

SHELLFISH AQUACULTURE AS A COTTAGE INDUSTRY: A MODEL FOR DEVELOPMENT IN NEW YORK

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ABSTRACT Employment in small-scale, labor intensive marine aquaculture—a local cottage industry—is in many ways comparable to that in commercial catch fisheries. It can be undertaken by individuals with limited financial resources and hence limited risk. It can be restricted to small plots for independent, individual users. If successful, it can supplement commercial fishermen's incomes which are as highly variable as landings and market prices. To preserve their independent lifestyle in the face of competition over marine resources, baymen may have to consider small-scale aquaculture production as a means of insuring the existence of commercial harvests. The promotion of aquaculture as a cottage industry in New York may break the socio-economic impasse which has stifled development of this industry to date.

KEYWORDS: shellfish aquaculture, Long Island, industry development

INTRODUCTION

New York state's marine coastlines are nearly all found on Long Island; a discussion of shellfish aquaculture in New York, therefore, is a discussion of the development of this industry on Long Island (see Figure 1). In contrast with the freshwater aquaculture industry of "upstate" or inland New York which is a much larger and more diverse enterprise (New York State Aquaculture Association Newsletter, June, 1988), marine aquaculture in New York continues to develop slowly in the face of a number of technical, economic and social obstacles. The purpose of this paper is twofold: first, to outline the development of Long Island's marine aquaculture industry to date by illustrating several of these key obstacles to industrial development; and second, to propose a model for continued development of marine aquaculture, principally of molluscan shellfish, which may be most appropriate given the obstacles which have impeded the development of shellfish aquaculture on Long Island.

Before entering into a discussion of the historical opportunities and constraints to aquaculture development on Long Island, it is worthwhile to consider the distinction between public and private aquaculture, two approaches which are particularly important on Long Island.

In broad terms, public aquaculture programs use public funds provided through government agencies to increase harvestable stocks to aquatic resources for the benefit of the public, including the fishing industry. Public aquaculture generally means programs to enhance important commercial and recreational fisheries. In practice, harvestable stocks enhanced by public aquaculture programs have been available to all members of the public whose taxes and fees underwrote the program. This implies that at some point in the organism's life cycle, public aquaculture programs must distribute the cultured stocks to the public, or make them accessible, and thereby relinquish control over the

fate of the "crop." The benefits of public aquaculture are obvious when stocks are made available to the public at harvestable sizes (e.g., freshwater lakes stocked with cultured finfish for "fee fishing"), however for molluscan shellfisheries, the benefits of public aquaculture are equivocal.

Public shellfish aquaculture programs are run on limited budgets; they can buy or produce a relatively large number of very small, hence inexpensive, bivalve seed stock or a smaller number of larger, more expensive, seed stock. Because there is considerable local support from commercial shellfishermen (termed "baymen" on Long Island) for highly visible seed planting programs which release as many seed clams as possible (see Kassner, 1988; see also reports of the Leasing Subcommittee of the New York State Shellfish Advisory Committee, referenced in Committee minutes, March, 1988) public shellfish aquaculture tends to plant as large a number as possible of very small seed stock onto public grounds. On these areas of public bay bottom, the seed face several season's additional growth before reaching legal harvest size. After such planting, very little is, or can be, done to assure the growth and survival of this publicly-owned crop. Unfortunately, the smaller the size of seed planted, the lower the survival to harvest (see Flagg and Malouf, 1983). Public aquaculture of molluscan shellfish is highly intensive (in hatcheries, land-based and field nursery systems) up to the point of seed planting at which time it ceases to be aquaculture at all. This "abandonment" at release is an important feature of public aquaculture on Long Island: at the time of planting, neither commercial nor recreational shellfishermen have derived any benefit from the efforts of the public aquaculture program, and any benefits of such an abbreviated form of aquaculture depend on the survival and growth of seed stock in the uncontrolled, poorly understood and often highly variable natural environment.

