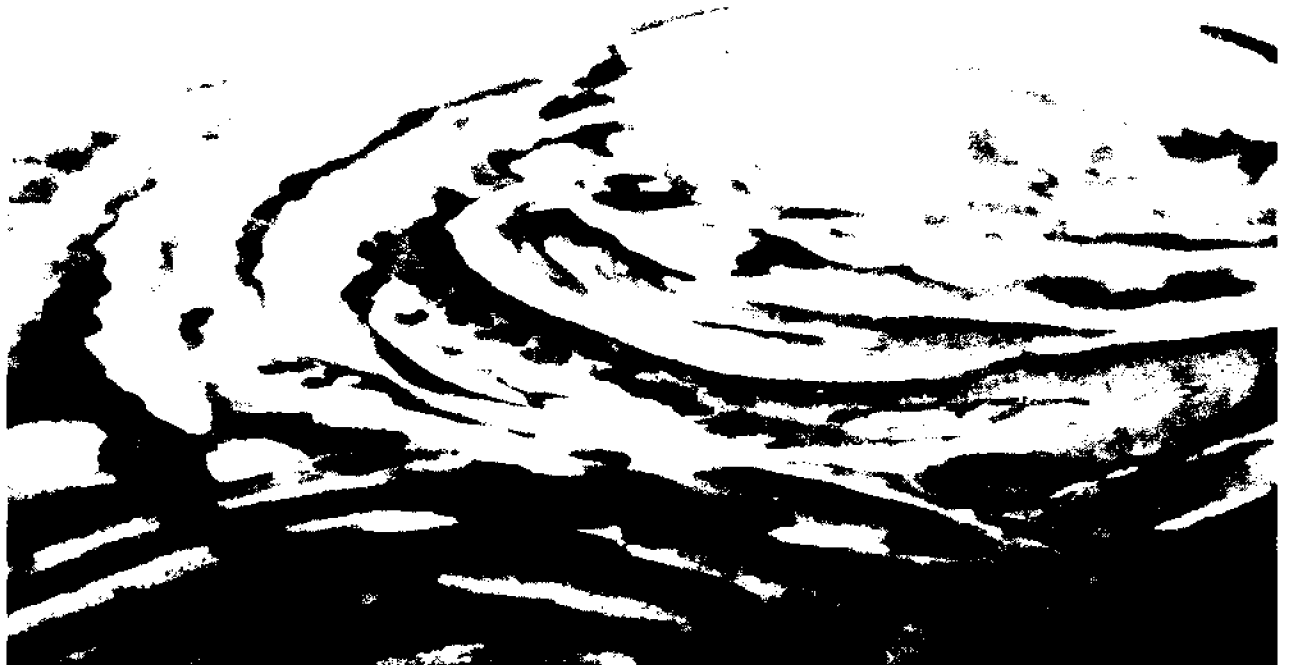


# Aquaculture Development in New York State



Final Report

New York Sea Grant Institute



State University of New York  
and Cornell University

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# Aquaculture Development in New York State

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## Final Report

Prepared by the New York Sea Grant Institute  
of the State University of New York  
and Cornell University

1985

## FOREWORD

In May 1983 the New York State Legislature, recognizing the potential of aquaculture and curious about ways to enhance its development, requested the New York Sea Grant Institute of the State University of New York and Cornell University and the New York State College of Agriculture and Life Sciences at Cornell University to prepare a plan for the development of aquaculture in New York. This document is the response. It is not a plan, for much of the potential of aquaculture will be realized through private investment. Recognizing this, we have sought to identify and address the factors perceived as inhibiting private investment. Public investment in stock enhancement and restoration, sometimes referred to as public aquaculture, is not extensively treated for reasons indicated in the text.

Some reviewers requested the inclusion of economic arguments for aquaculture which would provide justification for allocation of public lands for private use. For many of the crops offering potential in New York State, data providing such justification does not exist. In fact, consensus among technicians on the feasibility of culture of many of those species is absent--such is the stage of development of the art.

This report evolved from a discussion paper prepared by Margaret Becker, Program Associate in Aquaculture, New York Sea Grant Institute, which was widely circulated in the summer of 1983. Aquaculturists, fishermen, sportsmen, local and state governmental officials, academic scientists and others commented substantively on the issues surfaced in that paper. Based upon those insights, priorities, objections and other contributions, a draft plan was prepared under the leadership of Margaret Becker. That document was formally submitted to all State agencies for comment and was, again, widely circulated in the community. Substantial and constructive response was obtained. We are grateful to all those who so contributed. This final report was prepared by Laura McKay, Assistant Director, New York Sea Grant Institute and me.

In the time preceeding and during the preparation of this document, the New York Sea Grant Institute sponsored an increasing program of research in aquaculture addressing basic questions of biology, engineering, economics, as well as social and political issues. Those engaged in that research have contributed generously to this text. A most important contribution has been that of Professor Milton Kaplan, School of Law, State University of New York at Buffalo. Matters of underwater land ownership, leasing authorities and other legal issues have long clouded productive discussion about the use of New York's marine underwater lands. Professor Kaplan, with Sea Grant Institute sponsorship, completed two major studies clearly the most definitive yet undertaken.

Aquaculture is perceived by many as a "potential," an opportunity for the future, rather than an actuality. Yet the number of firms engaged in aquaculture both nationally and in New York, continues to grow despite obstacles. Some believe aquaculture is a threat to the economic well-being of the state's traditional fisheries and a force seeking to limit the freedom of movement and action in the commonly held waters of the State. Yet, from a technical viewpoint, aquaculture

remains the only feasible way of increasing production of biological materials from the sea, particularly from coastal waters. The wild fishery resources of this nation and others are, in general, being fully exploited. Among the more desirable species, over-harvesting is a general problem. Biotechnological research findings suggest that a new era of utilization of marine resources may be developing--one in which the production of high value pharmaceuticals, biopolymers and other exotic chemicals will be derived from marine feedstocks. These will require genetically refined strains of organisms which will be cultivated in the controlled conditions of aquaculture.

If New York wishes to become a producer of more of the seafoods it consumes, and continue its role as an exporter of premier quality shellfish to the rest of the nation, aquaculture is a means towards that end. If New York wishes to poise itself on the frontier of industries emerging from the new biotechnology, then the state must consider what role aquaculture might play in its future. Private investors believe New York to be disinterested in aquaculture and therefore do not select the state as a site for development. Without encouragement for such investment, aquaculture may continue to be a small, almost hidden, enterprise.

In the several years during which this report evolved, interest in aquaculture was sparked. Market opportunities for live sale of freshwater fish stimulated development of trout farming in upstate New York. Additional shellfish culture operations commenced. A striped bass culture operation was given an economic impetus through restrictions placed on catch of wild populations of that species because of contamination from PCB's. New York State's Department of Agriculture and Markets and the Urban Development Corporation made state funds available to industry for demonstration projects which may stimulate production of new crops. Most heartening of all developments has been the formation of the New York State Aquaculture Association representing the combined interests of the upstate fish farmers and the downstate shellfish farmers and other aquaculturists. That organization has committed itself to the further implementation of actions needed to foster aquaculture in the State.

Donald F. Squires  
Director

Albany, New York  
July 1985

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# I. INTRODUCTION

New York is committed to economic redevelopment. Aquaculture, the controlled cultivation of aquatic plants and animals, could help the state fulfill this commitment. Through aquaculture, New York could create greater employment opportunities; promote additional private investment; encourage technical innovation and growth in its agricultural industries; and perhaps eventually expand opportunities for export trade.

## **AQUACULTURE PLANNING ACT**

On May 17, 1983, Governor Mario Cuomo signed the Aquaculture Planning Act (Chapter 104 of the Laws of 1983; see Appendix A), which requested the Sea Grant Institute of the State University of New York and Cornell University and the College of Agriculture and Life Sciences at Cornell University to undertake a study to develop a statewide aquaculture plan. This is that plan.

Legislative findings leading to the Aquaculture Planning Act recognized the significant economic potential of aquaculture, but also recognized that a variety of barriers presently inhibit its development in New York. The purpose of this study is to assess the present status of aquaculture in New York and its potential for growth. Opportunities to support the developing industry are outlined. The study should serve as an information base for future public policy decision-making and encourage more informed discussion about the value of aquaculture for New York.

In mid-1983 the New York Sea Grant Institute circulated for review a discussion paper, "Aquaculture Development in New York State: Draft Plan." That paper was based on preliminary research carried out by the Institute and reflected the actual situation of aquaculture at that time. Through December 1983, that draft was reviewed and discussed by aquaculturists, commercial fishermen and shellfishermen, representatives of marine recreational interests, representatives of federal, state, and local government and the scientific community. Based upon these discussions and meetings, a revised plan was prepared and circulated widely for comment. (Appendix B lists those who contributed to this revision). This report embodies the comments of reviewers or reflects their divergent viewpoints.

## **SCOPE OF THE PLAN**

Because aquaculture is still in its infancy as a commercial enterprise, there is no base of information on technologies, economic potentials, markets, and a host of other considerations. Opinions about industry potential vary among experts. This study addresses that variation in knowledge by recommending research and development, economic assistance, or other measures as appropriate at this time.

Aquaculture, at present, has its greatest economic potential in the production of high-value foods which are in short supply. High volume production

## INTRODUCTION

of seafoods in direct competition with the commercial wild-harvest fishery does not seem probable in the next decade. But in New York State, a traditional base of shellfish culture offers immediate economic opportunities because some shellfish species traditionally fished in New York are now in short supply. A marketing campaign for live trout sales in supermarkets and a pragmatic demonstration of freshwater fish farming in Delaware County combined to demonstrate and stimulate production of fresh fish for local markets. Future developments in aquaculture include culture of species which are now available only through the commercial fishery but are in short supply, and the farming of plants and animals for the production of pharmaceuticals, energy, biopolymers, and chemical feedstocks.

Aquaculture is undertaken by both the public and private sectors. Public aquaculture has, in fact, the longest history. Early freshwater fish hatcheries were developed for the purpose of restocking public fishing streams. In New York, private aquaculture has been practiced primarily on the marine coast and has been directed towards shellfish culture. This report deals primarily with private aquaculture, on which developmental constraints are greatest. The economic efficacy of public aquaculture is still a subject of debate which will require further research for resolution.

## DEFINITION OF AQUACULTURE

A concise statement of the nature of any emerging field is difficult. Aquaculture is an excellent example of that difficulty. Many practitioners and scholars use the term aquaculture to define the culture of both fresh- and saltwater organisms. Others differentiate saltwater (marine) culture from freshwater culture by the term mariculture. More specific definitions distinguish plant, shellfish and finfish (and other) culture; public versus private; and technique or technology used.

