Capturing Fugitive Resources in a Globalized Economy: The Case of Marine Aquaculture in Hawai`i

By

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ABSTRACT

Technological development in breeding and growing Pacific threadfin (*mo`i*) in open-ocean cages has opened up the possibility of a new growth industry for Hawai`i. However, two types of challenges must be overcome before this potential could be realized. *First*, the issues of equity and overlapping claims associated with marine aquaculture production must be resolved. The new mode of production requires new property institutions that incorporates not only the rights of access and extraction that are common to marine tenure, but also exclusive individual claims (over the fish stock inside the cages) by aquaculture operators and exclusive cultural claims (over the fish species) on behalf of native Hawaiians. *Second*, commercial marine aquaculture production must be placed in the context of a globalized economy that generally favors large trans-national corporations over local independent producers. Developing marine aquaculture without acknowledging this pervasive trend would result in an industry whose profitability is short lived once the technology is reproduced in other lower cost areas.

The paper explores opportunities to build policies and programs in Hawai`i that address the potential social and cultural obstacles while simultaneously building economically viable strategies for marine aquaculture producers. Drawing from studies in agro-food systems and actor-network theory, we examine ways of facilitating problem-solving among local stakeholders in order to appropriately apply new technology and maintain strategic positions in dynamic networks that support the new industry. The challenge is to strike the delicate balance between favoring local enterprises rooted in cultural traditions, maintaining competitiveness and ensuring environmental and aesthetic standards.

Key words: marine aquaculture, cultural property, global food systems

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1. Introduction

During the summer of 1999, the first offshore marine aquaculture cage in Hawai`i was stocked with Pacific threadfin (*polydactylus sexfilis*), locally known as *moi*, under the direction of the Pacific Marine Aquaculture Center. The Pacific Marine Aquaculture Center consisted of researchers from the Oceanic Institute and the University of Hawai`i Sea Grant College Program with support from the State Aquaculture Development Program and federal funds. In November 1999, this demonstration project saw the first harvest of high volume, modern cage-raised fish in the state of Hawai`i. By summer 2000, a local private firm has applied for a permit to operate marine aquaculture based on this technology. The pending launch of the first marine aquaculture venture triggered a sense of optimism for a new growth industry in a state struggling to diversify an economy that has been overly reliant on tourism.

The viability of commercial marine aquaculture in Hawai`i, however, does not hinge simply on scientific knowledge and technical capacity available in the State. Our initial observations indicate that there are important socio-cultural and economic issues that need to be resolved in order for a marine aquaculture industry to fully thrive. The first proposal by a private venture to utilize modern marine aquaculture technology immediately drew opposition from fishermen, Native Hawaiian rights advocates, as well as members of the general public (Lum 2000).

In addition, commercial marine aquaculture production must be placed in context of the globalization of agro-food systems. High-volume fish cultivation is susceptible to the same forces of global restructuring that have marginalized other commodity producers, such as macadamia nut or pineapple growers, in Hawai`i (Suryanata 2000). Developing marine aquaculture without acknowledging this pervasive trend in the global economy would result in an industry whose profitability is short lived once the technology is reproduced in other lower cost areas.

Our understanding of the socio-cultural and economic conditions in Hawai`i points to the need for policies and programs that address the potential social and cultural obstacles while simultaneously building viable strategies for Hawai`i aquaculture producers to operate in the context of a globalized economy. The paper will begin with a brief overview of marine aquaculture, and the specific circumstances that surround its development in Hawai`i. Then we will examine the two areas of concern that confront the efforts to commercialize the industry in Hawai`i.

2. Marine Aquaculture in a global perspective

Aquaculture - the farming of fish, plants, shrimp and other shellfish - has been practiced for thousand of years, particularly in Asia. In the past two decades, however, aquaculture has been growing at an unprecedented rate worldwide. Between 1984 and 2000, aquaculture grew at an average of more than 10 percent each year, making it one of the fastest-growing food production activities (FAO 2000). Today, about one-third of the fish consumed by humans is the product of aquaculture (World Resources Institute 2000), and this proportion will continue to increase as aquaculture expands and conventional fish catch declines. Meanwhile, demand for fish for direct consumption is expected to grow about 20 percent by 2010 (Matthews and Hammond 1999; FAO 2000).

A majority of aquaculture production comes from inland and coastal aquaculture that produce shrimp as well as lower-value species such as tilapia and carp. A serious constraint on the industry's future growth, however, is competition for land and water. In China, Thailand and Indonesia, the growth of aquaculture (primarily shrimp ponds) has been accompanied by rising concern over the loss of arable lands and ecologically fragile wetlands and mangrove forests (Holmes 1996; Naylor, Goldburg, Mooney et al. 1998). In addition, the intensification of aquaculture has also led to second-generation of problems, such as eutrophication and disease contamination of the overall ecosystem, and a collapse of pond production due to disease and poor water quality. Such problems have affected aquaculture industry in countries that include China, Ecuador, and Taiwan.

