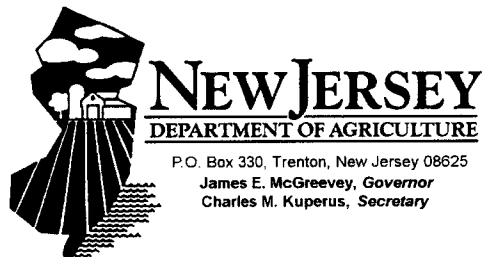
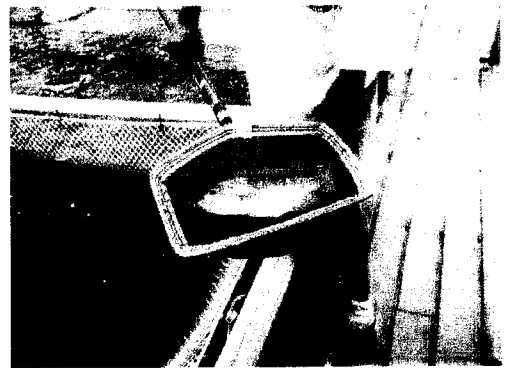
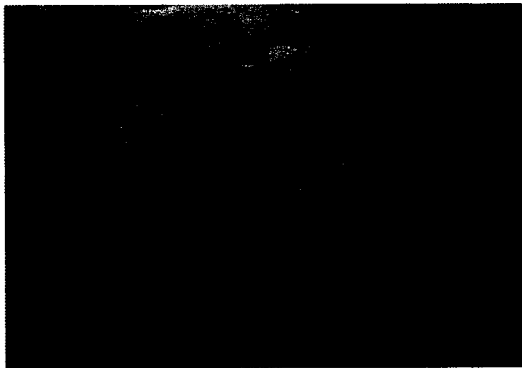


State of New Jersey Aquaculture Development Plan Update August 2002



P.O. Box 330, Trenton, New Jersey 08625

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Aquaculture Development Plan Update—2002

Introduction

In 1993, the Governor signed an Executive Order establishing the Aquaculture Development Task with a mandate to draft a *State of New Jersey Aquaculture Development Plan*. The Task Force, comprised of representatives from government, industry and academia finalized the Plan and submitted it to the Governor in 1995. To implement the Plan, the legislature crafted *The New Jersey Aquaculture Development Act* which was signed into law on August 27, 1997 by Governor Christine Todd Whitman.

The Task Force and subsequent Legislation identified key challenges and concerns regarding the development of aquaculture in New Jersey

- Encourage the development and expansion of an aquaculture industry in a manner that protects natural stocks and their habitat.
- Stimulate private investment and enhance business opportunities in aquaculture
- Ensure coordination among state agencies with jurisdiction over aquaculture and related issues.
- Address issues related to effluent discharge, product standards, marketing research and demonstration, training and outreach.

Although aquaculture in various forms has been practiced for thousands of years, it is still a developing science. Recognizing this, the framers of the *Aquaculture Development Act* stipulated that the Plan be reviewed at least every five years to allow for mid-course corrections. Since the original plan was put into place, significant steps have been taken to remove some of the regulatory barriers that have stood in the way of development. It is only when a well-conceived policy framework is in place that we can expect to achieve some of the gains projected by the original Plan. Such an atmosphere is conducive to business development since it allows potential entrepreneurs to make valid assessments of the cost of doing business in New Jersey.

Executive Summary

The goal of the *New Jersey Aquaculture Development Act* was the formulation of a business-friendly and environmentally-sound policy framework that creates an enabling atmosphere for the growth of the New Jersey aquaculture industry. The Act mandated a number of specific activities. The current status of those activities is included in Table One of the Appendix. Many of those projects have been completed or in draft form.

Status of Aquaculture World Wide

Aquaculture provides over 20 percent of global fisheries production. This translates into 15-20 percent of all animal protein consumed worldwide. Asian countries continue to dominate production. China produces more than 68 percent of the world output followed by India, Japan, Indonesia, Thailand, Bangladesh, South Korea, the Philippines and Taiwan.

- During the past three decades, aquaculture has become the fastest growing food production sector and is an increasingly important contributor to national economic development, the global food supply and food security
- Aquaculture consists of a broad spectrum of users, systems, practices and species operating through a continuum ranging from backyard ponds to large-scale industrial systems
- A large percentage of aquaculture production takes place in developing countries
- Production of high value species tends to finance food imports to developing countries
- Aquaculture complements other food production systems, and integrated aquaculture can add value to the current use of on-farm resources
- Education and research will continue to make a significant contribution to the growth of aquaculture
- Policies must be developed that are environmentally responsible and socially acceptable
- Global slow down in growth of fish supplies that started in 1997 is continuing
- FAO projects that demand will not grow as rapidly as projected in 1995 due to slower population growth, projections of slower economic growth and increased competitiveness of poultry and pork. Projected demand in 2010 is currently 105-110 million metric tons compared to 1995 projections of 110-120 million metric tons
- Even with the new FAO projections, there is a shortfall of between 15 and 20 million metric tons between wild harvest and demand for aquatic products projected in 2010. Since wild harvest is believed to be at maximum sustainable yield, this shortfall will have to be made up by farmed product.
- In 1991 Asia was responsible for 80% of the world's aquaculture production, currently the balance has changed and that percentage has dropped to 55% as production grew in other countries. China is still the world's leading producer.
- Fish production and real prices have increased over the past three decades

Currency devaluations in Europe, the United States and some Asian nations are effecting trade

It is expected that Asian economies will continue to contract, thereby reducing demand in some major markets.

Future demand will be determined by:

- number of consumers
- eating habits
- disposable income
- price of fish

Some poorly planned and managed aquaculture operations have resulted in negative impacts on ecosystems and communities as well as disenchantment of investors.

Status of Aquaculture Production in the United States

As the world population exceeds six billion, there is a major impetus to develop new mechanisms to supply the world's food needs. Food production has long been considered a cornerstone of national security. As we embark on the 21st Century, America has increased its dependency on the import of fish and seafood products with an incredible trade deficit of over 6 billion dollars. This makes fish and seafood the second largest contributor to our overall trade deficit. Foreign oil ranks first. Autos used to hold second place, but we have successfully recaptured much of that market. The increase in domestic production has resulted in jobs, tax revenues and a better standard of living for millions of Americans. Now is the opportunity to develop those same gains for domestically produced fish and seafood products.