The term public aquaculture is used to define culture activities undertaken for the purpose of augmentation of stocks of aquatic organisms in public waters or on publicly owned bottom lands. Early culture of freshwater fish was undertaken to replenish stocks in public fishing streams. Long Island towns have supported a variety of practices designed to augment the natural production of shellfish available for harvest on town-owned bay bottoms. Public aquaculture is, by definition, undertaken in public waters or bottom lands. Harvest of the resource is usually undertaken by permitted individuals or companies.

In contrast, private aquaculture is undertaken in situations in which the culturist has obtained rights to waters and/or bottom lands and thus has ownership of the organisms cultured.

Research is required to determine the efficiencies of many of the techniques of public aquaculture. Usually these techniques involve control of only a portion of the life cycle of the cultured organism, which is then released onto public grounds. Economic efficiency of public aquaculture is reduced by losses through predation, inefficiency of harvest and other factors. In contrast, private aquaculture, like agriculture, requires that control be retained over the organism to maximize its survival.

Some would question whether a number of activities undertaken on Long Island by local management programs to enhance the public shellfishery can be described as aquaculture. Such techniques include, for example, hard clam relay and spawner

transplant programs in which mature stock are harvested from one area and planted in another to increase the availability of clams in certified waters and/or increase the reproductive potential of stocks.

At the other extreme are fish culture operations in which the fish are spawned in land-based tanks and held in them until harvest. The majority of aquaculture operations fall in between these types; the issue is the degree to which the life cycle and environment of the animal are controlled.

Aquaculture techniques have been employed to produce aquatic species for food, entertainment, recreation, and industrial raw materials. A broad definition of aquaculture would therefore include culture of exotic fish species for fish fanciers. Others favor a narrow definition of aquaculture which would include only the production of foods.

Some definitions of aquaculture specify private operations only. In New York, however, a number of public agencies undertake aquaculture projects for wild stock enhancement.

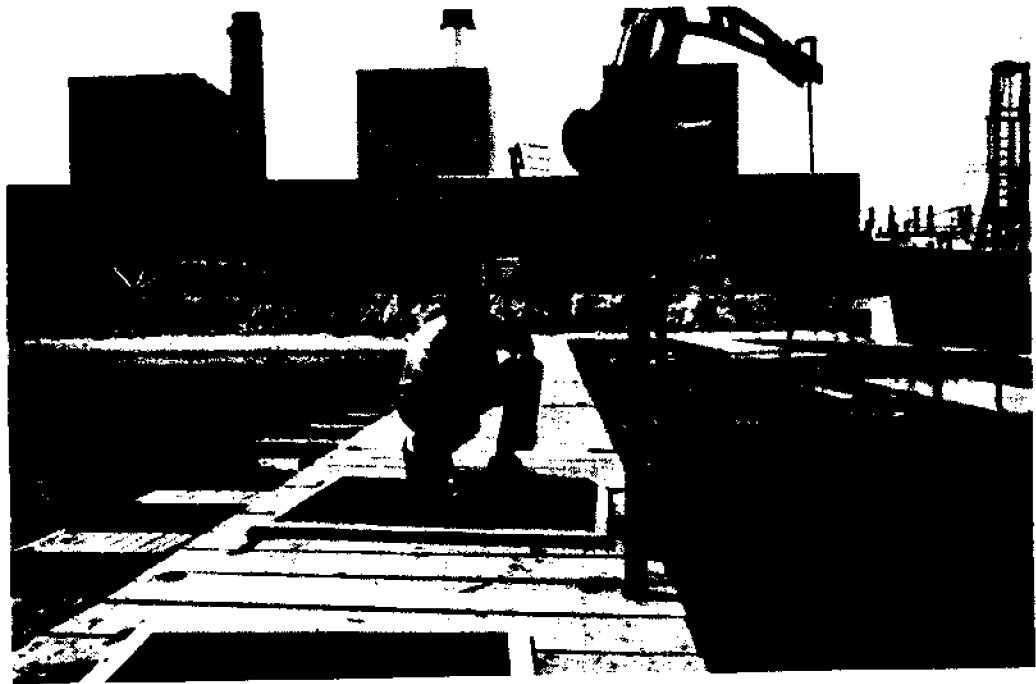
Confusion sometimes arises over the difference between aquaculture and hydroponics. These are related only through the use of water. Aquaculture produces species in water that by nature grow in water; hydroponics produces species in water that by nature grow on land.

A definition of aquaculture that focuses on the technology, not the use of the product, provides broadest opportunities for development. Regardless of how specific the definition chosen, three important criteria must be met to define aquaculture: (1) The organism has been cultured or deliberately manipulated to achieve the desired product; (2) the organism throughout its life cycle is cultured in water (either in an artificial aquatic environment located on land or in a controlled setting in a natural aquatic environment); and (3) the product is by nature aquatic (excludes hydroponics) (Wildsmith, 1982, p. 1).

The following definition is widely accepted nationally and is both flexible and yet considers the legal criteria:

**The controlled cultivation and harvest of aquatic plants and animals.**

This definition will be used throughout this study.



II

## Aquaculture Yesterday, Today and Tomorrow

## II. AQUACULTURE YESTERDAY, TODAY, AND TOMORROW

### AQUACULTURE WORLDWIDE

Aquaculture is of growing importance in many areas of the world, particularly those where protein is needed or where seafoods are a major portion of the traditional diet. Estimates of annual worldwide aquaculture production range from 5.6 to 9.4 million metric tons of seafoods. This is roughly 10% of world fish production. But some countries already rely upon aquaculture for over 40% of their total fisheries supply. Almost 100 different species are cultured including shrimp, crawfish, oysters, clams, mussels, salmon, and seaweed. Finfish account for 37% to 57% of the volume of all cultured products; molluscs for 24% to 37%; seaweed for 18% to 25%; and crustaceans for less than 1% (Joint Subcommittee on Aquaculture, 1983, Vol 1, p. 1)(see Tables 1 and 2).

### AQUACULTURE IN THE UNITED STATES

A significant portion of the U.S. supply of some species is now produced by aquaculture.

Private aquaculture produces over 40 percent of our oysters, most of our catfish and crawfish, nearly all of our rainbow trout, and small quantities of several other species. Total harvest of edible fish and shellfish in 1982 was 1,500,000 metric tons (3.3 billion pounds), of which about 179,500 metric tons (395 million pounds), or about 11 percent of the total, was produced by aquaculture. (Joint Subcommittee on Aquaculture, 1983, Vol 1, p. 4) (see Tables 3 and 4 for selected species produced through US Aquaculture)

In 1978, the National Research Council estimated that aquaculture production in the United States could increase to 250,000 metric tons by 1985 (although this has not come to pass), and to about 1,000,000 metric tons by the year 2000 (National Research Council, in Office of Sea Grant, 1982, p. 2)

### AQUACULTURE IN NEW YORK

New York has been a leader in aquaculture development in the United States; some of the first aquaculture in the nation was practiced in state waters. Aquaculture developed through work of shellfishermen on Long Island and finfish aquaculturists upstate. Both types of aquaculture evolved in response to the same need: the replenishment of wild stocks. While the first efforts were largely experimental and their success limited, some of those early operations serve as the basis of a number of ventures in business today.

#### Early New York efforts

##### Freshwater

Freshwater finfish culture in New York developed in the 1800's out of a desire to augment dwindling wild harvests. The causes of the decline were not immediately understood, but the economic importance of the fishery could not

AQUACULTURE YESTERDAY, TODAY, AND TOMORROW

Table 1 ESTIMATED WORLD PRODUCTION THROUGH AQUACULTURE IN 1975

	Metric Tons		Metric Tons
<b>Finfish</b>	<b>3,980,492</b>	<b>Shrimps and Prawns</b>	<b>15,683</b>
China--all provinces excluding Taiwan Province	2,200,000	India	4,000
Taiwan, Province of China	81,236	Indonesia	4,000
India	490,000	Thailand	3,300
USSR	210,000	Japan	2,779
Japan	147,291	Ecuador	900
Indonesia	138,840	Taiwan, Province of China	549
The Philippines	124,000	Singapore	105
Thailand	80,000	Korea, Republic of	30
Bangladesh	78,485	<b>Oysters</b>	<b>591,386</b>
Nigeria	75,000	Japan	229,899
Poland	38,400	USA	129,060
Vietnam, Republic of	30,000	France	71,448
Yugoslavia	27,000	Korea, Republic of	56,008
Romania	25,000	Mexico	45,000
Hungary	23,515	Thailand	23,000
USA	22,333	Taiwan, Province of China	13,359
Italy	20,500	Australia	9,200
Madagascar	17,392	Canada	5,080
Germany, Democratic Republic of	16,000	United Kingdom	3,000
France	15,000	Spain	2,289
Czechoslovakia	12,222	The Netherlands	1,500
Israel	12,189	Chile	870
Denmark	12,120	The Philippines	782
Brazil	12,000	New Zealand	700
Germany, Federal Republic of	8,900	Senegal	191
Sri Lanka	7,859	<b>Mussels</b>	<b>328,517</b>
Egypt	7,000	Spain	160,000
Mexico	7,000	The Netherlands	100,000
Malaysia	6,559	Italy	30,000
Zaire	5,000	France	17,000
Cuba	4,500	Germany, Federal Republic of	14,000
Hong Kong	4,019	Korea, Republic of	5,578
Norway	3,500	Chile	1,260
Austria	2,500	Yugoslavia	287
United Kingdom	2,000	The Philippines	182
Finland	1,940	New Zealand	150
Belgium	1,800	Tunisia	60
Tanzania	1,500	<b>Clams</b>	<b>38,851</b>
Burma	1,500	Korea, Republic of	24,920
El Salvador	1,208	Taiwan, Province of China	13,898
Canada	1,103	The Philippines	33
Greece	900	<b>Scallops</b>	<b>62,600</b>
Chile	800	Japan	62,600
Uganda	700	<b>Cockles and Other Molluscs</b>	<b>29,987</b>
Singapore	680	Malaysia (cockles)	28,000
Kenya	400	Taiwan, Province of China	1,243
Nepal	400	Korea, Republic of	733
Venezuela	332	The Philippines	11
Switzerland	300	<b>Seaweeds</b>	<b>1,054,793</b>
Ireland	207	Japan	502,651
Korea, Republic of	189	China--all provinces excluding Taiwan Province	300,000
The Netherlands	129	Taiwan, Province of China	7,347
Ecuador	90	Korea, Republic of	244,795
Central African Empire	43	<b>TOTAL</b>	<b>6,102,289</b>
Cyprus	40		
Ghana	40		
Zambia	29		
Paraguay	23		
Ivory Coast	10		
Puerto Rico	9		

Source: Pillay, in Terry, 1977.

AQUACULTURE YESTERDAY, TODAY, AND TOMORROW

Table 2

**WORLD AQUACULTURE PRODUCTION BY MAJOR COMMODITY  
GROUPS FOR 1979 AND 1983 (in metric tons x 1000)**

Commodity Groups	1979	1983*	% Change
Finfish	3,490	4,448	27.4%
Molluscs	3,450	3,246	-5.9%
Crustaceans	71	123	73.2%
Seaweeds	2,390	2,394	0.2%
Totals	9,400	10,211	8.6%
(Pounds, millions)	20,730	22,515	
World Commercial Fishery Catch **	70,943	76,436	7.7%
Aquaculture % of World Catch	13.3%	13.4%	

\* Preliminary data.