More recent technical development has allowed a move of aquaculture production to offshore locations (McVey 1996). This allows moving out of delicate freshwater systems and estuaries where nutrient loading from human activities is or near system capacity. Offshore production also allows culture of high-value marine species. In its early development, most of the research on marine aquaculture focused primarily on the technical aspects such as new engineering that could withstand the rough offshore conditions, new candidate species, or the logistics of maintenance, hatchery management, stocking, feeding and harvesting.

Developing aquaculture in offshore sites was assumed to raise fewer conflicts with other users. But it quickly became clear that this was not the case. Legal and institutional issues associated with commercial marine aquaculture have been identified as a major constraint to the industry's development (National Research Council 1978), and numerous other scholars have since continued to reiterate these issues. As Bailey, Jentoft and Sinclair (1996a: 15) state:

> "…aquaculture cannot be treated only as a technological innovation; it also involves forms of organization that must be considered legitimate in themselves in the local society".

Today there is a growing body of literature that examines the social and legal dimension of this emerging industry (e.g.Cicin-Sain 1992; Bailey, Jentoft and Sinclair 1996b; Millar 1996; Robertson, Lindsay and Gardoqui 1996; Rieser 1997). Some of the issues that have been raised in the literature that are relevant to marine aquaculture in Hawai`i include the problem of tradeoffs between competing goals among stakeholder groups and strategies to build consensus, cooperation and networks in support of the industry.

Marine aquaculture development results in new uses of resources, alterations of existing marketing channels for fish products, and the creation of new opportunities for employment and wealth creation. Inevitably, however, there are tradeoffs between these competing goals (Aarset and Foss 1996; Perez, Bailey and Waren 1996). Decision makers in marine aquaculture thus face serious dilemmas in designing appropriate policies, processes and programs that are economically viable and work in tandem with ethics of behavior and cultural norms and values within a society. Depending on stakeholder politics, different nation-states have developed differing policies.

Much of the experience in modern, highly commercialized marine aquaculture has been gained from the salmon farming industry that underwent an explosive growth since the 1980s. Total world production increased from a mere 7000 metric tons in 1980 to almost a million metric tons in 1999 (Fish Information Service 2001). The industry was first

developed in Norway and United Kingdom, and since then has expanded to other North European countries, USA, Canada, Australia, Japan, New Zealand and Chile.

In Norway, the largest producer of farmed salmon, marine aquaculture was initially developed as a means to economically revive coastal communities that had been suffering from problems of stock depletion in capture fisheries. To this end, access to the industry was regulated through a licensing system that limited the size and number of fish pens, controlled the spatial distribution of the farms, and required local ownership and management (Holm and Jentoft 1996; Aarset 1998). In addition, the technology was designed to minimize technical and economic barriers to fishers and coastal dwellers. As a result, although marine aquaculture represents a radical departure from the conventional fishery, until the 1980s salmon farming was generally characterized as small scale and well integrated into the fishing communities.

Participation and acceptance by local communities proved critical in the early stage of the salmon farming industry. Until the mid 1980s, the rise of salmon farming in Norway was attributed to the strength and versatility of social networks among fish farmers, fishers, and actors in the marketing channel (Holm and Jentoft 1996). In Shetland, the industry was dependent on trust building among the fish farmers, which was then extended as a strategy of external relations (Millar 1996; van der Schans 1996). Research exploring the potential social impacts of marine aquaculture in Northern New England reiterated the need for greater public involvement in the project planning and implementation processes in order for marine aquaculture to be successful (Robertson, Lindsay and Gardoqui 1996).

The literature also critically examines the various consequences of policy approaches. Critics have argued that aquaculture policies that promote small-scale enterprises could also result in unintended negative consequences. For one, these policies were found to cause economic and production inefficiencies that made it difficult for firms to compete in the face of expanding global production. The entry of multinational corporations, especially those that operate in lower cost areas such as Chile, triggered a precipitous drop in farmed salmon prices throughout the 1990s, ending with the demise of most of the Norwegian small producers (Aarset and Foss 1996; Holm and Jentoft 1996). Similar trends also occurred in other countries such as Canada, Ireland and Scotland.