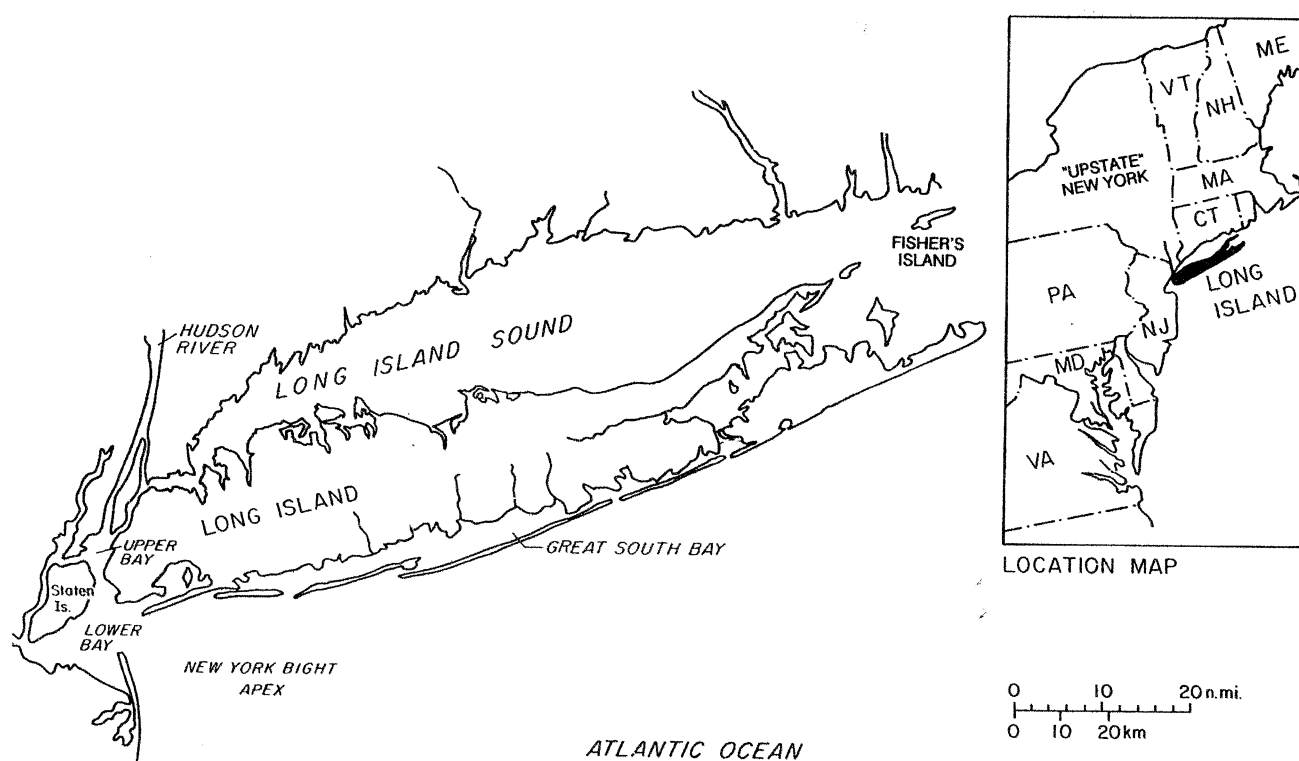


Figure 1. Locator map of Long Island, New York.

On the other hand, private aquaculture uses private funds and resources to maintain as much control over the crop as economically feasible until such time as the greatest economic benefits may be derived from the sale of products, either as seed stock or marketable shellfish. The benefits of private aquaculture, usually cash revenues, accrue solely to the individuals or corporations whose resources were used to generate the revenues. The private aquaculturist has made a more significant, personal investment of time and money in a crop than the taxpayers or baymen who have relatively minor, personal investments in the publicly produced shellfish.