\*\* Data on aquatic plants and marine mammals excluded.

Source: FAO, Rome, in Aquaculture Magazine 1985  
Buyer's Guide

Table 3

**SELECTED AQUACULTURE PRODUCTION IN THE UNITED STATES**

SPECIES	LOCATION
Abalone	California
Alligators	Southern states
Bait minnows	Southern states
Buffalofish	Southern states
Carp	Eastern states
Catfish	Southern states
Clams	Atlantic/Pacific coast
Crab	South--experimental
Crayfish	Louisiana, Washington, New York
Frogs	Southern states
Lobster	Experimental
Mussels	Atlantic/Pacific/Gulf coast
Oyster	Atlantic/Pacific coast
Pike/black bass, sunfish	Nationwide--farmponds
Salmon	Northeast/northwest
Shad/striped bass	Southern states/New York
Shrimp	Southern states/Hawaii
Tilapia	Southern states
Trout	Northern states

Modified from Bardach, Ryther, and McClarney, 1972

AQUACULTURE YESTERDAY, TODAY, AND TOMORROW

Table 4  
ESTIMATED U.S. PRIVATE AQUACULTURE PRODUCTION, 1980-83

Species Group	Value, \$US (x 1000)		Metric Tons	
	1980	1983	1980	1983
Bait fish	44,000	100,000	10,000	15,000
Catfish	53,572	132,000	34,855	100,000
Clams **	10,398	9,500	1,777	1,224
Crawfish	12,951	30,000	10,849	27,300
Freshwater Prawns	1,200	1,500	136	125
Mussels**	NA	1,500	NA	351
Oysters**	37,085	31,500	10,775	10,567
Pacific Salmon	3,400	6,800	3,455	9,400
Trout	37,474	50,000	21,836	22,000

\* Data are preliminary

\*\* Meat Weight.

Source: U.S. Dept. of Commerce in Aquaculture Magazine 1985 Buyer's Guide

be ignored and "the climate was created for the development of fish culture in America" (Benson (ed.), 1970, p. 71).

Although by the 1850's finfish culture was well established in Europe, it was just getting started in the United States. In 1853 a fish farm was established near Cleveland where experiments in culture were carried out. Several years later, experiments in fish culture were conducted in West Bloomfield, New York.

"The most noted of the [US] trout breeding enterprises was started in 1864, just before the end of the Civil War, by Seth Green" in Caledonia, New York (Benson (ed.), 1970, p. 72). New York became a leader in aquaculture largely because Seth Green discovered there a new method of fertilization of eggs in a hatchery which increased fertility by about 50% (Benson (ed.), 1970, p. 76).

The New York Commission of Fisheries, established by Chapter 285 of the Laws of 1868 with Seth Green as one of the first commissioners, was a predecessor of the present state Department of Environmental Conservation. An early commission report states:

The purpose of the fish commission is to utilize these waters, make them productive, if possible, and, through them, interest the public in that new, practical and valuable science, fish culture; to convert them at once into schools of instruction as well as sources of much additional enjoyment, and, perhaps, even of some actual profit. (Second Report, 1870, p. 9)

By 1870, the first New York State fish hatchery was built in Caledonia, and nationwide "some 200 private persons were practicing fish culture, either as a business or as a hobby" (Benson (ed.), 1970, p.1).

In 1870, the American Fish Culturists' Association was established to advance culture theory and practice. The association helped convince the US Congress to



## AQUACULTURE YESTERDAY, TODAY, AND TOMORROW

recognize fish culture as having great national importance. By this time the importance of protecting natural fish stocks, if not augmentation of those stocks, through state management efforts had been widely recognized. Many states, in addition to New York, had established state fish commissions to look into the protection of the resource (Report of the Commissioner, 1873, pp. xxxii-xxxv). Interest was increasing and in 1871, the US Commission on Fish and Fisheries was established to promote wise resource management including the restocking of depleted fisheries.

Social considerations were an important factor in elevating fish culture to the dominant force in fish conservation. There was internal agreement that populations of several prominent food fisheries had been depleted. Stringent regulations might have been imposed to "save" the fisheries. But stocking held greater public appeal. (Parker, 1980, p. 11)

Stocking seemed to be a productive rather than a restrictive force, creating immediate, visible results (Benson (ed.), 1970, p. 83).

### Marine

Some of the first New York aquaculture was the planting of very young shellfish, known as shellfish seed, in protected waters. This came about because high demand for oysters led to overharvesting of the natural beds. To replenish the natural stocks, shellfish seed was imported and planted in New York waters: "As early as 1825, a few small seed oysters from Chesapeake Bay were transferred to waters near Staten Island" (Kellogg, 1910, p. 189). This is probably the first instance of shellfish planting in the nation (Kellogg, 1910, p. 189).

By 1850, the town of Brookhaven had granted the first leases of town water for oyster aquaculture, and thereafter other towns also made similar grants. Naturally productive areas were left open to the baymen (Van Popering and Glancy, 1947, p. 175).

In 1881, Brookhaven initiated one of the first "public" aquaculture projects by seeding town beds in response to a declining natural harvest of oysters (Van Popering and Glancy, 1947, pp. 193-194).

In 1923 two oystermen developed the first artificial method for spawning oysters, the Wells-Glancy method. This technique is still used today by some shellfish hatcheries.

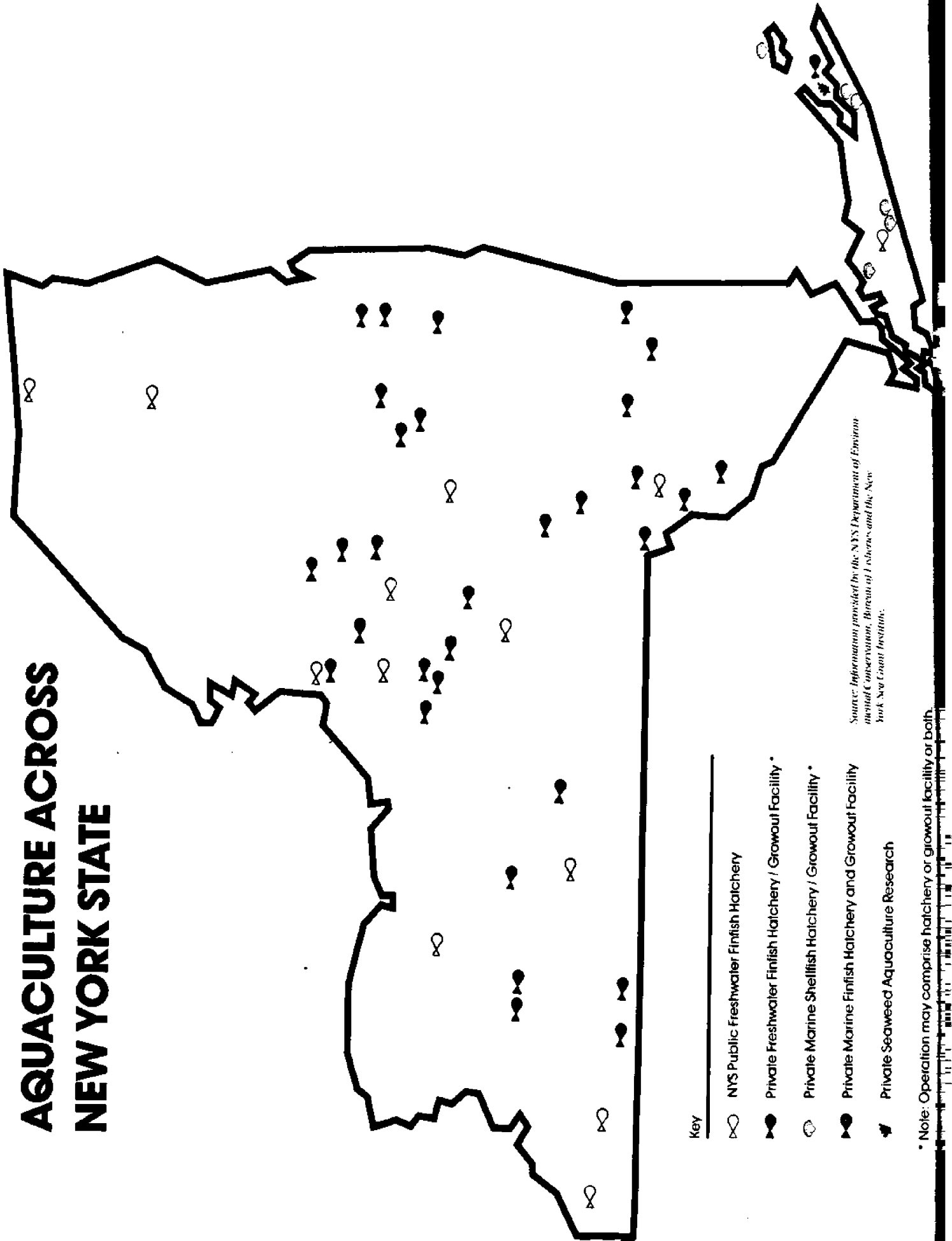
Several of New York's present shellfish aquaculturists trace the history of their operation to early oyster cultivation, but some have turned to clams as their primary crop. After 1930 the oyster industry declined because of a complex set of factors including overharvest, storms, predation, and disease.

### Aquaculture in New York today

New York hosts a wide variety of private and public aquaculture enterprises across the state (see map).

Approximately 70 private commercial ventures operate in upstate New York. Of these, 10 to 15 raise baitfish, about 30 raise trout in hatcheries to fingerling

# AQUACULTURE ACROSS NEW YORK STATE



Source: Information provided by the NYS Department of Environmental Conservation, Bureau of Fisheries and the New York Sea Grant Institute.

- Key**
- NYS Public Freshwater Finfish Hatchery
  - Private Freshwater Finfish Hatchery / Growout Facility \*
  - ◐ Private Marine Shellfish Hatchery / Growout Facility \*
  - ◑ Private Marine Finfish Hatchery and Growout Facility
  - ★ Private Seaweed Aquaculture Research

\* Note: Operation may comprise hatchery or growout facility or both.

AQUACULTURE YESTERDAY, TODAY, AND TOMORROW

size for pond stocking, and the remaining form a cooperative in Delaware County which raises trout to food size for sale in local markets. No data exist on baitfish produced in New York, but private finfish hatchery operators raised almost 60,000 pounds of trout in 1980 (US Crop Reporting Board, 1981). In New York most freshwater aquaculturists are part-time and most of the fish are sold for sport stocking purposes. Fish sold for stocking receive a higher price in the market than fish sold for food. A US Crop Reporting Board survey of 1981 indicates about 5% price differential, although this may underestimate the difference in New York because data collected for foodsize (larger) and stocker size (smaller) fish do not differentiate purpose--many foodsize fish are actually used for stocking (US Crop Reporting Board 1981). Table 5 shows New York production and markets.