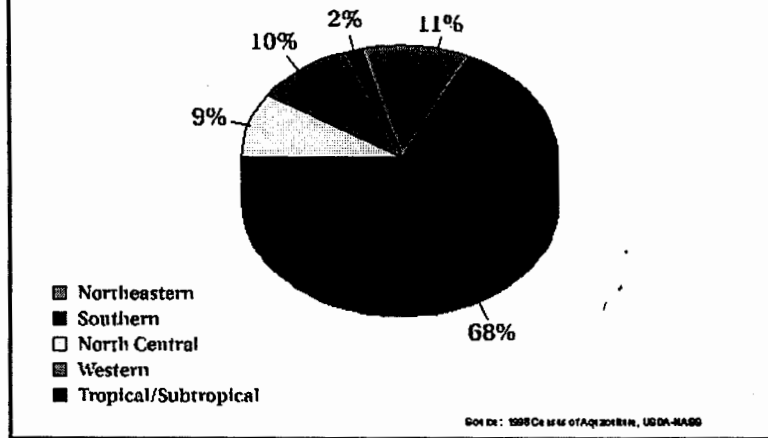
Aquaculture in the United States is dominated by catfish. The four largest catfish producing states are Mississippi, Alabama, Arkansas, and Louisiana. Idaho dominates in trout with over 75% of U.S. production

The United States Department of Agriculture released its Census of Aquaculture in early 2000. The Census data was compiled in 1998-1999. In 1998, the farm gate value of aquaculture production was \$978 million. The overall contribution to the economy based on a standard economic multiplier of 6 is well in excess of \$6 billion.

The following graphics from that report provide an overview of aquaculture in the United States.

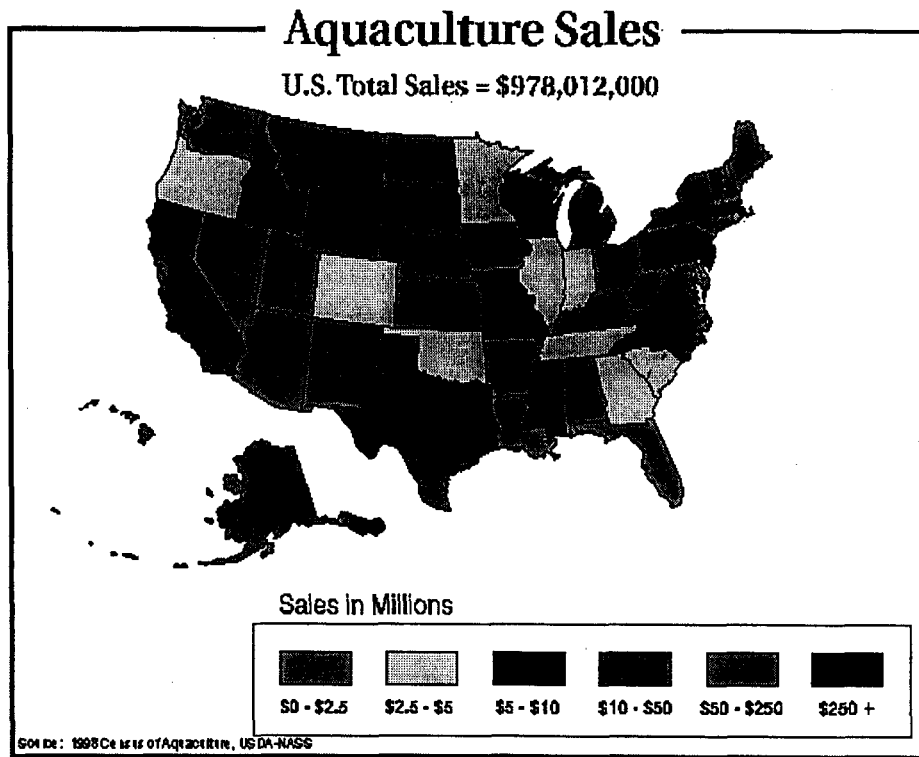
Aquaculture Farms by Region

U.S. Total Farms = 4,028



By far the greatest number of farms are located in Southern United States where climate, land price, cost of labor, etc. tend to reduce the cost of production. Most of the farms use either earthen ponds or raceways. The primary crop in this region is catfish.

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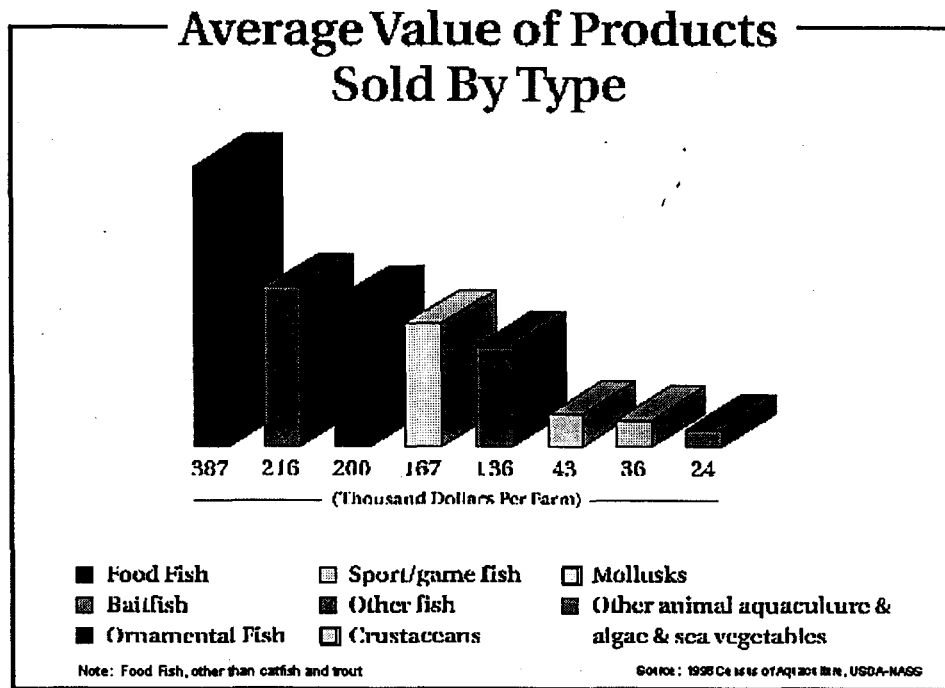


A number of other states surpass New Jersey in terms of aquaculture sales. Most of these states have taken a more liberal approach to regulation. Some states, such as South Carolina, are in the process of revising their original regulations based on a number of years of practical application. Since many other states have moved forward to establish policies, it is possible to profit from their experiences.