Second, small scale producers have been less able to cope with environmental problems that have arisen in direct relation to the expansive size of the industry, creating high environmental externalities and use conflicts (Anutha and Johnson. 1996; Phyne 1996). Size limitations on cages in Norway, for example, led to fish farmers increasing the stocking density in fish pens, which then increased the risk of diseases (Bjorndal and Salvanes 1985 in Holm and Jentoft 1996). Indeed, reports on the environmental impacts of salmon farming have led to farmed salmon being declared ‘the politically incorrect fish’ by the late 1990s, a fish to be avoided by environmentally conscious consumers (see for example, Naylor, Goldburg, Mooney et al. 1998; Stephens 2000; Meek 2001).

From a technical point of view, one ‘solution’ to the various obstacles encountered by marine aquaculture firms is a shift from floating to submerged pens and cages, and a spatial move towards open ocean environments. On the positive side, offshore sites generally permit greater economies of scale and hence more competitive in the global market. They also allow lower stocking densities and related disease problems, fewer

environmental impacts and less public opposition (Phyne 1996). But maintaining submerged cages also pose its challenges. Open ocean technologies require higher capital costs and technical knowledge and skills (e.g., more expensive cages, larger boats, diving requirements). Herein lies a critical tension. On the one hand, the overall result of the shifts in technological innovation, economic globalization and environmental attitudes has been a rapid move in the industry towards large-scale production dominated by multinationals. On the other hand, the success and stability of open-ocean technology that leaves cages vulnerable to vandalism depends highly on support among local stakeholders.

3. Marine Aquaculture in Hawai`i

In Hawai`i, fishpond cultivation was widely practiced by native Hawaiians from about 800 to 1000 years ago (Kikuchi 1976, Wyban 1992). The arrival of Europeans in the 18th century brought changes that include the depopulation of native Hawaiians, the breakdown of the traditional authority, and the transformation of property rights systems. These changes resulted in the disruption of the labor regime required to maintain the fishponds. In the twentieth century, increased development on the islands further destroyed the fishponds, and only a handful of traditional fishponds remained today. Nevertheless fishponds continue to have a significant cultural meaning for native Hawaiians. The concept of moral righteousness and spiritual harmony is considered central among many that advocate restoring fishponds and aquaculture in Hawai`i.

Modern aquaculture operations in Hawai`i began in the 1970s. By 1999 there were more than 100 aquaculture operations in the State of Hawai`i, producing 2.2 million pounds of products with a value of more than $18.1 million (State of Hawai`i 2000). Thirty-five aquatic plant and animal species are being raised for both research and commercial production. Of these species, algae and seaweed production is the leading revenue earner, followed by shellfish. Finfish is raised in land-based ponds, producing Japanese flounder, Chinese catfish, tilapia, carp, mullet, *moi*, and milkfish. Its production is still limited and their collective value in 1999 was estimated to be $1 million. The technical development of marine aquaculture that can grow *moi* therefore provided a breakthrough in finfish production that could revolutionize this sector.

In the most recent development, the technology used for growing *moi* is the *OceanSpar SeaStation*, which is a rigid, submersible, double conical shaped cage approximately 30 feet in height and 80 feet in width. The cage is a completely enclosed system with zippered openings on its taut netting. The steel spar is used to vary buoyancy by displacing air with water inside the spar. The cage is anchored by lines to concrete blocks and can be permanently submerged. With this technology, fish farmers would be able to raise 140,000 pounds of *moi* per cage over a 6-month grow out period.

Submerged offshore cage technology is favored in Hawai`i for both technical and political reasons, many of which are interrelated. Technically, fish growing in submerged cages are protected from surface waves and therefore experience less stress. Taut netting on rigid cages reduces possible predator interaction with the fish. Siting cages in the open ocean also reduces effluent concentration and the risk of diseases, as stronger currents remove waste and allow more circulation. Equally important, the use of submerged cages is expected to reduce the problem of use conflicts, as submerged cages

would not obstruct seascapes and seldom interfere with navigation, recreation, fishing and other ocean activities.

In Hawai`i, marine tenure systems are generally considered state property regimes, in which the rights to particular water are limited to a defined user group that is regulated by the State. Individuals such as recreational boat owners may have rights of access only, while fishermen have rights of access and extraction of marine products. This access is subject to compliance with operational rules specified by the State. The power to determine who will have these rights also resides in state authorities, as embodied in the licensing system that is administered by the State Department of Land and Natural Resources. Under Hawai`i State law (*HRS § 190D*), a Conservation District Use permit is required for any activity taking place in conservation lands. This includes the use of ocean waters and submerged lands. On July 1, 1999, this law was amended to specifically address ocean leasing for the development of marine activities. Included in this definition is 'marine aquaculture' and 'aquaculture' (*HRS § 190D-21*), thus providing a legal framework of how the tenure systems are to be reallocated.