Finally, there are several important relationships between public and private aquaculture programs on Long Island, summarized in Figure 2. Most public aquaculture programs acquire shellfish seed stock from private aquaculture facilities on Long Island or out-of-state. Private aquaculturists derive substantial economic benefits from sales of seed (see Malinowski, 1986), and are able to diversify sources of revenue while sustaining cash flow required for continued development of methods to culture shellfish to

marketable size. Public aquaculture programs often rely on the expertise of private aquaculturists in resolving technical problems of production (some towns now produce their own seed) and planting. Finally, many private aquaculturists are dependent upon state, county or town agencies to permit exclusive use of areas of bay bottom for grow-out of seed stock to marketable size. Thus, the public agencies regulate the space required by the aquaculturist while the private aquaculturist produces seed stock and can provide technical assistance for public seed planting programs.

Davies (1982, 1984) reviewed the aspects of Long Island which favor aquaculture development. He noted that nutrients and temperature regimes are particularly favorable for the reproduction, growth and survival of several commercially important shellfish species. Private shellfish aquaculture on Long Island has been successful for several species including the eastern oyster, *Crassostrea virginica* and the hard clam, *Mercenaria mercenaria*. Long Island communities rely heavily on marine-related economic activities, and maritime expertise is abundant. Baymen generally support government-sponsored public aquaculture programs, and in some cases, government-sponsored private shellfish transplanting activities which may benefit the public fishery. Davies also noted the proximity of Long Island to very large marketing channels (in New York City and on Long Island) for high quality seafood.

Indeed, there have been substantial economic activities related directly or indirectly to private aquaculture on Long Island for many decades. Some of the pioneer studies of molluscan hatchery methods were conducted at Long Island

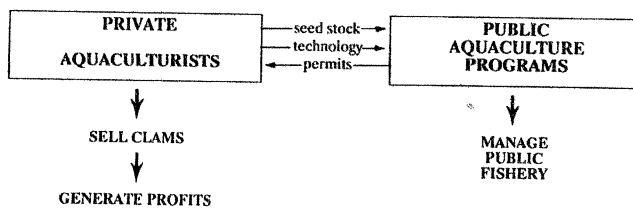


Figure 2. Relationships between private and public aquaculture.

institutions by Wells and Glancy in the first half of this century (Wells, 1933; Glancy, 1965). The privately-held firm of F. M. Flower and Sons of Oyster Bay, Long Island, which has been culturing and harvesting oysters since 1887 (and additionally hard clams since 1984), is one of the pre-eminent examples of successful shellfish aquaculture in the nation. And the Blue Points Company, of West Sayville, Long Island, which produced oysters during its early years (from 1888 to the mid-1950's) and now harvests both cultured and naturally produced hard clams, is one of the largest private shellfish aquaculture firms in the nation with more than 13,000 acres of bay bottom owned on the basis of a 300 year old "patent" (land grant).

One might ask, then, why private shellfish aquaculture on Long Island remains an emerging industry. Why aren't there more than an handful of private shellfish culturists on Long Island? What are the important constraints to further development of the industry?

Davies (1982) and Siddall and Davies (1985) reviewed several problem areas for continued aquaculture development on Long Island. Constraints include a lack of action by either state, county or town agencies to implement mechanisms which encourage, or even make possible, expanded private aquaculture activity. It is commonly assumed that these governmental positions are maintained by legislators and politically-appointed agency leaders who are sensitive to the opinions of well-organized and traditional marine user groups, in particular Long Island's commercial shellfishermen. While local definitions of "traditional" often fluctuate over time (*e.g.*, shellfish relaying programs are the traditional activity in Delaware Bay; L. Taylor, personal communication), Long Island's definition of traditional shellfisheries has not changed for decades. Suggestions of change for Long Island's traditional, independent catch shellfisheries seem to be taken even by the public as an attack on the fundamental traditions of the Island.