Maine and Washington have been active in the development of Atlantic salmon. Major competitors producing this species are Norway and Chile. Mussel farming is also big business in Maine and during the past 15 years, this product has become more commonplace in markets and restaurants in the Northeast. Anti-dumping suits have been filed on behalf of U.S. producers of both salmon and mussels. The global market

Florida is active in the production of oysters and clams. With the State's extensive marketing program and enabling regulatory climate, Florida clam producers are aggressively capturing New Jersey clam markets.

Climate considerations coupled with the high cost of doing business in the Northeast severely curtail the ability to increase production. Another difficulty is that production tends to be spread out over a larger geographic area than in the South where catfish production is centralized. Clustered activities allow for the development of vertical integration and high volume production providing significant benefits of scale.



Food fish still remains one of the most profitable crops, however, major production is confined to the Southern United States. Although tilapia production has been on the upswing, importers are rapidly capturing marketshare at the expense of domestic production. Catfish has also faced serious challenges from low cost basa imports from Vietnam. Baitfish is another industry that has rapidly expanded in the southern United States. Although it is often argued that an important advantage enjoyed by New Jersey is proximity to market, the reduction in the cost of shipping has essentially negated this advantage. Reduced shipping time is a primary advantage for companies producing either live or fresh product.

It is expected that ornamental fish production will be on the rise as more hobbyists and backyard gardeners develop an interest in and demand for these products. Often overlooked activities such as other animal aquaculture, algae and sea vegetables provide significant returns.

Aquacultured products are rapidly moving into the list of the top ten seafood products consumed in the United States. A portion of this success can be traced to the basic attributes of farm-raised products including: 1) consistency of price, 2) consistency of supply, 3) consistency of quality and 4) consistency of size. As supply of product increased, there has been a decrease in price making these products more acceptable to consumers. Although the demand for fish and seafood products is growing, imports are rapidly capturing markets in the United States and domestic producers are experiencing flat, if not decreasing, sales.

United States Seafood Consumption Top Ten List

<i>Rank</i>	<i>Species</i>	<i>Pounds per person</i>
1	Tuna	3.50
2	Shrimp	3.00
3	Salmon	1.70
4	Alaska Pollock	1.57
5	Catfish	1.16
6	Cod	0.77
7	Crabs	0.54
8	Clams	0.46
9	Flatfish	0.39
10	Scallops	0.20

Aquaculture in New Jersey

Potential for Aquaculture Development in New Jersey

Aquaculture can provide a number of positive environmental and economic gains for the State of New Jersey. Among those benefits are:

- Provision of an alternative source of income for displaced commercial fishermen and rural land-owners.
- Natural resource enhancement through stocking
- New Jersey's prime location provides the opportunity to meet the demands of ethnic center city markets. These are often niche markets with demands that make them particularly attractive to small growers handling live fish.
- Opportunity to supplement natural harvest/resource enhancement--work is being done with fluke, black sea bass and oysters just to name a few. These efforts provide benefits for both the commercial seafood and recreational fishing industries.
- Revitalization of the oyster industry in Delaware Bay which will ultimately result in an increase in jobs and economic opportunities in an area that has been severely stressed since the oyster industry declined.
- Provide a better market position for New Jersey products--aquaculture has the advantage of consistent price, supply and quality. These factors are critical to the restaurant trade since over 60% of all seafood is consumed away from the home.
- Ability to develop long term sustainable sources of fish and shellfish
- Decrease in the final cost of fish and shellfish making high quality, healthy foods available to a broader spectrum of consumers.

Current Aquaculture Production in New Jersey

Source: 1998 USDA Census of Aquaculture

- Twenty eight (28) farms with total sales of \$5,787,000 (*5th highest farm gate value in the Northeast*)
- Diversity of aquatic farms producing sport/game fish, foodfish, molluscan shellfish

- In the Northeast, New Jersey ranks second in the number of molluscan farms and 3rd in sales from those farms
- Freshwater farms comprise 64 acres
- Saltwater farms comprise 1,402 acres
- Use a variety of water sources including groundwater, surface water and saltwater
- New Jersey farms rely on a variety of culture types including tanks (flow through and recirculating), ponds, and leased (prepared) bottom
- New Jersey's sixteen (16) molluscan shellfish farms account for about \$3,134,000 in sales
- New Jersey farmers also engage in other types of aquaculture such as ornamental fish and plant culture/sales, baitfish culture/sales and fee fishing/stocking operations

Oyster Culture

In the late 1950's, the oyster industry fell victim to the MSX oyster parasite and, consequently, the local economy slumped. Average annual yields fell to 900,000 pounds of product worth \$1,000,000. Despite efforts to revitalize the industry, it never recovered. The Delaware Bay oyster industry has continued to decline because of additional oyster parasite problems (Dermo), poor seed bed maintenance coupled with a ban on the importation of seed, lack of innovation in production techniques, human health scares, bad press, together with lack of supply and the lack of a proactive marketing campaign.

Although there are differences in the fisheries, the history of the oyster industry in the state of Connecticut provides an example of an industry that declined to near zero production in the late 1960's and subsequently recovered to become one of the leading suppliers of oysters in the United States.

To address the problem in New Jersey and to develop recommendations that might lead to a similar recovery, the Legislature passed a joint resolution (SJR-19, 1996; Appendix 5) establishing the "Oyster Industry Revitalization Task Force".

Recommendations of the Oyster Industry Revitalization Task Force:

1. Enhancement of natural seed supply through improved/innovative management of the seedbeds and expansion of the cultch program.
2. Development of new approaches for transplanting to foster optimum growth and minimize mortality
3. Enhancement of production based on current practices including extension of the season for direct marketing from the seedbeds and better stock assessment.
4. Development of intensive aquaculture production including development and use of

disease resistant oyster stocks, and stabilization of seed production.

5. Development of marketing options and value-added products.
6. Financing of research and development for enhanced production methods.

Recovery of the oyster industry in the Delaware Bay requires supplementing current funding with additional dollars to enhance production, supporting capacity building within the existing oyster resource management program, and expanding market development efforts. These activities will provide for the greatest economic return to the industry in the short term and establish the basis for a sustained, economically viable industry/government/academe program.