In spring 2000, Cates International, Inc. (CII), a Hawai`i -based private venture, submitted a Conservation District Use application for the use of a 28-acre rectangular submerged land area located off Ewa Beach, near the southernmost tip of the island of Oahu. Cates proposed to deploy a total of four cages, each of which would be moored to the bottom of the ocean with concrete blocks. The four cages would occupy a vertical area of approximately 0.5 acres above the sea floor with no less than 40 feet between the ocean surface and the tops of the cages so as not to interfere with fishing or navigation. They are approximately 80 feet wide by 60 feet tall with an internal volume of 92,000 cubic feet. The cages would be stocked with *moi* and maintained by divers who would visit the cages for daily feedings, cleaning, and monitoring of the structure, anchor system, along with any waste or effluent problems that may arise. The harvest capacity is estimated at 140,000 one-pound fish over a six-month growing period.

The application submitted by Cates International was not the only request received by the Board of Land and Natural Resources to lease State marine waters for commercial marine aquaculture operations. A second application was submitted by Black Pearls, Inc. (BPI) to lease 75 acres of ocean space for pearl oyster farm at the Reef Runway Borrow Pit, located adjacent to the Honolulu Airport Reef Runway. BPI proposed to place sub-surface head-lines stretched taut from one side of the borrow pit to the other by large floats. These lines will be anchored into the soft substrate at each end, and buoyed to sit beneath the water surface to prevent excessive abrasion on lines from wave action. Oysters will be suspended in panels or mesh pouch arrays at the depth of about 5 m. This area could support a farm standing stock of 50,000 adult oysters.

Following the submittal of these applications, respective public hearings were held to invite comments and concerns from the general public regarding the applications. Under Hawai`i Law, anyone opposed to the application can request a contested case hearing, a quasi-judicial process involving the presentation of evidence by witnesses, cross-examination and arguments in front of the Board of Land and Natural Resources. The following section analyzes the opinions that were submitted within the context of these hearings.

4. Property, Culture and History

Many studies have shown that the simple constructs of property and the use of two-dimensional maps are often inadequate in delineating the boundaries of the nested and overlapping rights to common resources such as forests (e.g. Fortmann and Bruce 1988; Schroeder 1993; Rocheleau and Edmunds 1997). Similarly, the development of marine aquaculture in Hawai`i has necessitated the conventional marine tenure systems to reconsider how overlapping rights are allocated among claimants. Marine aquaculture is essentially a capital-intensive industry that must be ensured by exclusive rights to the site (a key resource) where the cultivation is placed. Unlike the area leased for the oyster farm, the water column above the submerged fish-producing cages remains open for boat access. The relative permanence of these cages means that they have the potential of altering the micro-environment that may affect other users' rights.

Although the permitting and licensing systems are administered by the State, in practice much of the operational rules and enforcement mechanisms are embedded in ethics of behavior and cultural norms that govern the relationships among the users. A basic stipulation in the theory of property is that somebody's right implies a commensurate duty by another to observe this right (Schlager and Ostrom 1992). Development of a new property regime therefore is ideally predicated on a consensus among all participants that may involve changing values and practices (Millar 1996). In remote areas such as forests or open oceans, the cost of monitoring or enforcement, without the commitment of everyone who possesses the right of access, is generally prohibitive. Disgruntled parties could voice their opposition by acts of 'community-approved vandalism' (Peluso 1992; Neumann 1995), effectively nullifying the state-endorsed rights.

To established ocean users, marine aquaculture is both a new technology and a new system of property that regulates access and usage of marine resources. Until recently, the open ocean was generally considered to be the last commons, where ownership of fish products is based on the labor that fishermen invested in the act of catching them. While marine tenure systems may grant rights to fishing territories, they do not guarantee that fish (hence, a fugitive resource) would not migrate out of these territories. Until a fish is caught, nobody is considered to be a legitimate owner of that fish. The concept of marine aquaculture thus represents a significant departure from this notion. It is therefore not surprising that the two proposals for establishing commercial marine aquaculture venture drew much public attention.

Cates International, Inc.

CII's application to lease State marine waters for commercial marine aquaculture was discussed in a public hearing that was held on 21 June, 2001. In addition to the written testimonies submitted by individuals and organizations, over a dozen people presented oral testimony. About half of those who testified raised opposition or concern over the project. Opponents voiced concerns in two general areas: environmental protection and social justice. Issues of environmental protection pertained to effluents, debris, possible genetic alterations of brood stock and impact on wild fisheries. These environmental issues were primarily technical in nature and presumably their deliberation would be deferred to scientific experts.