Table 5

**AQUACULTURE PRODUCTION IN NEW YORK AND PRODUCT MARKETS**

SPECIES	CULTURE LOCATION	PRODUCTION PER YEAR (1)	PRESENT MARKETS (2)	POTENTIAL MARKETS (2)
Hard clam	Long Island	150,000 bu	1,2,3	4
Oyster	Long Island	150,000 bu	1,2,3	4
Striped bass	Long Island	20,000 lb	1,3	2
Trout	Upstate	60,000 lb	1	2
Seaweed	Long Island	Research		2,3,4
Baitfish	Upstate	Unknown(3)	1	1,2

(1) Production information is proprietary, values are gross estimates based on an informal survey of producers.

(2) 1 = Local; 2 = State; 3 = National; 4 = International

(3) The newly formed (2/85) New York State Aquaculture Association hopes to collect this information through its membership applications.

New York State operates 12 freshwater finfish hatcheries upstate and one on Long Island which raise a wide variety of cold and warm water finfish used to stock the lakes and rivers of the state. The Department of Environmental Conservation operates the upstate hatcheries to help provide for the management of the freshwater fishery resources of the state. These hatcheries produce about 1,100,000 pounds of fish for stocking each year. Species include trout (brook, brown, rainbow, lake and steelhead), salmon (red, chinook and landlocked), splake, bass (largemouth, smallmouth, and calico), walleye pike, and muskellunge. The Department of Parks, Recreation and Historic Preservation operates the Connetquot River hatchery on Long Island as part of a sportfishing enhancement program. The hatchery annually releases about 35,000 brook, brown, and rainbow trout (NYS Department of Parks, Recreation and Historic Preservation, unpublished statistics).

## AQUACULTURE YESTERDAY, TODAY, AND TOMORROW

On Long Island, nine commercial operations raise a variety of marine shellfish and finfish. Shellfish Inc., F.M. Flower and Sons Oyster Company, Bluepoints Inc., and the Shinnecock Indian Tribal Oyster Project each operate a hatchery in which seed shellfish are raised for further grow-out on company bay bottom or for sale to other companies. These companies raise primarily the American oyster and the hard clam. While only a small amount of bay scallop seed is now raised, some operations plan to expand production of this species soon. Coastal Farms grows out seed clams to harvest size and Ocean Pond Inc. and Island Marine Services, Inc. grow out seed oysters to harvest size. The latter company and a few others lease space from Long Island Lighting Company's Northport Environmental Research Center. This 10 acre site has the advantage of LILCO's thermal effluent which keeps the water temperature between 55 and 90°F and so promotes faster growth. Multi-Aquaculture Systems Inc. is a marine finfish aquaculture venture, raising striped bass and other fish for sale to institutional and direct consumer markets. Hydro Botanicals, a research organization, raises marine plants for extraction of industrially important substances. Another operation, the Long Island Oyster Farms, recently discontinued its hatchery operation and now manages only the wild stocks of oysters on its underwater property.

In 1984 the New York State legislature appropriated \$1,000,000 for aquaculture demonstration projects. The Department of Agriculture and Markets has \$250,000 which it is using to fund 7 saltwater aquaculture demonstration projects on clams, oysters, mussels, and striped bass and 3 freshwater projects on brown bullhead, trout, and largemouth bass. Several of the projects are demonstrations of public aquaculture. The remaining \$750,000 has gone to the Urban Development Corporation. UDC is now in the process of sending out a request for proposals for aquaculture demonstration projects which may be public or private-oriented and fresh or saltwater but must be undertaken in the Long Island area.

### POTENTIAL FOR AQUACULTURE DEVELOPMENT

#### Opportunities for New York through aquaculture

While some have investigated the use of aquaculture for universal production of a low-cost source of protein, the near-term potential for this is quite low. In developing countries where cost of land and labor is low, production of high-volume, low-cost aquaculture species is possible. In New York, where labor is expensive and coastal land values (although not rural land values) are at a premium, production of low-cost species, for the most part, is not at this point economical. Expanded use of underutilized species in the wild harvest fishery may help meet the demand for lower-cost fish in the near term. At present, aquaculture development will most probably take place in higher-value species such as clams, oysters, scallops, striped bass, trout, and salmon. A number of development opportunities, however, can be gained through the support of a local fish and shellfish production capability in aquaculture.

Aquaculture could provide an opportunity for economic development through production of food products for the local market and for export. In 1982, the United States imported 48% of all the seafood consumed domestically. The value of the US trade deficit in seafood has increased over 100% since 1976 (US Department of Commerce, 1984). Domestic markets could be reclaimed and annual trade deficits reduced by locally produced fish and shellfish.

## AQUACULTURE YESTERDAY, TODAY, AND TOMORROW

Additional employment opportunities could be developed through aquaculture across the state. Upstate, aquaculture could provide an additional income for small-scale farm operators who find it difficult to compete with expanding agribusiness. It also has the potential to provide new jobs should large-scale, recirculating culture systems become feasible. In the marine district, pressures such as pollution and overharvest lead to declining natural stocks of fish and shellfish and reduce the number employed in the fishery. The inshore shellfishery has been significantly affected. From 1970 to 1983 the number of licensed shellfishermen varied yearly, increasing steadily to 1976 and then decreasing to the present. While the number of men in the fishery now approximates the number in 1970, the amount of shellfish harvested per man has decreased almost 50% (see Figure 5 in Section VI). In Nassau and Suffolk counties this causes particular problems for those not trained in other fields. The number of jobs available in those coastal counties is increasing, but these are primarily in the high-technology industries that require specially skilled labor. There is a need for retraining of local workers or for an increase in jobs that meet the qualifications of the local labor force for semiskilled labor (Fedelem, pers. comm., July 6, 1983). Aquaculture can provide alternative employment in a field requiring many of the skills of the shellfishermen. Yet with labor costs so high, there will likely be continual efforts to make aquaculture (like agriculture) less labor intensive in the interest of maximizing profits.

Other states are exploring this potential. The New Jersey Department of Agriculture is investigating the potential for part-time, small-scale fish culture in New Jersey. The Department has studied the marketability of several species and finds potential for small scale aquaculture to provide alternative employment for farmers and prison inmates (Stolpe, pers. comm., September 1982).

Aquaculture may offer New York opportunities for increased economic development in an industry that is compatible with the economy and lifestyle of the rural and coastal communities of the state. Aquaculturists draw on many of the same skills as either fishermen or farmers. Some Long Island culturists employ local fishermen who are knowledgeable about local waters and about handling the boats and other equipment (Steidle, pers. comm., July 19, 1982, and Relyea, pers. comm., July 9, 1982). In Delaware County, a group of residents including area farmers have joined together in a fish farming cooperative that takes advantage of the abundant natural and human resources of the region (Titus, pers. comm., July 13, 1982). Local communities seek development which will not change the nature of their regions.

Aquaculture, properly managed, could help counter environmental pollution. Clean water is critical to the aquaculturist: Pollution can destroy the venture. Therefore aquaculturists will be continually monitoring the quality of the water they use and are likely to bring strong political pressure to bear on maintenance of water quality. Effluent from very large scale aquaculture operations should be managed so that undue amounts of nitrates and phosphates are not released to the environment. These substances occur naturally and do not pose as serious a threat as effluent from other sources containing PCB's heavy metals, viral and bacterial contamination, etc. Furthermore, because culturists generally engage in nonconsumptive use of water and aquatic species, aquaculture could help relieve the strain on the state's resources.

Aquaculture may provide economic benefits to New York as a whole beyond those gained at the local level. Future aquaculture development will entail construction and equipment purchases, training and research. Operational ventures could provide

## AQUACULTURE YESTERDAY, TODAY, AND TOMORROW

opportunities for processors, shippers, and marketers. The value-added multiplier for fisheries products has been estimated to be \$3.87, and the employer multiplier to be 3.83 persons. Thus, for every one dollar of products and every one fishery-related job, \$3.87 and 3.83 jobs are generated in the macroeconomy (National Marine Fisheries Service, in Feldman, 1978, p. 54).

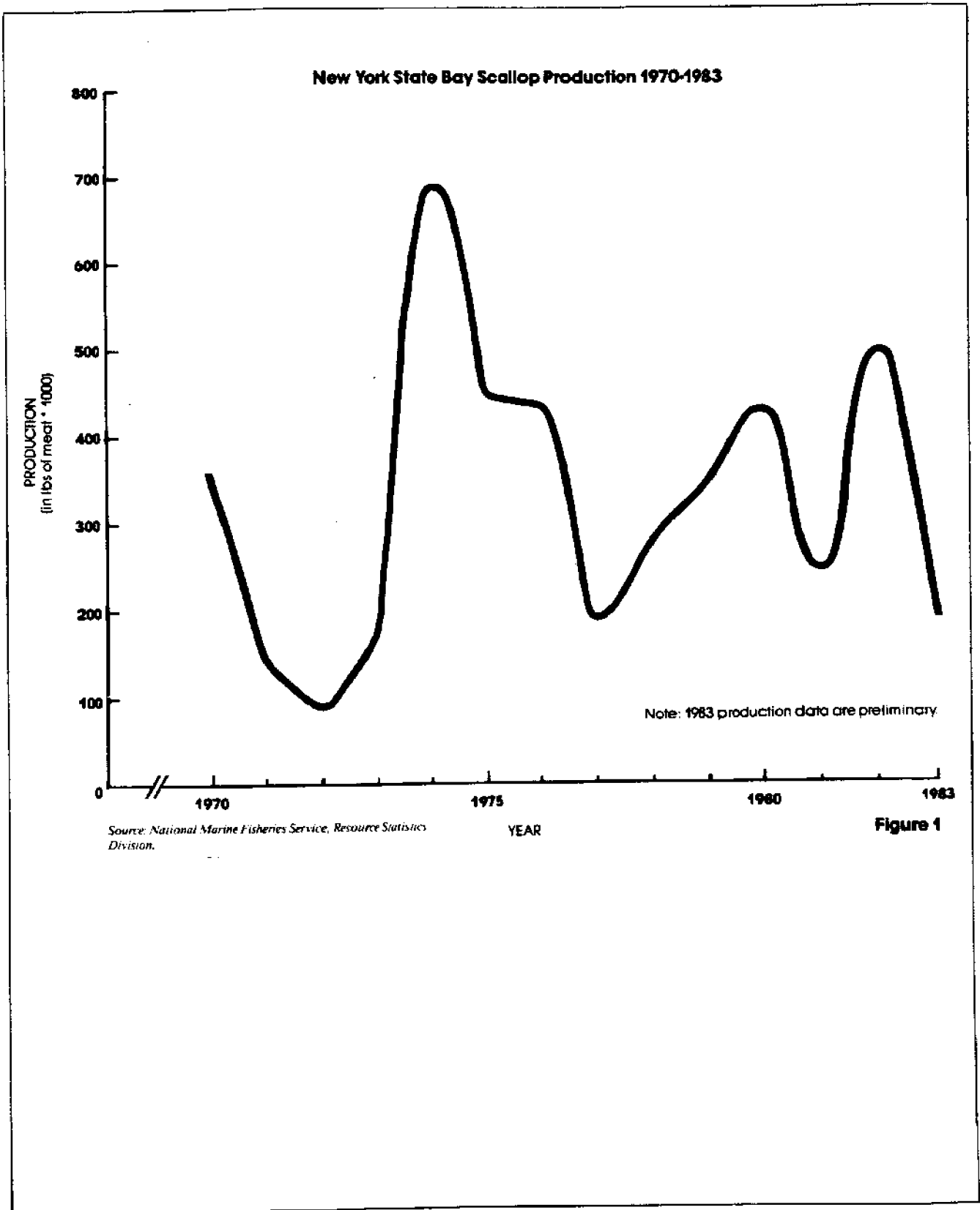
Increased pollution of marine and freshwater areas threatens public health. In New York, about 20% of the shellfish beds are closed as a public health measure (Hendrickson, pers. comm., May 23, 1984). Aquaculture could help assure the safety of consumers by providing high-quality shellfish. Culture areas are carefully chosen and monitored and a high degree of accountability can be maintained since each aquaculturist will be traced easily by his product.