Towns edging the Delaware Bay developed as a direct result of the healthy oyster industry. The subsequent decline of the industry led to a high rate of unemployment and a drastic decline in the standard of living for many families with established roots in the region.

It is anticipated that given an initial input of state funds to bolster the industry, production can increase to between 200,000 and 330,000 bushels per year within a five-year period. It is anticipated that the stabilization of supply and increased market development activities will result in a higher ex-vessel price (\$21 per bushel). Using a very conservative harvest and a very conservative ex-vessel value of \$4 million annually and applying a standard seafood economic multiplier of six, the value of the industry to the state's economy is potentially \$24 million annually. This is especially critical because these economic gains can be achieved in an area that is under severe economic stress. It can also be anticipated that most dollars earned in the region will stay in the region supporting local small businesses. The value of the industry extends well beyond the oyster industry itself and extends to other waterfront activities such as shipbuilding and repair, preserving New Jersey's maritime heritage through eco-tourism and the preservation of the maritime way of life.

Given changes in environmental conditions and other natural variables, it is difficult to develop accurate projections of return on investment. However, even under the most conservative estimates, return on investment in the State's oyster industry is substantial. The following table summarizes the funding recommendations developed by the Task Force and the anticipated dollars generated.

COST BENEFIT ANALYSIS					
Program	State Funds Required	Ex-vessel value	Total Return to Economy	Expected Taxes Generated	Benefit for \$1 invested (total return)
Base Support	\$829,000	\$7,000,000	\$42,000,000	\$2,940,000	\$51
Cape Shore Planting	\$31,000/ cycle	\$175,000/ cycle	\$1,050,000	\$73,500	\$34
Multiple Transfers	\$562,000	\$3,265,920	\$19,595,520	\$1,237,168	\$35

For a more complete analysis: please consult: Oyster Industry Revitalization Task Force Report to the Governor and Legislature of the State of New Jersey, January 1999.

Hard Clams

Section provided by: Gef Flimlin, Marine Extension Agent, Rutgers Cooperative Extension of Ocean County

The hard clam, or northern quahog, *Mercenaria mercenaria*, has long been a mainstay of New Jersey's coastal communities. Since the resources of the rich coastal bays were first harvested, the clam captured a strong hold in the fresh seafood market and the hearts of the summer residents. In recent years, the focus of the clam fishery has shifted from being a product harvested from the wilds to being another crop successfully cultivated in the Garden State.

This bivalve mollusk, sought by commercial and recreational clammers alike, grows well in many parts of our bays. Each year, landings of this species represent over \$5 million, ex-vessel price. Using a normal fisheries economic multiplier of 6, and factoring in the recreational harvest, the hard clam contributes about \$35 million to New Jersey's economy each year.

Unfortunately, New Jersey's natural clam beds have diminished steadily for the past thirty years. This decline cannot be attributed to any one specific reason, but is probably the result of habitat degradation, siltation, harvest pressure, lack of management, varied water quality, harmful algal blooms, and wetlands destruction. As a result of this downturn, the growth of the commercial aquaculture industry now accounts for more than 25 percent of the total landings of hard clams each year.

The Hard Clam Aquaculture Industry

The industry currently has seven hard clam hatcheries and two separate land-based nursery systems, located mainly in southern Ocean, Atlantic, and northern Cape May counties. Most of the leased grow-out areas are in the same general vicinity. These facilities grow clam seed either for their own use, or for sale to growers in New Jersey and other states. There are about 60 active clam growers producing millions of high quality clams each year. These clams are consumed in many homes and local restaurants, and are also shipped to other states.

The clam aquaculture industry is monitored by two divisions of the New Jersey Department of Environmental Protection (NJDEP) and, as with all shellfish, the New Jersey Department of Health. The NJDEP Bureau of Water Monitoring and Classification classifies all shellfish harvesting and growing areas by taking numerous water samples year round to certify the quality and purity of the

water. The Division of Fish, Game and Wildlife, Bureau of Shellfisheries oversees the leasing of areas for growing clams. Approving or denying leases is the responsibility of the Shell Fisheries Council, which is composed of licensed and practicing shellfishermen. Before any lease is granted, there is a biological survey is conducted by the Bureau to confirm that the area in question is truly not productive. This assures that only areas with minimal recruitment (little or no clam abundance) are given to an individual to farm. This allows public access to the largest area of productive beds.

The Culturing Process



In nature, clams spawn in the spring. When coastal bays warm up, the shellfish release their eggs and sperm into the water. These eggs and sperm unite to form larvae, but in nature the recruitment/reproduction process is haphazard at best. Those larvae that result feed on the naturally occurring phytoplankton, or algae in the water. This algae is the product of the photosynthetic process which combines the nutrients washed off the salt marshes by the spring rains, the increase in sunlight, and the rising water temperature.

After several weeks in a free-floating state, the clam larvae settle to the bottom, nestle into the sand or mud, and begin to grow to market size. The average littleneck clam in nature is probably 4 to 5 years old at harvest.

Hard clam aquaculture mimics this process, but the culturist takes control, and increases the speed at which the clams are produced. A large group of parents, or brood stock, is placed on a spawning table that looks like a very shallow bathtub. These 50 to 100 ripe clams are bathed with alternating doses of cool and warm salt water to simulate the springtime tides. Once the clams start to release their eggs and sperm, the spawners are removed from the table, the males and females are separated, and set in small bowls. The eggs and sperm (gametes) are collected separately, and eventually mixed together. Fertilization then occurs in a bucket. The resultant larvae are placed in a large tank containing filtered seawater. For the next 1 to 2 weeks, the larvae swim in the tank feeding and growing on a diet of specially prepared unicellular algae grown previously by the culturist.