In the issue of social justice, there were concerns regarding how the proposed marine aquaculture enterprise would impact the rights of Native Hawaiians and traditional fishermen. Two related issues of cultural property were articulated in this argument. The first was the claim that the proposed lease site was a highly productive ancient Hawaiian fishery. Pu`uloa, now commonly referred to as Pearl Harbor, had been an important estuary and reef fishery, rich with marine resources including seaweed, claims, oysters, and a wide variety of fish prior to the dredging of Pearl Harbor for military purposes. Though Ewa Beach is outside of the harbor itself, the general area was known to be rich in marine resources. Fishermen testified that the site is known as a breeding ground for *moi,* the fish being proposed to be raised in the cages.

Pu`uloa is also home to a number of sacred sites. In written testimony, a Native Hawaiian rights advocate and cultural resource management specialist, Toni Auld Yardley, submitted a compilation of excerpts from scholarly works on the history of the fisheries of Pu`uloa and Halawa. According to these writings, some of the weir or fishtraps were associated with ko`a (fish shrines). Images of the fish god Ku`ula and moon goddess Hina were said to have been placed at the north and south points of one shrine. When the Pu`uloa channel was dredged for the construction of the military harbor, the caretaker was said to have removed the images and dropped them into the sea. Numerous historic stone wall fishponds also remain unused in and around the harbor area.

A second aspect of cultural property had to do with fish species selection. *Moi* was well known as the food of the *ali`i*, or royalty, during the reign of the Hawaiian monarchy. A tender, moist and succulent white fish, *moi* was a delicacy reserved only for Hawaiian royalty, or *Mo`i*. Commoners used to be forbidden to eat *moi*. As put by those who testified in the public hearing, "I fish for *moi* thinking it's the fish for *ali`i o kanaka,* the royalty of our people"[3]; and "*moi* is *ali`i* fish… we respect that right. How could someone take away that right as an economic venture?"[4] In the context of the recent upsurge in the movement for Hawaiian sovereignty, the claim resonates more broadly within the political environs where national pride and identity among native Hawaiians are expressed.

Black Pearl, Inc.

Public opposition to the proposal by Cates International may have been articulated in cultural terms because of particular choices of the marine sites as well as the species being bred. In contrast, the proposal by Black Pearls, Inc. (BPI) involve neither a historical site nor a species with significant cultural meaning. The proposed area was previously dredged to obtain fill for the Honolulu International Airport reef runway, and thus represents a highly disturbed environment. It is bordered on its landward side by an inner reef flat, and on its seaward side by an outer reef exposed to the open ocean. Currently the most common coastal uses in this area include pole fishing, netting, seaweed gathering and octopus fishing. None of these activities will be directly impacted by pearl farming as currently proposed. BPI, however, made their request for exclusive

[3] Oral testimony presented by Walter Kamakau to the Board of Land and Natural Resources in response to CDUA OA 2989B, 21 June 2001.
[4] Oral testimony presented by Glen Oamilda to the Board of Land and Natural Resources in response to CDUA OA 2989B, 21 June 2001.

access to the water column above the area under lease. Access by boat within the proposed oyster farm would not be allowed because of the safety risk for divers who will be working with the oysters. More importantly, exclusive access is requested to protect the investment from possible vandalism. The oyster farm would be marked on the surface of the water by buoys and marking lines.

At the public hearing held in January 2001, 25 people presented testimony related to the farm's expected benefits as well as issues related to fishing and ocean recreation. The exclusive access requested by BPI would directly deprive fishermen, divers and boaters access to an area customarily accessed by these groups. Boaters and jet-skiers noted that the proposed area is located within a designated thrill craft recreation area, and therefore requested the Board of Land and Natural Resources to designate an alternative area as a substitute.

One of the testimonies objecting to the proposed project, however, brought up a more fundamental issue of property rights. This concerned citizen was a native Hawaiian who agreed that there was a need to expand and revitalize the economy. Nevertheless, he voiced his reservation of the level of exclusivity that would be established in the State marine waters by the lease. He argued that doing so would take away the customary access that he referred to as a 'fundamental human right' of Hawai`i's own residents and fishermen[5].

Concerns of Institutional Change

None of the stated objections to the projects were formalized into a request for a contested case hearing. Nevertheless, they provided a glimpse of the range of sentiments among the general public with regard to the proposed shift of in the definition of property rights within the traditional ocean commons. Following negotiations between opposing parties and modifications by the applicants, the Board of Land and Natural Resources eventually awarded a lease of State marine waters for commercial marine aquaculture both to Cates International, Inc. and to Black Pearls, Inc.

The concerns on surrounding the shifting property rights system is also linked to issues of past disenfranchisement. Hence, the current allocation of property rights is thematically and logically linked to prior takings. Fishermen and native Hawaiian advocates protested the permit application on the basis, in part, that submerged lands were ceded lands, that is, public lands illegally acquired by the United States in 1898 without the consent or compensation to persons of Hawaiian ancestry. A large portion of ceded lands were transferred to the state of Hawai`i at the time of statehood in 1959. Submerged lands, which are ceded lands, were among those that came under the administration of the state Department of Land and Natural Resources.