Aquaculture could provide a means of aquatic food production to help meet rising consumer demand. Per capita consumption of fish is expected to increase an average of 3.4% per year (Port Authority of New York and New Jersey, June 1981 p. 1). Production of the world's fisheries has remained level whereas aquaculture has more than doubled in 10 years. Aquaculture has the potential for continued expansion; fisheries may be constrained by the natural biological limits of target species.

Aquaculture could help stabilize the supply of some species and supplement the stocks of those which are locally limited by pollution or overharvest. Demand for seafood is high in New York. Across the state there is a high consumer acceptance of fish and shellfish. Although demand is strong, supply of some species may be seasonally limited. For example, scallops by law may be harvested only during certain months of the year, limiting times when fresh scallops are available to consumers. At other times of the year scallops will be in short supply or in frozen form. In addition, availability of scallops varies widely from year to year depending on the wild harvest. Aquaculture could provide an alternative to this erratic supply and help even out the production (see Figure 1). This would benefit consumers, who could depend on a fresh supply year-round, and fishermen or culturists, who could depend on a stable price. Manufacturers of processed seafood products require a consistent supply of high quality fresh fish (Baker, pers. comm., June 10, 1982). Aquaculture in the near term may not be able to supply such processors economically, but a number of companies have expressed interest in exploring the possibilities for increased aquaculture production including Coca Cola, Weyerhaeuser, and Con Agra. The venture capital is coming mainly from these large companies. "The big companies are looking at aquaculture because there's a diminishing supply of fish, and if fish farms are the answer, we want in," was the explanation of a scientist for one corporation" (Saltus, 1981, p. 116).

In addition, aquaculture could produce a higher quality product of more uniform size, more consistent flavor and texture. This has several advantages. Long Island Oyster Farms achieves economies in processing through careful management of oysters. Ordinarily, wild harvest oysters have irregularly shaped shells, many of which may have grown together. By eliminating overcrowding, the Oyster Farms grows more uniformly shaped oysters which can be shucked more easily after harvest and which bring a higher price from restaurants and others who demand consistent quality and size (Mulhall, pers. comm., July 20, 1982).

Another shellfish, mussels, often have pearls, poor meat yield, off-color meat, or other defects owing to variations in natural food available, and foreign matter (sand) in the meat. Commercial processors do not like to use these



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organisms because the pearls and other foreign material cause problems in processing and cooking. Consumers do not like the off-color and low meat yields. Cultured mussels can virtually eliminate all these problems, increasing yield and providing a superior product (Lutz, 1980, pp. 9-10).

Further opportunities lie in the production of aquatic products for the extraction of industrially important substances.

Exploitation of the biochemistry of marine organisms is in its infancy, yet offers the opportunity to introduce important new products to commerce, medicine, and agriculture and to substitute, in part, for products and organic materials derived now from increasingly expensive fossil chemicals, primarily petroleum and natural gas. Not to be discounted is the potential of marine biomass to serve as a source of energy directly or through fermentation to alcohols or other simple chemicals. Production of chemical feedstocks by fermentation offers greater promise because the chemical value of a reactive or "starter" compound is about three times its value as a fuel. (Attaway, draft, 1983, p. 2)

Research is being conducted in New York on various methods of culturing and utilizing seaweed, particularly the brown kelp, Laminaria saccharina. The Gas Research Institute, the New York State Energy Research & Development Authority, the New York Gas Group, and the New York Sea Grant Institute worked together for five years, spending about \$2 million to demonstrate the feasibility of cultivating this kelp to be used as feedstock for producing methane (natural gas). Now that its culturability has been proven in New York waters, scientists are focusing on ways to improve yield such as strain selection and cloning. There is a potentially wide variety of uses for Laminaria apart from fermentation to methane. These include production of butane diol, a building block for synthetic rubber, and alginates which are used throughout in the textile printing industry and the food processing industry as thickeners, stabilizers, emulsifiers, gelling agents, clarifiers, and preservatives (Chapman, 1980).

### New York's resources

Water is a primary ingredient for aquaculture, and New York has abundant marine and freshwater resources. The state's borders include 1670 miles of marine coastline and 1440 miles of coast on the Great Lakes. Inland the state has numerous lakes and rivers although springs and groundwater are perhaps the best sources for freshwater aquaculture because they are uncontaminated by diseases of wild fish. An inventory of salt and freshwater resources appropriate to aquaculture is recommended in this plan's Section 5. Trained labor is also important; a large pool of labor already exists in farmers and fishermen who possess many of the basic skills required. New York's colleges and universities could provide training in aquatic animal husbandry to develop successful culturists. Some support services required by aquaculturists are already available. New York hosts 4 shellfish and over 20 finfish hatcheries to provide juvenile animals for further grow-out. Extension services are in place to assist further development of the marine culture industry.

### Increased interest in aquaculture

At the federal level, some of the first legislation addressing aquaculture



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was the 1871 act creating the US Commission of Fish and Fisheries. One of the first pieces of federal legislation to mention aquaculture specifically was the National Sea Grant College and Program Act of 1966 (33 USC sec 1121 et seq.), which recognized "that aquaculture, as with agriculture on land, . . . can substantially benefit the United States" (33 USC sec 1121[c]) (Newton, 1978, p. 67). Other early pieces of federal legislation were 16 USC 750-751 in 1922 on propagation of mussels and 16 USC 760h in 1961 on establishment of the Milford, Connecticut federal shellfishery research laboratory.

The Agricultural Research Act of 1977, signed into law as 7 USCA sec 3122, gives the US Department of Agriculture responsibility to coordinate, identify, and fund agricultural research and extension needs. Aquaculture is specifically mentioned as one of the research areas in this Competitive Awards Program. Although the Department of Agriculture has initiated some research, it has been limited by funds (Newton, 1978, pp. 70-73).

The first United States law to address specifically the problem of and need for aquaculture development in this country and the coordination of federal government support is the National Aquaculture Act of 1980. In its "Findings" Congress recognizes the potential for aquaculture to expand in the US and to fill the need for increased fishery products, leading to a decrease in the balance of trade deficit. While Congress affirms that the primary responsibility for the industry's development rests with the private sector, the legislators find that the industry has been inhibited by many economic, legal, and production factors. Therefore, the purpose of the act is to promote aquaculture in the United States by (1) declaring a national aquaculture policy; (2) establishing and implementing a national aquaculture development plan; and (3) encouraging aquaculture activities and programs in both the public and private sectors of the economy (National Aquaculture Act of 1980).

The act established a national policy to encourage aquaculture in the United States and called for a national development plan to be put together by the Secretaries of Agriculture, Commerce, and Interior (Joint Subcommittee on Aquaculture, 1983), and for a continuing assessment of aquaculture in the United States thereafter by the three Secretaries. As prescribed by the law, the Secretaries have conducted studies of the capital requirements for the aquaculture industry as well as of regulatory constraints to industry development. In addition, all aquacultural support activities are coordinated through an interagency coordinating group, operating as the Joint Subcommittee on Aquaculture of the Federal Coordinating Council on Science, Engineering and Technology.

Reauthorization of the 1980 National Aquaculture Act is still underway. On April 25, 1985, after holding hearings, the House Fisheries Subcommittee approved a bill (H.R. 1544) to reauthorize the program and amend it to: (1) establish the Secretary of Agriculture as the lead federal official for aquaculture; (2) establish a National Aquaculture Information Center in the Department of Agriculture; (3) require a report on the effects of aquaculture on existing fisheries, and (4) require a study on the potential impacts of introducing non-native species through aquaculture. In September 1985 the House passed the National Aquaculture Improvement Act of 1985 (H.R. 1544), authorizing appropriations of \$3 million each to the Departments of Agriculture, Interior, and Commerce for fiscal years 1986-88. This represents a 40% reduction in federal expenditures on aquaculture but proponents believe it is, nonetheless, a step forward given the national budget deficit.

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States participate in implementation of the National Aquaculture Plan. The US Secretaries of Agriculture, Commerce, and Interior are required to consult and cooperate with interested persons, including state agencies. A number of New York aquaculture experts helped draft the National Aquaculture Development Plan.

Interest in aquaculture development in New York State is not limited to the participation in federal efforts or the writing of this plan. Governor Cuomo in his 1984 message to the state legislature called for a project to demonstrate the potential for economic development in New York through aquaculture (see "Aquaculture in New York Today" above). The Governor also requested the preparation of a statewide master plan for economic development in agriculture, including aquaculture, to the year 2000. That plan has been completed (see Agriculture 2000 Project in Literature Cited).

### THE FUTURE OF AQUACULTURE IN NEW YORK

#### Promising species

The future of New York aquaculture is in the cultivation of marine shellfish, marine finfish, freshwater finfish, and aquatic plants. The outlook for each of these groups depends on a number of variables including biological and technical considerations; markets, economics and finance; social and political environment; public policy; and support services available to the industry. These factors are addressed in following pages. However, in order to project a profile of the industry, a number of experts were asked to consider the effect of these on industry development for each group of organisms, over time, under different levels of political and financial support, and to identify those species which have the greatest potential for development. A summary of the survey follows (see Table 6).

Of shellfish, oysters and hard clams present the most immediate opportunities in terms of technological advancement, market potential, and, to some degree, investment interest. The oyster has been cultured for over a century and is a model aquaculture product worldwide. Other species, including the bay scallop and blue mussel, have excellent long-term potential. For all shellfish, however, a number of factors could limit potential, and financial and political support will be required to overcome these inhibiting factors.