Throughout 1986 and 1987, a series of public meetings were held to solicit input from a wide range of marine interest groups on the preparation of a planning document (Koppelman and Davies, 1987). This public process confirmed the widely held perception that commercial shellfishermen of Long Island publicly oppose the exclusive use of bay bottom (required for private shellfish aquaculture) on the basis that successful culture of shellfish on privately controlled underwater lands may lead to expanded or consolidated private aquaculture ventures which might eventually exclude independent shellfishermen from Long Island's productive shellfishing grounds and result in inappropriate market competition. Trends in many U.S. industries substantiate the baymen's concerns; very few small firms which have achieved success remain small, but rather expand and gain a larger market share, in this case, at the expense of independent baymen. One of the few successful shellfish culture companies on Long Island actually has demonstrated something similar to this phenomenon, over the course of several decades, by buying out the leases

of several marginal shellfish producers in a town-managed bay. Clearly, the baymen's concerns are well founded.

Additionally, and perhaps more importantly, many full-time commercial shellfishermen on Long Island are descendants of baymen who fought in Long Island's legendary "Oyster Wars" of the 1890's (see Taylor, 1983, for an ethnohistory of this community and this conflict between large companies and independent operators over access to shellfishing beds and markets). Therefore, many of the spokespeople of the baymen's organizations on Long Island draw on a personal, family history of opposition to the sort of exclusive use of large tracts of underwater lands which they perceive to be an outcome of continued aquaculture development (see also Matthiesen, 1986, for an informal, non-fictional account of the plight of baymen on Long Island).

Other important constraints to aquaculture development exist as well. There is no secure, long-term access to small tracts of bay-bottom for use in private aquaculture. The state Department of Environmental Conservation, which has responsibility (under section 13-0301 of the state Environmental Conservation Law) for much of the state-owned underwater lands of Long Island (excluding the most productive areas controlled by counties and towns), implemented a program which has issued only eight 2 hectare "Temporary Marine Land Use Assignments" for aquaculture purposes, three of which ceased activity soon after issuance as a result of private, developmental obstacles. The state has not leased any other underwater lands for shellfish culture in recent history and those areas which remain under private control from "franchises" granted earlier in this century are too expensive for use by small-scale aquaculture developers. Financing for aquaculture enterprises is as difficult on Long Island as it is in many other parts of the nation, but the very high cost of energy, labor and supplies on Long Island amplifies funding difficulties. Finally, there are a number of ambiguities in state, county and town laws which affect the management of marine resources. On the basis that their charters predate the U.S. Constitution, some of the towns in eastern Long Island manage and allocate marine resources under their jurisdiction in contradiction to state law, and while such "home rule" may present an opportunity to local aquaculture interests, potential investors cannot be confident that state or county regulations will favor aquaculture investments. Contrasts between local, regional, state and national policies on aquaculture development are being investigated by Davies (doctoral dissertation at the Marine Sciences Research Center under the supervision of Robert Malouf).

COTTAGE INDUSTRY MARINE AQUACULTURE

Many of the constraints to marine aquaculture development on Long Island are summarized diagrammatically in Figure 3 which depicts the situation as an impasse.

There are a number of technical (biological) obstacles to aquaculture production of marketable shellfish. While

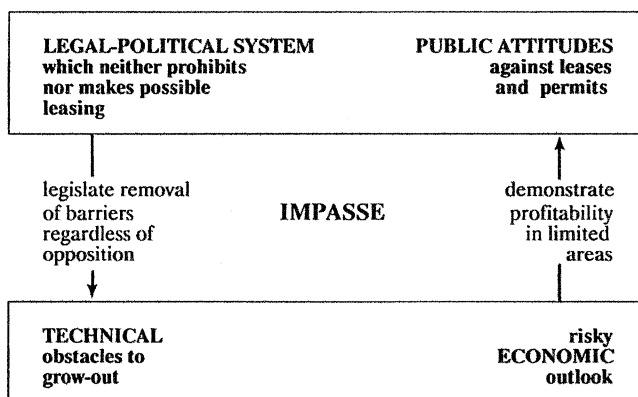


Figure 3. Summary of relationships among technical, economic, social and legal forces which maintain the impasse to private shellfish aquaculture development on Long Island.

