaculture in a variety of areas in the CMSP overview.

Effectively communicate and promote our needs and reasoning.

Objective/outcome

Our overarching goal is to ensure that aquaculture secures the marine space and onshore access required to operate our present and future facilities.

Bottom line

Our bottom line is that we cannot afford to be ignored. We need to ensure that space is responsibly considered as appropriate for sensible aquaculture methods. This includes established, experimental and as-yet untested systems. New and emerging approaches to aquaculture need to be considered in the CMSP process to secure the ability to test some of these methods in order to move productively and intelligently into the future of aquaculture.

We are willing to give up space currently demarcated as shipping lanes or marine protected areas, as well as areas that currently recreational or tourist destinations or critical habitat areas. We recognize that we will likely be impinging on fishing grounds, and are willing to give up space that is known as particularly important for fishermen, but will attempt to maximize alliances or co-management schemes with synergistic or compatible uses..

Approach

Because there are so many possible negative externalities associated with aquaculture (environmental impacts, spatial conflicts), but also because there are so many benefits to be had from aquaculture (reduce overfishing burden, maintain and increase human

dietary protein source, job opportunities for displaced fishermen), it is important that we work openly, honestly and in concert with CMSP officials and other potential allies. If we garner their respect, they are much more likely to consider our needs, and more likely to listen to us as we describe how we will mitigate the negative externalities as much as possible.

Strategic alliances for achieving goals

Potential allies

- Onshore business partners
- Oil industry (synergy with structure)
- Wind turbines (synergy with structure)
- Recreational boaters (regarding sub-surface cages)

Onshore businesses such as refrigeration companies, trucking companies, seafood purveyors, and others that benefit from aquaculture present a clear support system in this campaign. Some of our best allies amongst ocean-users will likely be groups that have stationary physical structures for their ocean uses, where we could piggy-back an aquaculture venture and share electricity or upkeep costs. These sorts of groups include wind turbine proponents, oil rig or extraction rig owners. Especially in the latter case, they share with us the fact that environmental groups often chastise their practices. If we work together, we could show that we are committed to minimizing environmental impact by being more efficient (concentrating both our efforts in a single space and thus negatively affecting fewer habitats). In the case of wind turbines, our reputation only stands to benefit from allying ourselves with progressive clean energy measures. Wind turbine proponents stand to gain from our alliance, as well, since whatever energy we use on site is less energy that will have to be sent back to shore. They could see helping us as a meaningful way to 'green' an industry that does not have a strong environmental track record.

Recreational boaters may be willing to help us, if we stress the sub-surface type cages that are currently theoretical, since these sorts of cages would not interfere with surface activities. Other unforeseen alliances could be created, so listening and connecting with each ocean-use group is important. Because aquaculture necessarily displaces most other ocean-uses, it is imperative that we be willing to support other ocean uses, in exchange for their support. For instance, unlikely allies or former rivals, such as whalewatching groups, might be exploited by trying to change our messaging (and actions) to more closely reflect their viewpoints. Using the personal and political connections of our investors could be another important way to secure success in CMSP.

Methods

Methods for forging alliances include meetings (telephone, skype, or in person) with appropriate figureheads of each group initially, followed by maintaining connection via emails or letters, discussions, and meetings. Meals featuring aquaculture-raised finfish, mussels, and seaweed will provide a particularly compelling connection for these potential alliance members to remember.

Grassroots efforts are important as well. Contacting supportive citizens, chefs and distributors and encouraging them to make public comments supporting aquaculture on CMSP reports is essential.

Outreach strategy for achieving goals

Key messages

•Aquaculture is necessary to maintain and grow protein sources for human population now and in the future.
•The aquaculture sector is interested in sustainability. The health of the industry relies on the health of the surrounding habitat.
•We are a relatively new sector of ocean use, and are actively exploring innovative ways to deal with problematic issues. This science-based, disciplined consideration will help us figure out the most efficient, effective techniques and practices.
•We hope to offer a marine-related career option to fishermen who find themselves without jobs due to more stringent quotas and overfishing. We believe the culture of marine careers passing from generation to generation is relevant and important along our coasts.

Target audiences

Public, CMSP professionals, fishermen, conservation NGOs, other ocean-use groups.

Tactics/tools

By anticipating counter arguments, and proactively requesting former and/or potential rivals' collaboration, our arguments become stronger for moving forward and allowing aquaculture to gain a solid footing as a sector among ocean uses. Our tactics and tools include:
•Discussing integrated multi-trophic aquaculture (IMTA) as well as extensive aquaculture as possible ways to mitigate environmental issues.
•Including underwater cages as a possible way to avoid interfering with surface activities.
•Emphasizing research as opportunities and innovative methods of pursuing aquaculture present themselves.
•Finding more chefs like Dan Barber that choose certain farm-raised fish over wild-caught species for their dishes, as spokesmen.
•Engaging NGOs like Monterey Bay Aquarium Seafood Watch and Ocean Conservancy to see what aquaculture they are willing to endorse. Move forward with these.
•Engaging unemployed fishermen, discussing possible jobs in the aquaculture industry.

References

Buck, B. H., Krause, G., Rosenthal, H. "Extensive open ocean aquaculture development within wind farms in Germany: the prospect of offshore co-management and legal constraints, Ocean & Coastal Management" 2004. <http://epic.awi.de/epic/Main?puid=19832>

FAO. "The State of World Fisheries and Aquaculture" Food and Agriculture Organization of the United Nations. 2009. 16 Oct. 2010 <ftp://ftp.fao.org/docrep/fao/011/i0250e/i0250e.pdf>

FAO b. "National Legislation Overview: United States of America" 18 March 2011 <http://www.fao.org/fishery/legalframework/nalo_usa/en>

FTAI. Fisheries Technology Associates, Inc; Fisheries Consulting. "Aquaculture Facts and Fish Farming Facts and Figures" 18 March 2011<http://www.ftai.com/aquaculture.htm>

FWW. Food and Water Watch. "National Offshore Aquaculture Act 2007" 29 May 2011 <http://www.foodandwaterwatch.org/fish/fish-farming/ooa-bill-2007/>

Kite-Powell, Hauke. "Taking Finfish Aquaculture to the Open Ocean: U.S. Experience and Prospects" Marine Policy Center, Woods Hole Oceanographic Institution. 13 April 2011 <http://aquanic.org/systems/cages/documents/10_HAUKE_KITE_POWELLS.pdf>

Harrell, Reginal. Maryland Sea Grant Extension. "Cage Culture in Maryland" 13 April 2011 <http://www.mdsg.umd.edu/programs/extension/aquaculture/finfish/factsheets/FF2/>

NOAA. "Aquaculture in the United States" revised July 15 2010. 18 March 2011 <http://aquaculture.noaa.gov/us/welcome.html>

NOAA offshore. 18 March 2011 <http://aquaculture.noaa.gov/us/offshore.html>

OC. Ocean Conservancy. "Right from the Start: Open-Ocean Aquaculture in the United States" March 2011. 18 March 2011 <http://www.oceanconservancy.org/our-work/aquaculture/assets/pdf/oc_rfts_v11_single.pdf>