Development of marine finfish aquaculture will be led by striped bass in both the near and long term, and some believe Atlantic salmon also offers excellent opportunities although no commercial-scale ventures presently operate in New York. Flounder, eels, weakfish, and black sea bass offer near- and long-term potential. Pufferfish may offer high potential in both the short and long term. Markets for these marine species are good and can remain strong with some support. Although technology is well developed for some species such as striped bass, considerable effort will be needed to improve the culture techniques for many others. Strong market demand could encourage investment in some of the high-value species.

A variety of freshwater finfish species including salmon, trout, and baitfish have potential for aquaculture development in the next decades. Freshwater species such as trout have been cultured successfully for over 100 years. Markets look good for these species, especially for local consumption and use, although competition from other states and countries will be strong if national and international markets are sought. Some states have even experienced surpluses of

Table 6  
 AQUACULTURE DEVELOPMENT POTENTIAL OF SELECTED  
 SPECIES IN THE NEAR AND LONG TERM (1)

Species	Near Term (to 1990)			Long Term (to 2000)		
	None	Some	High	None	Some	High
<b>Shellfish:</b>						
Hard clam			----->			----->
Soft clam	----->			----->		
Surf clam		----->		----->		
Bay scallop		----->		----->		
American oyster		----->		----->		
European oyster		----->		----->		
Blue mussel	----->			----->		
American lobster	----->			----->		
Blue (claw) crab	----->			----->		
<b>Marine Finfish:</b>						
Summer flounder		----->		----->		
Winter flounder	----->			----->		
Eel		----->		----->		
Weakfish	----->			----->		
Atlantic salmon		----->		----->		
Black sea bass		----->		----->		
Striped bass		----->		----->		
Pufferfish			----->			----->
<b>Freshwater Finfish:</b>						
Trout		----->		----->		
Salmon		----->		----->		
Perch		----->		----->		
Walleye		----->		----->		
Sturgeon		----->		----->		
Baitfish		----->		----->		
Eel	----->			----->		
Atlantic Salmon		----->		----->		
Bullhead		----->		----->		
<b>Aquatic Plants:</b>						
<u>Laminaria</u> (Kelp)	----->			----->		
<u>Gracilaria</u>		----->		----->		
<u>Codium</u>		----->		----->		

Based on informal survey of aquaculturists and researchers, March 1984.

(1) Lines indicate consensus, arrows majority, of opinion. 1 arrow, opinion skewed one direction. 2 arrows, opinion evenly divided.

## AQUACULTURE YESTERDAY, TODAY, AND TOMORROW

frozen trout and catfish because marketing needs were not addressed beforehand.

While a variety of seaweed species of commercial importance can be grown in New York, competition from California, China, and Japan will restrict development of high demand species such as kelp. But New York could be a leader in species used in production of specialized products such as marine polysaccharides and biopolymers. A necessary adjunct and valuable opportunity for New York is the development of a seaweed processing industry. Technological development and markets are strong, but greater public support will be needed to encourage development in seaweeds.

A future potential for New York aquaculture is the production of fish and shellfish in the warm water effluent of power generating plants. This concept has been tested with some success in New York by the Long Island Oyster Farms for nursery grow-out of shellfish on Long Island, and as previously mentioned, a few Long Island companies are now using space in the thermal effluent of LILCO. It is an ongoing success in New Jersey where a power company harvests 10,000 pounds of effluent-raised tilapia each week (Stolpe, pers. comm. September 1982). A problem remains with contaminants released by the plant and by periodic plant shutdowns, but this form of culture can take advantage of the waste heat generated to promote increased growth rate in animals and should be explored further.

### **Circumstances affecting development**

Even though New York has the resources needed to encourage aquaculture development and aquaculture could provide a number of opportunities for the state, growth of the industry has been slow and future expansion considered unlikely by some. A variety of factors ranging from the biological and technical to the legal and political continue to hinder development.

Constraints on orderly development of aquaculture tend to be political and administrative, rather than scientific and technological. . . development of aquaculture in general has been constrained by limited public support. (National Academy of Sciences, p. 1)

These factors are considered in greater depth in the remainder of this study.



III

## Aquaculture and the Law

### III. AQUACULTURE AND THE LAW

Two recent studies of aquaculture and the law completed by Professor Milton Kaplan, Law School, State University of New York at Buffalo, provide a comprehensive framework for understanding how aquaculture is affected by leasing policies and regulatory strictures. These studies, sponsored by and available from the New York Sea Grant Institute, form the basis for this study (Kaplan, April 1984, and May 1984).

#### INTRODUCTION

Just as farming on dry land requires access to arable acreage, the space needs of aquaculture can be met only by access to lands and waters adapted for its purposes. Given the nature of most types of aquaculture presently practiced or having potential for future development in New York, access to lands or waters in or bordering large water bodies is critical. The limited supply of such land, particularly along the coasts of or near Long Island, the fact that several user groups are in competition for the space, and the fact of public ownership of most of the submerged lands in the coastal zone account for the special spatial problems faced by the New York aquaculture industry.

For the most part, lands under non-navigable streams and ponds are in private ownership. In acquiring them or any other privately owned lands for their purposes, aquaculturists are subject to much the same rules governing the acquisition of private land generally, posing no special problems demanding attention here.

The problems of access to rights in land for aquaculture in New York relate to lands owned by the state or local governments, or to some extent held by their grantees or lessees. Federal ownership of underwater lands is confined to land acquired by the United States from prior owners by eminent domain, gift, or purchase; "lands expressly retained by or ceded to the United States when the State entered the Union"; certain tribal lands; and lands occupied by structures built by the United States government "in the exercise of its navigational servitude" (43 USC sec. 1313). They are not an important factor in the development of New York's aquaculture industry. The only federal lands of potential significance for aquaculture are those lying within the territorial sea (waters within three miles of the state's coastline) adjacent to the Fire Island National Seashore in Great South Bay, to the extent formal steps may have been taken to acquire them; and the Wertheim National Wildlife Refuge under or near Bellport Bay.

#### ACCESS TO STATE LANDS UNDER NAVIGABLE WATERS

Through assumption of ownership of lands formerly held by the British crown, the state owns most of the lands under navigable waters (Public Lands Law sec. 4). These include waters both inland and within three miles from the state's coastline as confirmed by Congress in the Submerged Lands Act, 43 USC sections 1311(a), 1312 (1976). Pursuant to interstate compact with Connecticut, underwater lands south of the middle of Long Island Sound are owned by New York State.

The various statutes authorizing the transfer of rights in state lands to

## AQUACULTURE AND THE LAW

private parties were designed to deal with particular needs. Most of those needs were unrelated to aquaculture, and those that were so related accommodate only one type of aquaculture, usually of shellfish. Existing statutes create ambiguities in the various authorities of agencies empowered to grant leases or other private property interests in state owned underwater lands. The distribution of authority among several agencies works against the establishment of a coherent policy or leadership in approaching leasing of state underwater lands. The authorities of the Office of General Services, the Department of Environmental Conservation, and Suffolk County are outlined below.

### Short-term leases

The Commissioner of General Services may grant leases for terms up to five years (possibly renewable) on state lands, under the superintendence of his office, not appropriated to any immediate use. However, the wording of the enabling statute indicates that this authority might not embrace underwater lands (Public Lands Law sec. 3[1] [2]). Subdivision two mentions underwater lands in regard to rights and easements but not in regard to leases. It could be inferred that the legislature meant to exclude underwater lands from the leasing provision. However, Kaplan notes that this is probably not the case since the original subdivision two did not contain a specific reference to underwater lands "and cannot be regarded as showing a conscious legislative decision to bar leases of underwater lands" under this subdivision (Kaplan, April 1984, p.24). If clarified to include underwater lands, this statute could provide additional resources for aquaculture development. The five year limitation on the lease, however, would limit its use by aquaculturists who need sufficient time to recover investment capital.

### Rights and easements

The same statute authorizing the Office of General Services to grant leases of up to five years includes the power to "grant rights and easements in perpetuity or otherwise in and to all state lands, including lands under water" (Public Lands Law sec. 3[2]). The statute considers the preservation of the rights or easements upon subsequent disposition of title to others. The limited scope of "rights or easements" would conceivably limit their utility for types of aquaculture requiring the installation of structures, or the use of substantial space.

### Long-term leases

Although the Commissioner of General Services is empowered to grant long-term leases, not exceeding 99 years, of lands not needed for present public use, and the grant may include "subterranean rights," the leasing is subject to competitive bidding and there is some doubt as to whether the enabling law limits the leases of subterranean rights to areas adjacent to highways (Public Lands Law sec. 3[4-a]).

### Grants of underwater lands to adjacent upland owners

The Commissioner of General Services may grant land under water, in specified areas, in perpetuity or otherwise, to owners of adjacent uplands, "to promote the commerce of this state or for the purpose of beneficial enjoyment thereof by such owners, or for public park, beach, street, highway, parkway, playground, recreation or conservation purposes" (Public Lands Law sec. 75[7]). The promotion

of "commerce" and "purpose of beneficial enjoyment" would appear to cover aquaculture. However, the restriction to grantees owning adjacent shorelands might bar the granting of rights to subaqueous lands lying beyond the shore. An additional constraining factor is the limitation of the grants to areas "[a]djacent to and surrounding Long Island," and the part of Westchester County "lying on the East river or Long Island Sound, but not beyond any exterior water line established by law" (id sec. 75[6]). Kaplan notes that the effect of this limitation on aquaculture depends on "the water depth in a particular locality; the desirability of locating aquaculture facilities near the shore; and the existence or non-existence of such exterior water lines in a particular location" (Kaplan, April 1984, p. 28).

#### Leases and permits for marine plant and animal cultivation

From 1877 to 1893, legislation authorized the commissioners of fisheries to grant franchises for shellfish cultivation on state lands. Legislation in 1893, now found in the Environmental Conservation Law, shifted this authority from franchises to leases, authorizing the leasing, for 10 years, of "state owned lands under water for the cultivation of shellfish," with the exception of lands within 1000 feet of high water mark in specified areas along the shores of Gardiner's and the Peconic bays (Environmental Conservation Law sec. 13-0301). The statute does not provide sufficient flexibility, however, for the department to issue leases for other types of aquaculture, such as finfish or plant, and conditions of the leasing restrict size to minimum 50-acre plots for on-bottom and 5-acre plots for off-bottom culture. Furthermore, the provision that "lands shall not be leased where there is an indicated presence of shellfish in sufficient quantity and quality and so located as to support significant hand raking and/or tonging harvesting" (Environmental Conservation Law 13-0301) needs to be more clearly defined. As presently written, the phrase "indicated presence of shellfish" can be, and is, interpreted as meaning the presence of even a few individual shellfish.