many production problems in the hatchery have been resolved, and land-based and field-based nursery techniques have been refined (*e.g.*, Koppelman, 1984; Manzi, *et al.*, 1984; Malinowski and Siddall, in press), grow-out of seed stock to market size has proven to be a formidable obstacle to economic success (*e.g.*, Flagg and Malouf, 1983). The economic outlook for shellfish aquaculture on Long Island hinges primarily on improvements in culture methods which increase survival from seed to market size. Economic viability is not likely to be demonstrated until someone having exclusive access to bay-bottom resolves these technical barriers and makes money raising shellfish. Until then, private shellfish aquaculture remains a risky enterprise. Very few investors are willing to take financial risks required to develop this new industry, especially in the face of widespread, vocal opposition to leases and exclusive access to underwater lands. At the same time, opposition is unlikely to moderate in favor of an economically unproven activity. The result is an impasse to development. Without access to resources, there is minimal development of improved methods. Without improvements in methods, investment remains risky. Without a basis for profitable investment, there is little pressure to open access to private aquaculture.

Figure 3 also presents two (of many) approaches which might be used to break this impasse in favor of aquaculture development. The first, presented on the left side of the figure, is titled "legislate removal of barriers regardless of opposition." Within this approach might be listed a number of recommendations which have been made in the past, including the designation of a lead state agency for aquaculture development and the convening of a conference of involved state, county and local agencies to implement a regulatory program involving the granting of leases (the legal questions in this instance would be monumental). This approach assumes that legislators would be willing to bear the consequences of baymen's opposition to aquaculture development, which seems unlikely given the per-

ceived electoral power of this vocal marine interest group. This approach also assumes that it is possible to coordinate regulatory authority and management among a broad range of state, county and local governmental units.

The alternate approach, presented on the right side of Figure 3 and titled "demonstrate profitability in limited areas," is the basis of the cottage industry model for marine aquaculture development. The state Department of Environmental Conservation, in implementing temporary assignments for access to limited areas of bay bottom, has initiated this alternate approach however the program has important restrictions. Assignments and renewals may be made unless substantive and non-mitigable objections are brought forward during a public review process. Aquaculturists may culture shellfish on floating structures, bottom racks, *etc.*, if other required permits can be obtained, but they may not free-plant seed stock onto natural substrates on the assigned bay bottom. The purpose is to insure that the shellfish inventory can be removed in case conditions on the assigned bay bottom become inappropriate for assignment, that is, if natural shellfish populations develop on the assignment. In this instance, renewal of the assignment may not be possible because the state is not empowered to lease or assign any underwater lands which are naturally productive of shellfish.

Important examples of successful, small-scale aquaculture operations are The Clam Farm and Ocean Pond, of Fisher's Island, New York (see Figure 1). The Clam Farm, a private aquaculture facility in operation since 1982, operates on a two hectare temporary assignment, sells shellfish seed stock to several town programs and is involved in several development programs aimed at improving the grow-out process for several bivalve species. The lack of a local molluscan shellfishery on Fisher's Island is one of the principal reasons why there continues to be minimal opposition to The Clam Farm. Clearly, this is not the case on Long Island proper, but recall that the basis for most opposition to private aquaculture development is the perception that the industry would eventually acquire a substantial fraction of Long Island's underwater lands which have production potential for shellfish. The location of the Island further offshore than most of Long Island results in lower mean water temperatures, a shorter growing season, and hence affects some shellfish culture practices (see Malinowski, 1986), however, aquaculture facilities in the Island's near-shore waters have been productive. The stated goal of this family-operated company is to provide an annual income to the owner/operator and seasonal employment to one or two part-time employees. The details of The Clam Farm operation, which emphasizes manual labor and minimal technology, are reported in Malinowski (1986). A central theme of this practical manual is the similarity between the daily work routines of small-scale, private aquaculturists and independent catch shellfishermen.