Prior to Western contact, Native Hawaiian subsistence depended on fishing. But most of the near shore fisheries were depleted over time with the arrival of newcomers and the destruction of traditional means of resource management. The decline in wild stock prompted state legislation to limit the amount of time that fishermen could lay their nets and cages. Some fishermen perceived the granting of submerged land leases for cages as a "double standard" that allows a new firm using modern technology to leave their cages

[5] Oral testimony presented by William Aila, Jr. to the Board of Land and Natural Resources in response to CDUA OA-3004, 25 January 2001.

underwater indefinitely while traditional fishermen are limited to casting nets and cages for a four-hour limit.

This depiction of a "double standard" is also underlined by perceived (and real) obstacles for fishermen and residents of the nearby leeward coast to gain access to new marine aquaculture technology. The two obstacles are capital and technical expertise. Modern technology allows producers of marine aquaculture with promising returns on investment. But the capital investment needed to begin production is very high. For example, the cost of deploying two submerged cages stocked with *moi* is estimated at a very minimum of $400,000 (Donoho 2000). For most fishermen and residents of the leeward coast where poverty rates are among the highest on the island, this level of capital investment is out of their reach.

Furthermore, these collective concerns have been raised in a general social atmosphere of longstanding localism and suspicion towards US mainland and multinational firms that are seen as extracting benefits from business activities without greater return to and, in some cases, respect for local residents. These issues are also raised in the context of a maturing movement for native Hawaiian sovereignty as well as protests led by native Hawaiian organizations against high profile court cases (e.g., Supreme Court decision on Rice v. Cayetano) that threaten to dismantle programs targeting native Hawaiian beneficiaries.

Opponents are also concerned with the future of native Hawaiian gathering, fishing, access and water rights. Dawn Wasson, speaking on behalf of Hui Malama 'Aina 'O Laie, argued that the granting of a permit for Cates International, Inc. was an "opening (for marine aquaculture industry) to prevent native Hawaiians from accessing an area."[6] She expressed fear of exclusion from large marine areas, presumably on the assumption that the marine aquaculture industry may grow to the extent that the industry comes to dominate the use of Hawai`i's ocean shelf.

In these two cases, the sites chosen for marine aquaculture are areas with relatively little existing use. The opposition to marine aquaculture, especially at this early stage of development, is thus more about conflicts over value on what constitutes the ocean commons than about competing uses. Unless the stated concerns are satisfactorily addressed or there is a satisfactory process through which stakeholders and disputants can fully deliberate their concerns, the potential for the industry is left tenuous.

5. Marine Aquaculture and the Globalization of Agro-food Systems

Moi or Pacific Threadfin is indigenous to Hawaiian nearshore waters. Overfishing as well as habitat destruction since the 1950s have depleted *moi*'s population in the wild. In 1992 the Oceanic Institute, a private non-profit applied aquaculture research organization in Honolulu, began a program to restock Hawai`i's coastal areas with *moi* fry as well as distributing them to inshore fish farmers.

Moi is considered a high-value species, with high market prices and limited availability. While good quality is an important price determinant, equally significant is the constructed value that gives meaning to food. The historical position of *moi* as 'fish for

[6] Oral testimony presented by Dawn Wasson the Board of Land and Natural Resources in response to CDUA OA-2989B, Honolulu, 21 June 2000.

the royalty' gives it an elite status to begin with. The relative scarcity of *moi* however made the fish unfamiliar to many island residents, although it has made a comeback since the restocking along with the increased popularity of 'Hawai`i Regional Cuisine' (Lewis 1999). In promoting the cuisine, a central strategy for Hawai`i 's restaurants is to offer dishes based on high-quality local ingredients, and place marketing is very important. Within this strategy, the position of *moi* as a symbol of Hawai`i is not overlooked.

Onshore fish farmers who are currently the primary producers of *moi* view the development of marine aquaculture with wariness, fearing that the high production volumes from marine aquaculture would undercut their prices in the local niche market. Land-based fish farming operations are generally of a smaller scale and must confront the high rents for land and the high prices for water and energy required for land-based aquaculture. In contrast, marine aquaculture entrepreneurs are viewed to have benefited from the research and development support given by the State and Federal government, and thus presents a case of unfair competition. To avoid confronting this opposition, Cates International, the pioneer marine aquaculture firm, has informed inshore fish farmers of their intent to sell their product outside of Hawai`i.