The Department of Environmental Conservation also has the authority to issue permits for the operation of marine hatcheries and for the on- and off-bottom culture of marine shellfish, finfish, and plants. (Environmental Conservation Law 13-0316). Kaplan identifies several problems in reading these statutes together. First, an applicant for an off-bottom culture of shellfish permit after 1973 is not required to hold a lease on at least five acres of underwater lands (Environmental Conservation Law 13-0301, amended by 1973 NY Laws ch. 632).

Did that mean that the applicant would have to show that he already held a lease on some bottom ground, even though less than five acres; or that the off-bottom permit itself would grant him the necessary license to use the bottom? There are two facets to the problem: (1) Would the Department's permit alone grant the applicant a right to use state owned underwater lands, if he did not in addition hold some lease or other user right from the state, or would he have to obtain a lease from the Department of Environmental Conservation or a lease or other form of user right from some other state agency? (2) If the underwater lands were owned, or their use controlled, by a municipality, would the state permit allow the use of the water bed without local permission, by way of a lease, license or some other type of local authorization? (Kaplan, April 1984, p. 33)



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Kaplan notes that the Department of Environmental Conservation regulations clarify the issue by requiring applicants to have appropriate legal control, by lease, grant, etc., over lands owned by a town or by the state. However, the 1983 amendment to Environmental Conservation Law, section 13-0316, authorizing the department to issue permits for on-bottom as well as off-bottom shellfish culture further confounds the issue by:

adding the precondition that the applicant shall have obtained the written authorization of the person or political subdivision having title or legal control of the underwater lands on or above which such on-bottom or off-bottom culture shall take place.'[1983 NY Laws ch 467] If the bottom land is owned by a municipality and has not been leased out to a private person, the question may arise whether the amended section 13-0316 itself authorizes the municipality to give the approval without having to grant a lease on the bottom land. An additional feature of the amended statute needing clarification is the absence of any reference to authorization to use bottom lands owned by the state. The provision for obtaining the written authorization of the "person or political subdivision" with title or control does not apply to the state. The state itself is not one of its political subdivisions nor is it a "person" within the meaning of that term in the Environmental Conservation Law. (Kaplan, April 1984, pp. 35-36)

Kaplan notes that revised regulations of the Department could clarify these issues but that statutory revision may be needed to resolve them altogether (Kaplan, April 1984, p. 36).

### **Underwater lands ceded to Suffolk County**

The state legislature ceded lands under the Peconic bays and Gardiner's Bay to Suffolk County for the purpose of promoting shellfish cultivation (L 1884, ch 385, as amended by L 1923, ch 191, and L 1969, ch 990). Suffolk County leasing under this authority is conditional on the county's surveying and mapping the lands to determine the locations of existing private interests, a condition not yet fulfilled. Questions regarding the construction and application of the law have been raised, including whether Hog Neck Bay and Southold Bay are considered part of Little Peconic Bay and whether Orient Harbor is considered a part of Gardiner's Bay for the purpose of the law; whether the county's leasing rights are confined to reverted and escheated lands; whether the law bars the Commissioner of General Services from granting ownership or user interests in bottom lands of these bays; and whether the law has impaired any jurisdiction the town of Southold might have in part of the lands covered by the law. If these or any other issues arising from the law are deemed sufficiently serious upon further study, legislative clarification may be in order.

#### **Recommendations:**

- The legislature should establish a policy in support of aquaculture development in New York State.
- Responsibility for making underwater lands available for aquaculture development should be clearly defined. A conference of involved parties including the Office of General Services, the Department of Environmental

Conservation, and Suffolk County should be held to clearly identify and establish lead responsibility.

- The lead agency should be given unique authority to make leases of lands for shellfish, finfish, and plant aquaculture of suitable size and duration. Some authorities suggest these should be of up to a maximum of 100 acres for up to 20 years.
- The lead agency should be given the authority to revoke and renew leases of underwater lands for aquaculture based on performance criteria to be established by the lead agency with guidance from industry and other interested departments.
- The lead agency should establish other terms of aquaculture leases including rents, transferability, and disposition of improvements to the leased land upon termination of the lease with guidance from industry and other interested departments.
- The Department of Environmental Conservation aquaculture permitting laws should be clarified to specify whether proof of legal access to underwater lands is required before a permit will be granted.

#### Leasing of underwater lands owned by Long Island towns

Complex legal issues have been raised, many of them litigated or currently in litigation, regarding the authority of agencies of Long Island towns to grant leases for aquaculture purposes on lands owned by them under bays or other tidewaters flowing into Long Island Sound or the Atlantic Ocean. The complications may arise because the ownership interests of the respective towns have been derived from individual colonial patents preceding independence, overlaid by 150 years of special state legislation adding to or altering powers of particular towns to deal with their lands. The major issues are (1) whether the leasing authority lies in town boards or special boards of trustees created to manage certain town properties; (2) whether procedural requirements in general laws govern leases of the town lands; and (3) whether the leases are constrained by statutory or common law rules limiting the alienation of lands held in a trust capacity.

Some of the Long Island colonial land patents designated trustees to hold the land and others did not. Important questions arising from this are, first, why?; second, does this make a difference today?; and third, "does the trust status give the trustees any more or less flexibility than the town board has in conveying or leasing the land for aquaculture purposes?" (Kaplan, April 1984, pp. 59-60).

Some special state laws have expressly recognized the powers of particular towns to grant leases for shellfish cultivation; but in doing so pose the question whether leasing for other aquaculture purposes would be ultra vires. The particular wording of other statutes not expressly mentioning shellfish cultivation may raise other questions of interpretation potentially clouding the prospect for leasing for various other types of aquaculture such as finfish and plant.

The question whether leases of underwater lands by the Long Island towns for aquaculture must comply with the permissive referendum requirement of section

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64(2) of the Town Law has not been directly confronted by New York's highest court. Kaplan notes from cases involving the permissive referendum requirement that compliance is required...

(1) . . . unless the sale or lease is made by a board or trustees with legal status separate from that of the town board, or by the town board itself or other local unit acting under legislative authority superseding the Town Law provision; (2) such legislative authority may be found in statutes confirming the patents or in special statutes creating and defining the powers of the trustees; and (3) absent such authority the mere fact that the lands were derived from colonial grants will not justify disregard of the Town Law requirement. (Kaplan, April 1984, p. 83)

Kaplan concludes that the enabling statutes of a particular town governing the leasing or conveyance of town-owned lands must be carefully analyzed to determine the authority of the town for granting leases for various aquaculture operations (Kaplan, April 1984, p. 84).

Statutory and common law "public trust" restrictions on the grant of exclusive rights in navigable waters, though conceivably not a serious barrier to the leasing of underwater lands for aquaculture facilities of modest proportions, may be sufficiently troublesome to demand legislative attention. Sweeping law reform may not be essential to make the land resources of Long Island towns accessible for aquaculture, but even limited proposals for revision of existing laws should be approached with the whole picture in mind, and with the idea of bringing some measure of uniformity and certainty into the system.

### Recommendations:

- Special state statutes authorizing some Long Island towns to lease town-owned underwater lands for shellfish cultivation should be amended to include leasing for finfish and plant aquaculture.
- Long Island Towns should investigate their authority for making leases of town-owned underwater land for aquaculture and adopt policies that will encourage local development.

## REGULATIONS TO CONTROL THE FLOW OF WATERS TO PROTECT NAVIGATION AND WATER RESOURCES

### Federal regulations

#### Regulation of placement of structures and dredged and fill materials in navigable waters

To protect navigation the federal government regulates activities creating obstructions in or impairing the flow or circulation of navigable waters (Rivers and Harbors Appropriation Act of 1899, sec. 10, 33 USC sec. 403; Federal Water Pollution Control Act, as amended, sec. 404, 33 USC sec. 1344). Permits from the US Army Corps of Engineers (the Corps) are required for the installation of aquaculture facilities that might create obstructions in or involve excavation, filling or altering the course of navigable waters (33 USC sec. 403); or to

discharge dredged or fill materials in navigable waters (Federal Water Pollution Control Act, 33 USC sec. 1344). Statutory exemptions of the discharge of dredge and fill material from various "farming" and "silviculture" activities include discharges from the "construction or maintenance of stock ponds" (33 USC sec. 1344[f]). The Corps' specification of permitted disposal sites of dredge and fill material must follow guidelines set by the Administrator of the Environmental Protection Agency, and may be subject to the administrator's veto or restriction if the discharge would have "an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas (including spawning and breeding areas), wildlife, or recreational areas" (id sec. 1344[b],[c]).

The state, with approval of the Administrator of the Environmental Protection Agency (acting upon advice of the Corps and other concerned federal agencies), may itself administer a program of issuing permits for the discharge of dredge and fill material (id sec. 1344[g]).

#### **Fish pounds and traps**

Hunting and Fishing Regulations promulgated by the Corps in the exercise of its jurisdiction over obstructions to navigation include the designation of areas in bays or estuaries tributary to Long Island Sound and to parts of the Atlantic Ocean south of Long Island, and in the Hudson River, in which the use of fish pounds or other fishing structures may be used; and provision for the granting of permits for these structures outside of the designated areas (33 CFR sections 206.40, 206.45 [1892]).

#### **Navigational aids**

The installation of aids to navigation such as buoys, lights, or other signals in connection with the maintenance of fixed structures or floating facilities used for aquaculture (e.g., oyster cultivation rafts) is subject to approval of the Coast Guard, and must comply with Coast Guard regulations (14 USC sections 81-85; 33 CFR, Part 62).

#### **State regulations**

##### **Structures interfering with navigation**

Apart from the state enforcement of federal laws controlling obstructions in navigable waters, under permit programs approved by federal authorities, New York administers permitting requirements of its own to protect navigation. Section 32 of the Navigation Law makes it "unlawful to construct, in the navigable waters of the state, any wharf, dock, pier, jetty, or other type of structure without first obtaining a permit therefore in conformity with the provisions of" section 15-0503 of the Environmental Conservation Law. The Environmental Conservation Law section delegates the permitting power to the Department of Environmental Conservation. Problems of interpretation may result from the fact that situations subject to permitting under that section differ from those in the Navigation Law section.

State jurisdiction under the Navigation Law extends to "navigable waters" of the state, but the Navigation Law definition of that term expressly excludes "all tidewaters bordering on and lying within the boundaries of Nassau and Suffolk counties" (Navigation Law sec. 2[4]). That exemption is not found in the Environmental Conservation Law.

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The issue is further complicated in the cross-referencing of the laws because section 32 of the Navigation Law applies to "any type of structure," while section 15-0503 of the Environmental Conservation Law, with certain specified exceptions, applies to a "dam or impoundment structure, including any artificial obstruction, temporary or permanent, in or across a natural stream or water course." As applied to structures used for various types of aquaculture, the limiting scope of the terms "natural stream or water course" or "dam or impoundment structure," if relevant, may make a difference. For the purposes of the Environmental Conservation Law section, the contrasting term "waters" is defined broadly to include any waters of the state, navigable or otherwise (sec. 15-0105; and see 6 NYCRR sec. 608.1[h]).