The continuing experience of The Clam Farm suggests

that one to two people working a two hectare temporary assignment are likely to be able to secure financial returns which are similar to those of full-time, commercial shellfishermen on Long Island (see Malinowski, 1986). A simple calculation of the percentage of the bay bottom of Long Island required to support all current full-time shellfishermen (licensed through the state) is revealing. There are nearly 65,000 hectares of coastal waterbodies on Long Island which are open to shellfishing by fewer than 500 baymen who earn a substantial part of their total income from shellfishing, and another 2,000 for which shellfishing provides supplemental income (New York State Department of Environmental Conservation data, 1988). Even if all full-time shellfishermen shifted from catch fisheries to private aquaculture each on a two hectare temporary assignment, more than 98% of Long Island's shellfishing grounds would remain in the public domain. These calculations are not meant to suggest that all shellfishermen should examine aquaculture as a substitute for traditional shellfisheries, nor do these simplistic estimates account for the competition between catch fisheries and aquaculture for potentially productive shellfishing grounds (note that areas which are naturally productive of shellfish cannot be leased under current state law). The figures do suggest that small-scale, private, shellfish aquaculture leases, controlled by individuals for individual income, could exist without having a substantial impact on the total acreage available to catch shellfisheries. If such small assignments of bay bottom (not productive of natural shellfish at the time of leasing) were granted on a renewable basis with 10–20 year terms, and could be held only by private individuals and never aggregated into larger holdings, then many of the substantive, non-biological obstacles to private shellfish aquaculture on Long Island might be resolved.

Minor legislative revisions to state, county and town laws, regulations and policies could make possible the development of a cottage industry in shellfish aquaculture, however they are unlikely to be implemented without some support from commercial shellfishermen. In fact, several amendments to state laws (Shellfish Advisory Committee, 1988) and a state-sanctioned aquaculture council (almost exclusively focussed on freshwater aquaculture, however) have been proposed. Identifying the legal mechanisms to promote shellfish aquaculture is not the obstacle; convincing shellfishermen to support any level of aquaculture development is the principal challenge. Obviously, the constituencies of the shellfishermen's associations will have to demonstrate to their elected leadership new interests in shellfish aquaculture if their organizations are to alter their official policies which oppose exclusive allocation of marine resources to private aquaculture.

One goal of public aquaculture programs is to dampen fluctuations in natural abundances and stabilize landings. Small-scale, private aquaculture may be viewed as an additional means to reduce the individual's dependence on

highly variable natural stocks and hence stabilize personal income. As shellfish abundance varies in some waterbodies (e.g., the 75% decline in hard clam landings in the Great South Bay, Long Island, between 1977–1987), full-time baymen are obliged to increase fishing effort to maintain personal income. Small-scale, private aquaculture production could supplement income from marginal catch fisheries. Shellfishermen may have to become more involved in aquaculture or aquaculture-like processes which assure themselves of consistent, commercial harvests.

More than one public institution has attempted to promote further consideration of shellfish aquaculture on Long Island. Through support for the publication of a clam culture manual (Malinowski, 1986) specifically oriented to the baymen, much as is Castagna and Kraeuter's (1981) manual, the New York State Urban Development Corporation attempted to generate interest in shellfish aquaculture in the community of Long Island baymen. Additionally, the Cornell Cooperative Extension—Suffolk County (New York) Marine Program has organized several day-long workshops to introduce the opportunities and constraints of marine aquaculture to the public, including commercial fishermen. In fact, of all the marine interest groups, the commercial shellfishermen appear to be the most qualified to undertake the sort of low- to no-technology, labor-intensive shellfish culture which is the basis of a cottage industry approach.