Yet, few places outside Hawai`i are familiar with *moi*. Market research indicated that there is a potential demand for this type of fish in Japan, Mexico, Canada and China. A more important market to exploit is the mainland United States where there is a large population with a significant disposable income. Market expansion outside Hawai`i , however, would subject *moi* to the same global forces that have marginalized producers of other commodities such as pineapples or macadamia nuts (Suryanata 2000).

In a globalized agro-food system, giant food companies are the major agents that regulate and standardize the conditions for food production and consumption, thus allowing them to plan investment, sourcing of materials, and marketing on a global scale (Friedmann 1993). Seafood distribution has long been part of the globalized food system, and these companies have played a significant role in shaping the pattern of seafood consumption. Until recently, however, the conditions of production remained largely local. It reflects the nature of fishery resources in which a large segment of the productive cycle is still dictated by natural processes.

Marine aquaculture represents a major breakthrough because it allows industrial capital to further regulate the conditions of production. Key in this process is the ability for the industry to substitute labor, technology and capital for some of the natural processes necessary in the production of fish and shellfish. This gives the industry flexibility in distributing production, temporally as well as spatially, to best fit a global pattern of resource availability and market demand. As a result, global sourcing, a common strategy that used to be confined to agricultural products, is now commonly employed within the seafood industry. This phenomenon is best exhibited by what happened with salmon industry in the past two decades.

As recently as 25 years ago, most salmon in the marketplace came from wild catch. Salmon was considered a high-value fish not only because of the quality, but also because salmon's life cycle embodies other meanings associated with the fish migratory journey. The expansive growth of salmon farming has drastically changed the structure of salmon production. But by 1997, more than half of salmon in the global market came from aquaculture, and this proportion has been steadily increasing (Egan 2000). Mass

production, especially in Norway and in Chile, has sharply increased the supply of salmon worldwide.

As a food commodity, within the past two decades salmon has been transformed from a specialty item into a mass commodity. The domestication of salmon may have taken away the romantic image of the fish habitat and spirited passage important to niche consumers. But it has also standardized quality such as fat content, meat color, and size that are important to mass consumers. Moreover, farmed salmon can be harvested and thus is available as a fresh product year-round.

Latent demand worldwide could support the high prices for salmon until the early 1990s, even after salmon farming had been well-established in Norway and Northern Europe. The entry of multinationals and especially those that operated in lower cost areas such as Chile radically changed the salmon markets. For many years the United States was the largest supplier of salmon to Japan, but Chile surpassed it in 1997. Chile's increasing dominance in the world salmon market is also felt by consumers in the United States. Within the first four months of 2001, salmon imports to the Unites States from Chile increased by 49% compared to the year before, continuing a strong trend throughout the late 1990s. Meanwhile, world prices for farmed Coho and Atlantic salmon in 2001 on average declined by one third from the year before (Fish Information Service 2001).

With the development of marine aquaculture in salmon, the salmon industry is deeply integrated in the global food system. For Alaskan fisheries, much of the success or failure for Alaska sockeye will no longer depend solely on the total landed catch, but more on the supply of Chilean farmed coho. As long as the Chilean supply is high, these low prices are expected to remain, making the market for Alaskan sockeye very tough. Similarly, for salmon farmers off the coast of Maine, they must focus not only to technical issues, but most urgently, to rapidly falling prices.

A similar scenario could be envisioned for *moi* farming. If *moi* was to become an important commodity in the world market, the likelihood of other aquaculture producers to invest in *moi* farming, but in lower cost areas, is also high. In a mass commodity market, regional identity and uniqueness are generally downplayed, while quality standards and production efficiency become important. For example, mass consumers do not necessarily mind that most of the *Atlantic* salmon available in the US market are actually grown in the *Pacific* waters off the Chilean coast. Although *moi* is known and currently marketed as a fish of Hawai`i, its placename-based value would diminish once the fish becomes a mass commodity in the global market.

Meanwhile, much of the supply of fish and shellfish in the State of Hawai`i are imported. Per capita seafood consumption in Hawai`i is much higher than in the rest of the nation; consumption in Hawai`i is estimated at almost three times the national average[7]. The tourist population (6.7 million visitors in 1999), who favor seafood consumption as part of their 'island experience', and a large resident population of Asian or Pacific Islander ancestry account for the relatively high rate of seafood consumption. In 2000, the total annual consumption of fish and shellfish was estimated to be 53 million pounds, only one-third of which came from domestic fishery landing. This situation points to an

[7] Sam Pooley, industry economist at the Honolulu laboratory of the National Marine Fisheries Service (Pers. Comm., 6/28/01)

opportunity to develop marine aquaculture in Hawai`i not as a stand-alone industry, but as part of a diversified network that could be sustained by diverse actors within the State

6. Conclusion: Reworking the Networks

Marine aquaculture in Hawai`i offers many important opportunities while posing equally significant challenges. Marine aquaculture can expand the breadth of local economic activities in the state and thus diversify its tourism-dependent economy. This new industry can generate additional industries and provide jobs for local residents. Lease revenues for submerged ceded lands are accrued to the Office of Hawaiian Affairs (OHA), and these rents can support ongoing efforts among native Hawaiians, who by all socioeconomic and other indicators are faring far below other groups in measurements of physical and material well-being.