Once the larvae reach 200 microns, they begin to metamorphose or "set." During this process they lose their ability to swim and settle to the bottom of the tank. (A micron or micrometer is one millionth of a meter, or one thousandth of a millimeter. In English units, it is equivalent to 1/25,000 of an inch.) These "post set" are collected and placed in up-welling tanks where they are fed ambient bay water, (filtered to remove larger particles and potential competitors); and its naturally occurring algae. An up-weller, in its most simple design looks like a 5-gallon bucket with screening on the bottom. The bucket has a hole on its side near the top. A group of up-wellers are placed in a tank, which is fed bay water. The hole in the side of the up-weller is connected through the side of the tank. Thus, the only way the water entering the tank can escape is to flow through the mass of

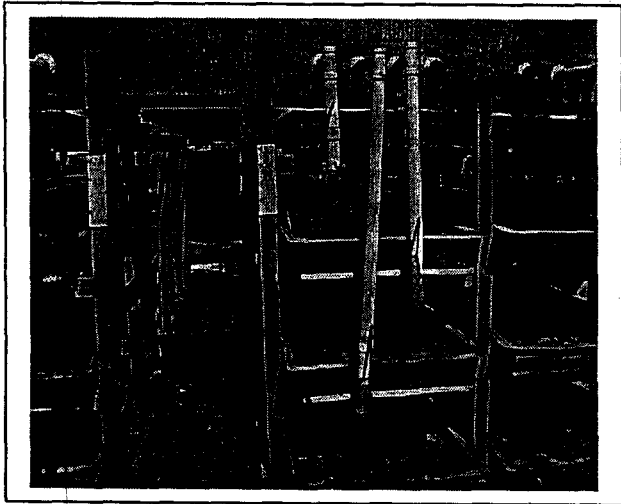
clam seed in the up-weller, and exit through the side of the tank

At about 1500 microns (1.5mm), the seed are taken from the up-wellers and placed on raceways. Raceways are made of 2 by 4's and plywood, or fiberglass, and are used to provide a surface on which to feed the clams by flowing bay water over them until they reach 8 to 15 millimeters, when they are ready for field planting. This part of the nursery process can also be done in the field in specially designed plastic mesh bags and boxes.

The field grow out process occurs in the leases previously mentioned. The clam seed are planted in small plots, approximately 14 by 20 feet, and are covered by ¼ inch flexible plastic screening to protect them from numerous predators that typically feed on shellfish. Blue crabs, green crabs, mud crabs, drills, moon snails, knobbed and channeled whelks, rays as well as waterfowl, can all damage the clam crop. The clams remain in these plots until they reach market size, which usually about 2 to 3 years after the spawn. During this time, the culturist manages the area as a farmer does his fields. Screens must be cleaned of fouling and checked for tears that might allow access by predators. Plots may be thinned and fast growers harvested for sale. They then find their way to seafood markets, raw bars and restaurants throughout the state and region.

Clam aficionados will sometimes notice reddish striations on the shells of some clams. These markings are found in the "notata" strain of *Mercenaria mercenaria*, and occur only about 2 to 3 percent of the time in nature. Aquaculturists breed these notata clams into their spawns because a high percentage of the marked clams indicate to a dealer that the clams are cultured. This serves as a deterrent to poachers who might try to pass the cultured clams off as something caught in the wild — one more method of predator control.

The benefits of hard clam culture



The advent of hard clam aquaculture has allowed many people who worked solely on wild clam stocks in the past to remain employed on the water. With the reduction of normal shellfish populations, the bay clammer, as independent as the New Jersey farmer, has a better opportunity to control his future by farming his own product. Clam aquaculture allows people the chance to continue as a working waterman, a profession that is dying out in many places. The culturist is able to supply safe, consistently high quality shellfish, in its most readily accepted market form, in large volumes, at a fair price, on a year round basis.

The hard clam aquaculture industry plays another significant role in preserving and enhancing the hard clam industry in New Jersey. Because the clams cannot be harvested until they reach a legal

size of 1-1/2 inches, they have been able to spawn at least once. These spawns release billions of gametes into the water, some of them fertilizing and setting in the areas, hopefully increasing the stocks of clams in the wild. Also, every day the culturist spends working on his clam farm is one less day he is exerting pressure on the wild populations. This gives other commercial and recreational clambers a chance to participate in the fishery.

Recent Events and the Future of Hard Clam Culture in New Jersey

The last five years of the 1990's have been hard on clam culture in New Jersey. There have been significant mortalities in several of the hatcheries in the Atlantic City and Brigantine areas, and some mortalities from seed purchased from the South and from a new disease named QPX. Massive blooms of a Brown Tide, *Aureococcus anophagefferens*, have inhibited seed and large clam growth in the lower Ocean and back bay Atlantic County areas. Extremely severe blooms of a macroalgae, *Grassilaria*, have smothered grow out areas causing some mortalities or very slow growth of market sized clams. Because of these problems, two private hatcheries that traditionally sold seed are planting their production for their own harvest and are, at this time, not selling seed to other growers. There has been little movement on acquiring new lease areas that would allow growers to avoid overcrowding and lessen the chances of mass mortalities from an epizootic event. Aside from these constraints, large numbers of cultured clams from Florida and Virginia are coming into the local markets depressing the price for New Jersey shellfish.

It is critical that the current leasing program be expanded as directed by the Aquaculture Development Act. Unless hatchery problems are isolated and remedied, and more areas are made available for leasing, the future of the industry looks flat.

There is an important program for moving hard clams from conditionally approved waters to clean waters for cleansing, a process called relay. The land based alternative to this process is to place the clams in tanks supplied with flowing seawater that has been treated to inactivate bacteria—a process called depuration. Relay is simply a natural form of depuration.

Approximately 50% of New Jersey's hard clams are either relayed or depurated. There are two clam depuration plants located along the Atlantic Coast. One plant processes 250 bushels during each 48 hour cycle and the second handles 125 bushels per 48 hour cycle.

In 2000, a number of acres have been opened to shellfish harvest because of improved water quality. Thirty-eight acres were opened in Ship Channel, Cape May County, forty acres in Thomson's Inlet in Cape May County and 3,629 acres have been opened in ocean waters. There was one downgrade because of stormwater run-off (139 acres in Bayhead).

Clam culture in New Jersey is the major aquaculture industry and our biggest generator of revenues. However, this industry is currently facing major competition from other shellfish producing states especially Florida where there are more grower friendly policies in place. In addition, the state of Florida expends considerable dollars in marketing and promoting product.

Ornamental/Aquarium Fish

The aquarium/ornamental fish business is an important sector of aquaculture in New Jersey as well as around the world. While it may not be an industry that has projected to expansion, there's no question that fish/aquatic organisms sold for home aquaria have value that far exceeds that of fish/aquatic organisms that are raised for either stocking or food purposes. For example, a three inch Gold Nugget Plecostomus will sell for an average of \$40 in a retail store. In terms of weight, this fish probably weighs 50grams (give or take 10g). When calculated in terms of price per pound, the value increases to \$360/pound. Compare that to the \$2.00/pound wholesale price for live tilapia in Chinatown. This is just one example of the many types of aquarium fish that are bred or imported by tropical fish wholesalers in New Jersey. Some examples of high value freshwater fishes are Cichlids, Corydoras catfish, Loricariid catfish, Killifish, Bettas, and Livebearers. Aquatic plants have high value (sometimes more than fish). Most marine fish are wild caught, but several marine species are now captive bred and are commanding a high market price.