The most compelling arguments for the participation of shellfishermen in private aquaculture development may come from changes in the environment rather than from promotion by public institutions. For example, recent losses in Long Island's fisheries have led to closer cooperation between commercial shellfishermen and private aquaculturists. Extraordinary, coastal phytoplankton blooms during 1985–1987 (Casper, *et al.*, 1987; Nelson and Suddall, 1988) nearly eliminated bay scallop populations which once were the basis for a commercial fishery in New York. Efforts to replenish natural populations were based on the importation of bay scallop seed stock produced by private aquaculturists both within and outside of the state. Several "spawner sanctuaries" were established in the area (Suddall, *et al.* 1986) under the management of baymen's associations. Members of the associations husbanded the seed stock to insure the success of the replenishment effort, and with technical advice from private aquaculturists, became temporary practitioners of a public version of the enterprise so many had opposed in its private form.

Reduced bacteriological water quality and closure of shellfishing grounds will exacerbate these trends of variable landings and market price. Long Island is already a densely populated area; according to census data, if Long Island were a state, it would be more populous than 25 of the 50 United States. Additionally, population surveys indicate that within 20 years, nearly all towns on Long Island will be at or very near saturation densities (LIRPB, 1984); the

associated shifts in land use will almost certainly be accompanied by increased point and non-point sources of pollution. Public perception of this problem (e.g., cover stories of "Troubled Waters," BusinessWeek October 12, 1987; "Our Filthy Seas," Time, August 1, 1988) is mounting, and if ex-vessel prices for naturally-produced shellfish fall as a result, baymen may have to increase harvests in order to maintain levels of personal income. The higher yields per unit area which may eventually be possible through aquaculture production represent an alternative means of sustaining shellfishing as an important economic activity on Long Island.

Based on national shellfish water quality indicators, approximately 18% of all of New York's marine habitats (most, such as Long Island Sound, not amenable to shellfishing) are uncertified (falling below national water quality standards for shellfish harvesting). When new indicators of contamination for purposes of certifying shellfish growing waters are redefined (Kilgen, 1988) and applied in the mid-1990's, it is almost certain that there will be major shifts in the areas open for commercial and recreational shellfishing. It is not clear if changes in water quality standards will increase or decrease the acreage available to shellfishermen, however several programs which transplant naturally-produced shellfish from uncertified to open waters are likely to be curtailed by a redefinition of the indicators of shellfish growing water quality. In the face of greater restrictions on areas for shellfish harvest, private, small-scale aquaculture may become an economically important means of producing shellfish on Long Island.

Finally, aquaculture products have several advantages in the marketplace which may become more important as federal seafood inspections are mandated. According to William Stelle (U.S. Senate Subcommittee on Fishery and Wildlife Conservation and the Environment; personal communication), several U.S. congressional initiatives (HR1483, HR3735 and S1813) requiring continuous inspections of all seafood (and poultry) products are very

likely to be passed and implemented within "the next two to three years." Cultured seafood products are likely to be easier and cheaper to inspect, and may be held for optimum market prices, then sold with a more positive image based on the fact they are farmed rather than caught from wild stocks.

CONCLUSIONS

The opposition of Long Island's commercial shellfishermen to private aquaculture has inhibited the development of this potentially important industry for many decades. Marine aquaculture, particularly molluscan shellfish aquaculture, is an industry in conflict with the traditional lifestyle of the region's baymen. Private aquaculture is not "institutionalized" and has few vocal supporters; if the *status quo* is maintained, opportunities for private aquaculture on Long Island may soon disappear. If revenues from traditional shellfisheries decline, both forms of shellfish production may be given very low priority when marine resources are reallocated as population densities on the Island increase.

Changes in the coastal environment, and new regulatory policies to deal with them, may substantially enhance the opportunity and need for small-scale, marine aquaculture in the area. The careful promotion of a cottage industry in marine aquaculture may prove to be the only model acceptable to influential commercial shellfishermen who may have to consider small-scale aquaculture as a supplement to income from their independent lifestyle on the water.

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