Just as the potential benefits of marine aquaculture in Hawai`i are great, so too are the challenges in sustaining the industry and ensuring that the aforementioned benefits are realized. In this paper we have discussed the challenges of negotiating social and cultural concerns while assuring its viability in the context of the global economy. We did not address the more pragmatic challenge of building the industrial infrastructure, both in technical research and development as well as in human resource development. In order to tackle these challenges, a great deal of discussion, planning and coordination is necessary to create dynamic networks, consisting of all major stakeholders and concerned residents, that support the industry. Creating the systems, structures, norms that form the networks is indeed no small task. However, the alternative of doing nothing would most likely lead to Hawai`i ’s inability to capture the benefits of marine aquaculture. Instead, global industrial capital with minimal ties to Hawai`i could appropriate the production process and hence be the primary beneficiary of the industry’s technological advance.

Scholars have begun to examine regional development dynamics in the context of the faster pace of technological development on the one hand, and the increasing mobility and dominance of global industrial capital on the other hand. Drawing lessons from actor-network theory, scholars in agro-food studies have examined the relationships between natural entities and social actors, devices, and technologies (Busch and Juska 1997; Marsden 1997; Whatmore and Thorne 1997; Goodman 1999; Marsden 2000). Using this approach, we can conceptualize global agro-food systems differently, allowing an analysis that examines both 'macro' and 'micro' processes, to understand how network of actors - people, institutions, things, and ideas - construct space for alternative geographies of food (Whatmore and Thorne 1997). In so doing, the key question becomes not that of scale, but of connectivity.

A study on the development of rapeseed industry in Canada shows that a robust subsector requires not only developing technological advances, but must include a far-reaching strategy of institutional, structural, and legal changes that allows the networks to establish and operate (Busch and Juska 1994). In culturally plural societies such as Hawai`i , we also need to examine ways in which cultural traditions and culturally-defined concepts can be incorporated into policies and democratic decision-making. Nearly all of the challenges discussed require the establishment of deliberative public processes, cooperative networks and collaborative management systems.

With respect to marine aquaculture, many nations have begun to respond to these challenges by developing formal government plans to manage this emerging industry. In the Australian state of Tasmania, for example, the 1995 Marine Farming Planning Act facilitated the preparation of statutory marine farming development plans by the Department of Primary Industry and Fisheries (Anutha and Johnson. 1996). Management plans developed as a result of this legislation designated certain areas as marine farming zones, selected upon their suitability for marine farming as well as competing uses. The established management system also purports to establish ecological and socio-economic criteria for siting and operations (Anutha and Johnson 1996). Other innovative planning processes include developing collaborative management systems involving diverse stakeholders. For example, various Native American tribes in the Pacific Northwest are part of the regulatory regime to manage the salmon fisheries in the region (Singleton 1998). Following negotiations between the state the tribes to set the parameters for the fishing season, regulations are implemented locally with the direct involvement of fishermen. These and other case studies offer useful lessons for the planning process as well as the implementation of legislation and negotiated agreements.

Key to any planning process is the participation of key stakeholders and interested parties. It is important to 'scope' out the various issues of concern by seeking out the opinions and ideas of potentially impacted publics (Robertson, Lindsay and Gardoqui 1996). This allows policy makers to identify the major issues and to engage publics in dialogue and mediation in order to devise a more comprehensive plan that adequately addresses the various concerns that may emerge. By establishing common ground through these processes, planning has the potential to build communities of concern that can develop into working networks. As a result, in addition to devising workable management systems, planning offers an opportunity to facilitate local stakeholders to take part and maintain strategic positions in dynamic networks. With this vision, policies to promote new aquaculture technology could strike a delicate balance between favoring local fishers and enterprises, maintaining competitiveness, and ensuring industrial development that meets an environmental and aesthetic standard.

The future of marine aquaculture in Hawai`i remains uncertain. However, its fate lies heavily in the collective will, social capital and institutional capacity of those organizations, agencies and individuals concerned. There are many lessons to be learned from the decades of experience elsewhere, but there is also a wealth of homegrown knowledge, experience and sensibility unique to this state. The upcoming challenge is to transform this collective understanding into a set of policies, networks, norms and practices that addresses the multitude of concerns.

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