Another important and growing sector is the production of ornamentals, both plants and fish, for backyard ponds and other water features. This is a rapidly growing sector with the majority of the product being imported from outside of the State. With careful research, this could present an opportunity for more local production.

Finfish

With the exception of the state fish hatcheries, finfish production remains low. Production has centered around trout, catfish, baitfish and hybrid striped bass. Most of this product is being sold live to ethnic markets in Philadelphia and New York. Several operators were severely impacted by recent drought conditions. Two new initiatives were stalled because of environmental compliance issues. Since many regulations still remain ambiguous when it comes to aquaculture, there have been difficulties in application.

Regulation

Aquaculture, as practiced in New Jersey, tends to be a "green use". Currently all aquaculture facilities are small. Most local production is centered around bivalve molluscan shellfish, clams and oysters. These shellfish are filter feeders that feed on organisms present in the water column. By filtering the water, they play an important role in improving water quality. Additionally, aquaculture provides an effective mechanism to supplement natural harvest. Aquaculture is also playing a major role in resource enhancement. The latter is especially important in the Delaware Bay where much of the local oyster production has been ravaged by parasites as a result of salinity changes in the estuary. Aquaculture is the key to reinvigorating natural stocks and reducing harvest pressure on some species.

Legal and regulatory impediments as well as the cost of permitting are still considered among the major barriers to the development of aquaculture in New Jersey. It is currently costly, difficult and

time consuming to obtain the appropriate permits many of which were developed to deal with industrial activities. The current situation in New Jersey can be traced to a lack of understanding of the industry and the positive role that it can play in New Jersey. Many competing states in the surrounding area have a more business friendly environment.

Major regulatory concerns that have prevented aquaculture from moving forward in New Jersey include: 1) water quality issues, 2) CAFRA, 3) waterfront development permits and the cost of those permits, 3) wetland issues including depth of buffers, 4) threatened/endangered species, and 5) lack of a coherent expanded leasing policy. These issues are based upon perceived environmental concerns but are often not applied in a rational manner especially when applied to small businesses.

The continued absence of a uniform approach creates a lack of transparency that makes it difficult for entrepreneurs to consider locating in New Jersey. Many laws do not consider the problems specific to aquaculture and tend to use catchall categories such as "industrial use". The cost of permitting coupled with other business costs clearly mitigate against industry development in New Jersey.

Currently New Jersey lacks a scientific fast track permit that can meet the needs of those researchers who would like to implement new and innovative technology on a trial basis. A fast track scientific permit would allow these researchers to meet the deadlines imposed by outside funding agencies.

In an effort to develop a more environmentally-sound and business-friendly policy framework to foster the development of aquaculture in New Jersey as mandated by the Aquaculture Development Act, a number of policy changes will be required. Specific tasks enumerated in the Act, responsible parties and current status are outlined in Table 1.

To move the process forward, three Memoranda of Agreement (MOA) have been signed. The first is between the New Jersey Department of Agriculture (NJDA) and the New Jersey Department of Health and Senior Services. The second is between the NJDA and the New Jersey Commerce and Economic Growth Commission. The third is between NJDA and the New Jersey Department of Environmental Protection. In developing the interagency memoranda of agreement, the departments have been mandated to develop provisions that foster the development of aquaculture in the state. The memoranda of agreement concern the implementation of the Aquaculture Development Plan, and delineate financial and regulatory responsibility based upon the provisions of the Act and other applicable laws.

An Aquaculture Advisory Council has been established in the Department of Agriculture. The Council consists of 13 voting and two non-voting members. The voting members include the Secretary of Agriculture who serves as chairman, the Commissioner of Environmental Protection, the Director of the of Commerce and Economic Growth Commission, The Commissioner of Health and Senior Services, the director of the Aquaculture Technology Transfer Center, the director of the Aquaculture Training and Information Center and the executive director of the New Jersey Agricultural Experiment Station or their designees, who shall serve ex-officio, and six citizens of the States, to be appointed as follows: two by the President of the Senate, one of whom shall be a representative from a recognized aquaculture organization or an operator of an aquaculture farm and

one of whom shall be a representative of the seafood industry; two by the Speaker of the General Assembly, one of whom shall be a representative of a recognized aquaculture organization or an operator of an aquaculture farm and one of whom shall be a representative of farmers; and two by the Governor from the public at large. The chairman of the Marine Fisheries Council and the chairman of the Fish and Game Council shall serve ex-officio and as non-voting members.

AQUACULTURE POLICY FRAMEWORK

An overriding premise of the Aquaculture Development Plan and the implementing legislation was the establishment of an enabling environment that will foster the development of aquaculture in New Jersey. The strategy to achieve this goal is through the development of a business-friendly and environmentally-sound policy framework. By developing a specific set of regulations and policies regarding aquaculture, a prospective aquaculturist will be able to develop a business plan based on realistic cost/time projections, thereby increasing the chance of establishing a successful business. Unfortunately, because of these regulatory and legal constraints coupled with the high cost of doing business, New Jersey has not emerged as an attractive location for siting aquatic farming facilities. As the process moves forward, it is hoped that many of these obstacles will be removed without jeopardizing the environment. Other states have moved ahead to develop sound policies and have been competing not only for marketshare, but also for prospective aquaculture entrepreneurs.

The Aquaculture License Application

The Aquaculture License Application that has been developed requests specific information about the size and nature of the proposed aquatic farm. Based on that information, regulators can make determinations concerning which additional permits, if any, may be required. The application is designed to exempt small environmentally-benign farms from excessive regulation and fees. Collaterally this strategy allows regulators the time necessary to focus on major developments with potential ecological implications. Upon completion of the applicable and issuance of all appropriate permits, the New Jersey Department of Agriculture will issue an Aquaculture License to the facility.

The License provides a number of protections for the aquatic farmer including: 1) definitive ownership of the organisms being cultured, 2) formal indication that the aquatic farm is in compliance with appropriate regulations, 3) protection against introduction of aquatic pests that may be detrimental to wild stocks and other aquatic farms, 4) guidance so that an operation can be planned in a manner that will reduce the regulatory burden and reduce or eliminate excessive fees while maintaining environmental integrity, 5) establishment of a documented production history that can be used for disaster relief and other financial assistance programs, and 6) eligibility for programs operated by the New Jersey and United States Departments of Agriculture.

It is anticipated that the Office of Aquaculture Coordination staff, in the Department of Agriculture, will assist with the completion of the Aquaculture License.

Guide to Developing Aquaculture Facilities in New Jersey

The Guidance Document that has been developed provides additional information on each section of the application. A brief overview of regulations and permits is included. It also provides strategies to expedite the process and gives direction for locating other forms of assistance. It is meant to function as a companion piece to the Aquaculture Application.

Aquatic Organism Health Management Plan

The Aquatic Organism Health Management Plan minimizes the disease risks associated with intensified production methods. It focuses on proper sanitation, adequate quarantine, optimal nutrition and efficient husbandry. The Plan operates in consort with the Aquaculture Management Practices. These two strategies can prove helpful in increasing production efficiency and reducing loss thereby improving bottom line profits as well as protecting the environment, wild stocks and other aquatic farms. This plan serves as the scientific rationale for developing import and disease control regulations associated with aquaculture activities.

The Health Management Plan:

1. Provides a proactive mechanism to predict, prevent and minimize incidence of disease.
2. Benefits the aquaculturist and the environment by protecting domestically raised and wild stocks from major disease introduction and develops means to confine disease outbreaks when they occur.
3. Establishes a protocol to deal with emergency disease situations in a practical, reasonable and timely manner.
4. Provides feedback to growers on disease issues in order to facilitate better disease management based on locally, regionally and nationally reported disease outbreaks.
5. Addresses and decreases stress on farmed aquatic organisms with standard operating procedures (SOPs)

Quality Assurance Program

It has been proposed that New Jersey should accept the Quality Assurance Program developed by the Northeast Regional Aquaculture Center. Companies using this Program are eligible to use a special quality seal. Because the seal will be used by a large number of companies nationwide, there is a greater possibility that the consuming public will develop an awareness and appreciation of the program.

Although the program has been in draft status and reviewed by various groups in the state, it is

anticipated that the final version will not be released by NRAC until late 2002. At that point, New Jersey producers will be made aware of the program and will be able to participate for a modest, one time fee payable to NRAC. The fee covers the cost of a manual that explains the requirements for the quality program. Manuals for both finfish and shellfish will be available.



Leasing Policy

Current leasing of bottom land is governed by NJSA 50:1-18 and 50:1-23 through 50:1-31. The objective of the current leasing program is to provide bottom for use in the planting and cultivation of shellfish, including aquaculture. The New Jersey Aquaculture Development Act stipulates that "the DEP and NJDA, in consultation with the Aquaculture Advisory Council, the Shell Fisheries Councils and the Pinelands Commission as it affects the pinelands area designated pursuant to section 10 of P.L. 1979 c>111 (C.13:18A-11), jointly shall establish,appropriate policies for the use of aquaculture leases in waters of the State and for lands underneath waters of the State, including but not limited to lease specifications, fees, royalty payments, and assignability and termination of lease agreements. The policies shall provide for an expeditious procedure for finalizing lease agreements, Lease agreements shall convey a necessary degree of exclusivity to minimize the risks to the aquaculturists caused by pollution, vandalism, theft and other forms of encroachment, while protecting the common use rights of the public and assuring the integrity and protection of the natural and wild stocks and their habitat".

Following the model adopted in other states, the general Aquaculture Application will also serve as the application to the Army Corps of Engineers. This will simplify the process and ensure faster turn around on applications.

The Department of Environmental Protection has identified several areas that may be designated Aquaculture Development Zones. The proposed areas include sites in the Delaware Bay and on the Atlantic Coast. The proposal is that the State would apply for any permits that may be required and would then sublet those areas to individuals engaged in aquaculture activities. Costs incurred by the State would be passed on to the lease-holders.

Concerns have been raised on the part of industry that a mechanism must be established to grandfather current leaseholders. Clam operations are, and have been for many years, the major aquaculture production sector in New Jersey. Other states have developed grandfathering provisions that allow for 50% expansion of current leases and activities once the Aquaculture Application has been filed. There are also concerns about the ability to lease in waters outside of the proposed enterprise zones. Since aquaculture operations tend to vary considerably depending upon factors such as target species and the technology employed, there is concern that severely limiting the ability to lease will further stifle industry growth. Additionally, under the current statutes, there is no provision for leasing the water column and lease policy is largely confined to bivalve molluscan shellfish. Most of the newly developed technology requires use of the water column.

Industry sectors have also raised concerns about the size of leases and the means available to harvest product on the leases. Positive deliberations have been held on several aspects and some substantial agreements have developed although no definitive format has been proposed.

Aquacultural Management Practices

A set of Aquacultural Management Practices (AMPs) outlining good production practices can provide significant economic benefits to aquaculturists and substantially improve bottom line profits. Good management practices can protect the natural environment, native fish stocks, reduce disease and mortality in aquatic farms, improve the quality of farm-raised product, allow the producer to achieve a greater economic return, potentially reduce the cost of permitting and reduce the cost of remediation and rehabilitation.

By legislative mandate, the AMPs are intended to preserve environmental integrity while minimizing cumbersome, duplicative and confusing environmental permitting requirements. Aquaculturists following these recommended practices will more easily satisfy the standards necessary for protecting and maintaining offsite water quality and wildlife habitat.

Because aquaculture is a developing science and appropriate technology is species and site specific, the AMPs are meant to be used as guidelines to assist the farmer in meeting appropriate environmental standards and maintaining the health and marketability of his/her crop.

Import Protocol

An import protocol is needed to provide a means to control the importation of aquatic organisms thereby preventing the introduction of invasive species, pests, pathogens and diseases. These measures not only protect native stocks and the environment but also the aquatic farmer. Inadvertent introductions can result in the loss of crops and a negative public perception of the industry.

The Aquaculture Advisory Council has appointed a representative to the New Jersey Invasive Species Council to help ensure that the interests of the aquatic farming community are considered. There currently exists within the NJDA a mechanism to regulate the importation of plant species.

Statistics and Market Survey

In 1998, the National Agricultural Statistics Service (NASS) a division of the United States Department of Agriculture conducted the first national census of aquaculture. Members of the Advisory Committee on Agricultural Statistics and representatives of both public and private organizations made significant recommendations that helped to establish the data content.

The census collected detailed information relating to on-farm practices, size of operation based on water area, production, sales, method of production, sources of water, point of first sale outlets, cooperative agreements and contracts, and stock enhancement/restoration projects. The survey dealt with both commercial and non-commercial operations. Examples of non-commercial operations included federal, state or tribal facilities (mostly hatcheries), academic and private research facilities.

The overall goal of the Census was to provide a comprehensive picture of American aquaculture. Complete results of the survey are available at the following website:
www.nass.usda.gov/census/census97/aquaculture/aquaculture.htm.

In order to assist the aquaculture industry better position its crops in the marketplace, a monthly market newsletter is in the planning stages. The newsletter will provide information on price, volume and origin of selected aquacultured products sold in the Mid-Atlantic and Northeastern states. The current strategy will collect information on a monthly basis and, as the industry expands, data collection intervals will be added. It is anticipated that this information will assist in the development of business plans and projections.

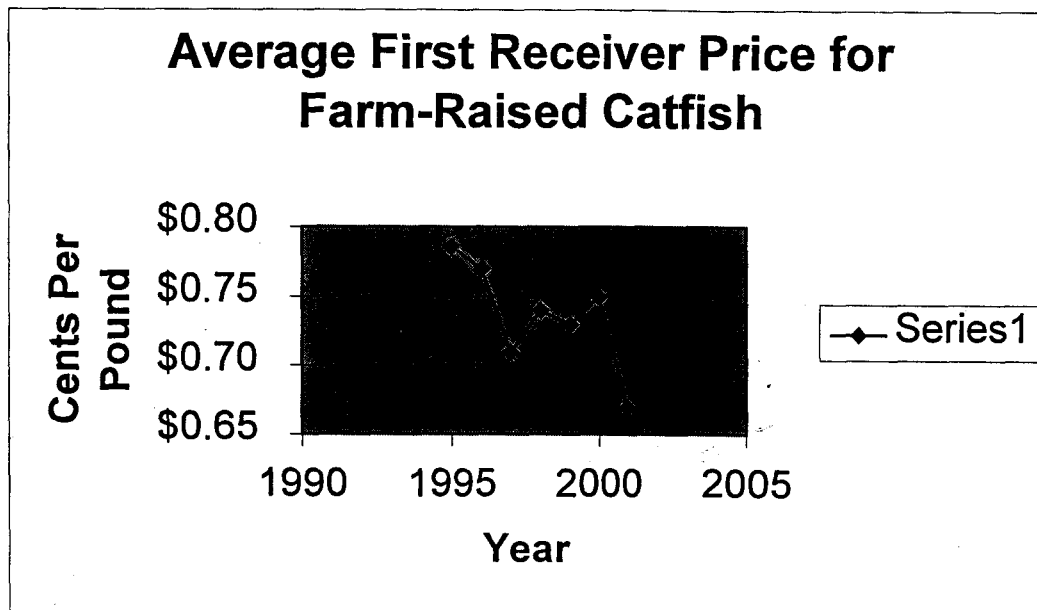
Business Environment

Although groups such as The New Jersey Commission on Science and Technology have been supportive of the industry by opening business incubator programs to aquaculture, there have been permitting problems that have considerably slowed down development of new technology and actual commercialization of aquaculture. Several bills were drafted to establish an aquaculture assistance fund that would provide some funding for development projects.

Marketing

The Kiplinger Agriculture Letter projects no major expansion for most U.S. produced aquaculture products. This is in direct contrast to other regions around the globe where aquaculture is the fastest growing agricultural sector. This projection is based upon what has been a flat demand, and in some areas even a decline, for fishery products in the United States over the past decade coupled with strong competition from overseas producers as well as competition from domestic pork and chicken producers.

The only domestic aquaculture sector that has expanded is catfish. The success of this sector is based upon major economies of scale in production, processing and marketing. The most desired product form is a fillet that can be sold directly to consumers and foodservice operators. Although catfish producers funded an extensive marketing and promotion program, their market is being eroded by lower cost imports primarily from Vietnam. These imports have significantly depressed prices. In response to these considerations, new labeling requirements have been instituted whereby the Vietnamese basa may not be sold under the market name catfish.



In 1999, tilapia consumption increased to a record 152 million pounds live weight worth over \$110 million according to the American Tilapia Association. However, the vast majority of tilapia consumed in the United States is imported. China, Indonesia and Taiwan are major exporters

serving U.S. markets. Only 18 million pounds of the total can be attributed to domestic production. Approximately 90% of domestic production is sold live to wholesalers and retailers in New York, Toronto, Vancouver, Chicago, Los Angeles and San Francisco. These outlets generally serve major ethnic markets.

Restaurants and other foodservice outlets are the major pathways through which novel fish and shellfish products enter the American market. Aquacultured products provide the advantages of consistent price, quality and supply which make them ideal for this application. Unfortunately, domestically-produced aquaculture products are still under-used and under-appreciated by this sector.

Catfish and salmon have fallen victim to market over-supply which resulted in substantial downturns in price. Both of these products tend to be supply driven rather than market driven producing a constant need to explore and develop new markets. Chile, Canada and Norway have been active in promoting their salmon in overseas markets and are rapidly gaining market-share in developing countries along the Pacific Rim.

The decline in the oyster market is a function of a highly complex set of controlling factors including the lack of a consistent source of product and concerns about food safety. A consistent supply of product is dependent upon the development of new approaches to culture techniques and resource management.

Aquaculture is becoming more viable because: 1) environmental conditions and product safety can be better controlled; 2) the genetic manipulation of stock for specific characteristics is becoming routine; 3) exclusive rights to the resource can be established; and 4) market demand can be increased because fish and shellfish can be produced on a year round basis with consistent size, price, delivery times and quality.

Marketing New Jersey aquacultured products will require:

- Development of product identity
- Public education to provide a better market position for aquacultured products
- Ability to process products
- Development of competitive products

Although the production and marketing of aquacultured products is a complex issue for small to medium sized aquaculturists, there are opportunities. These include direct sales such as fee fishing, production of ornamental and indicator organisms for research, production of marine plants for pharmaceuticals, nutraceuticals, cosmetics and stabilizers.