Section 15-0503 of the Environmental Conservation Law exempts particular types of facilities, including a "farm pond erected upon lands devoted to farming for the purpose of . . . propagation of fish," unless specified dimensions of the pond exceed certain minimums (subdivision 4[b]). Though a farm pond would not likely contain navigable waters subject to the Navigation Law, other facilities exempted from the permitting requirements of section 15-0503 of the Environmental Conservation Law might be located in navigable waters, including a "dock, pier, wharf or other structure under jurisdiction of the department of docks, if any, in a city or town of over one hundred seventy-five thousand population," or "built on floats, columns, open timber, piles or similar open-work supports having a top surface area of two hundred square feet or less" (subsection 4; and see 6 NYCRR sec. 608.3[b][2]). The Department of Environmental Conservation may, by rule or regulation, allow one application to cover projects requiring permits for the placement of structures in navigable waters as well as for the depositing of dredged or fill materials or disturbance of streams under other sections of the law (noted below) (id sec. 15-0503[3][d]).

The potential problems for the siting of aquaculture facilities arising from the cross-referencing scheme or from the use of ambiguous terminology in section 15-0503 necessitate a careful review of the statutes by the legislature to reduce uncertainty.

### **Recommendation:**

- Section 32 of New York State Navigation Law and section 15-0503 of New York State Environmental Conservation Law which address permitting of construction of docks and other structures in the waters of New York State should be reconciled to clarify their authority and scope regarding which waters and what structures are covered under each law.

### **Excavation or fill in navigable waters**

If the construction of aquaculture facilities requires the excavation or fill of "navigable waters of the state, or in marshes, estuaries, tidal marshes and wetlands that are adjacent to and contiguous at any point to any of the navigable waters of the state," a permit must be obtained from the Commissioner of Environmental Conservation (Environmental Conservation Law sec. 15-0505; and see Navigation Law sec. 31, and 6 NYCRR sec. 608.5). However, a similar confusion arises over the applicability of this law in the tidewaters waters of Nassau and Suffolk counties as with the cross referencing of Navigation law section 32 and Environmental Conservation Law section 15-0303.

**Fish pound or trap nets**

Though incorporated in a section of the Environmental Conservation Law aimed at regulating fishing modes, one provision concerned in part with the protection of navigation authorizes the Commissioner of Environmental Conservation to permit the use of "pound or trap nets" in specified areas in the Peconic Bay "provided they do not interfere with or obstruct navigation or the carrying out of shellfish cultures" (sec. 13-043[14][3]).

**Interference with the course, channel or bed of fresh surface water courses**

A permit from the Department of Environmental Conservation would be required for fish farming operations calling for change, modification, or disturbance of the course, channel, or bed of any freshwater courses, defined as including ponds or lakes of 10 acres or less (Environmental Conservation Law sec. 15-0501; and see 6 NYCRR sec. 608.2).

**Floating objects**

Sections 35, 35-A, and 36 of the Navigation Law bar the placement of floating objects in the navigable waters of the state, whether serving as navigational aids or other purposes, without a permit from the Commissioner of Environmental Conservation, or as permitted by United States laws or a local ordinance approved by the commissioner. Questions may arise regarding the applicability of some of these provisions to certain types of floating aquaculture facilities (e.g., an occasionally attended raft or other structure for seaweed farming). Presumably these provisions would not apply to "tidewaters bordering on and lying within the boundaries of Nassau and Suffolk Counties" (Navigation Law sec. 2[4]).

**Local government regulations**

Some local governments, notably a few in Long Island, have enacted local laws or ordinances regulating the placement of docks or other structures in waters under local jurisdiction, or restricting dredge or fill operations in such waters. It is difficult to generalize regarding the problems they may pose for aquaculture. The regulatory authority of a local government or its application to aquaculture facilities or operations may depend on a number of factors. (1) Attempts have been made by Long Island towns to justify the regulations on the basis of their ownership of underwater lands through colonial grants or state patents. (2) Home rule provisions of the state constitution or statutes may or may not provide a base for the local regulations. (3) The local legislation may or may not fit within the boundaries of municipal authority delegated by state statutes dealing with particular police power subjects. (4) Although the local government may purport to act pursuant to general delegations of police power, their regulations may be inconsistent with preemptive state statutes or regulations. (5) The local laws or ordinances, if framed to cover traditional types of structures or activities in waters (e.g., the placement of docks), may or may not be construed as covering aquaculture structures or operations.

The uncertainties of having to deal with restrictive local regulations of the placement of structures in or under town-controlled waters on a case-by case basis are sure to discourage aquaculture entrepreneurs. To be meaningful, a state legislative declaration of state policy to encourage aquaculture should be accompanied by statutory guidelines or other mechanisms to clarify the allocation of such regulatory powers between the state and local governments, and ensure fair

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consideration of aquaculture needs in the administration of such local regulations.

### Recommendation:

- The legislature should clarify the allocation of regulatory powers among state and local governments regarding control over local navigable waters.

## ENVIRONMENTAL CONTROLS

### Federal regulations

The federal government regulates the discharge of effluents into navigable waters under the Federal Water Pollution Control Act, as amended by the Clean Water Act (33 USC sections 1311 et seq) and National Environmental Policy Act of 1969 (42 USC sections 4321 et seq). Unless specifically excepted by the statutes, permits must be obtained from the Administrator of the Environmental Protection Agency.

The Administrator of the Environmental Protection Agency may "permit the discharge of a specific pollutant or pollutants under controlled conditions associated with an approved aquaculture project under Federal or State supervision" (33 USC sec. 1328[a]; and see 40 CFR sec. 125.10). This may be done in connection with the administration by the state itself of a permit program for aquaculture approved by the federal administrator (id sec. 1328[c]).

### State regulations

The policy of New York State to conserve and control its water resources, though calling for restrictions on aquaculture activities affecting state waters, at the same time is explicitly directed to the maintenance of reasonable standards of water quality in the interests of the "propagation and protection of fish . . . , including . . . aquatic life" (Environmental Conservation Law sec. 15-0105[7]; and see sec. 15-0103[8], which includes "shellfish" and "crustacea" among "aquatic resources" owned by the state). With particular reference to waters of the state in the marine district or to Long Island waters tributary to the marine district, the policy is implemented by a prohibition against the discharge of "any substance injurious to edible fish and shellfish, or the culture or propagation thereof, or which shall in any manner affect the flavor, color, odor or sanitary condition of such fish or shellfish so as to injuriously affect the sale thereof, or which shall cause any injury to the public and private shell fisheries of this state" (id sec. 17-0503).

### Permits for discharging effluents into state waters

The responsibilities for water pollution control, vested in the Department of Environmental Conservation, include the classification of waters of the state in terms of standards of purity, and the adoption and enforcement of "rules and regulations governing the use of chemicals in water for the control and elimination of aquatic vegetation, for the control or extermination of undesirable fish or for the control or extermination of aquatic insects" (Environmental Conservation Law sec. 15-0313[4]).

State law requires that a State Pollutant Discharge Elimination System or SPDES permit from the Commissioner of Environmental Conservation be obtained for the discharge of any wastes or effluents into the waters of the state (id sec. 17-0701). A state permit may not be required if the applicant holds an appropriate permit under the Federal Water Pollution Control Act or Rivers and Harbors Act (6 NYCRR sections 751.1, 752.1).

On April 1, 1983 the Environmental Regulatory Fee System was established by enactment of Article 72 of the Environmental Conservation law. This law authorizes the department to collect annual fees from public and private facilities required to have SPDES permits. This had a dramatic negative effect on the aquaculture industry in New York because, under the statute, aquaculture is defined as an industrial facility and thus assessed fees ranging from \$150 to \$15,000 depending on the volume of water discharged daily from the facility. Aquaculturists use large volumes of water primarily because the water is the medium for their aquatic crop, containing the necessary food and oxygen for its sustenance.

The Department of Environmental Conservation has proposed an informal solution to the problem for aquaculturists, who will be granted an exemption from the SPDES permit requirement for discharges of water used as a medium for culture which contain limited biological wastes. The SPDES permit will be required only for discharges of other chemicals such as might be used in occasional cleaning of the facilities (Hendrickson, pers. comm. May 23, 1984).

Informal solutions to this and similar situations are not satisfactory for aquaculture. They are susceptible to various interpretations and are an inadequate basis for investment decisions.

#### **Recommendation:**

- **The special requirements of aquaculture for abundant water flow to sustain the life of their culture organisms must be recognized within the SPDES permitting system. Permit costs for aquaculture facilities should not be equated with those of an industry in which water discharge is linked to effluent discharge.**

#### **Environmental impact assessment**

Environmental assessment procedures are prescribed in connection with the undertaking, funding, or issuance of leases, permits or licenses by any state agency, local government, or other political subdivision of the state for projects or physical activities "which change the use or appearance of any natural resource or structure" (Environmental Conservation Law sections 8-0101 et seq, the "State Environmental Quality Review Act," or "SEQRA"; 6 NYCRR sec. 617.2). They require the preparation and submission of environmental impact statements for actions specified in the regulations of the Department of Environmental Conservation, in a list labeled "Type 1 actions," or for actions not so specified which "may have a significant effect on the environment" (6 NYCRR sections 617.11, 617.12 [1978]). In view of the variety of types of state or local decisions relating to aquaculture, it is impossible to anticipate in advance the extent to which SEQRA procedures may be implicated by aquaculture development projects. It may be noted, however, that decisions or actions in the Type 1 list that might require environmental impact statements are those making local zoning changes affecting 25 or more acres, or "authorizing industrial or commercial changes within a



residential or agricultural [zoning] district," regardless of the amount of acreage involved; or "the acquisition, sale, lease or other transfer of 100 or more contiguous acres of land by a State or local agency" (6 NYCRR sec. 617.12). In addition, the regulations of the Department of Environmental Conservation provide that SEQRA procedures "will apply to activities" requiring permits to excavate, or place structures or fill in navigable waters, or to disturb the flow or beds of streams, "which may have a significant effect on the environment" (id sections 608.5, 608.9). Special environmental review procedures are prescribed with respect to permits involving stream protection (id sec. 615.2).

The specified criteria for determining whether a proposed action may have a significant effect on the environment, of possible relevance to aquaculture development, include a "substantial adverse change in existing . . . water quality"; "impacts on a significant habitat area" of "vegetation or fauna," or of "any resident or migratory fish"; the "creation of a hazard to human health or safety"; or "a substantial change in the use, or intensity of use, of land or other natural resources or in their capacity to support existing uses" (id sec. 617.11).

Environmental review, under the New York law, of actions with respect to which environmental impact statements have been prepared under the National Environmental Policy Act, as for example in passing on applications to permit dredge and fill operations or place obstructions in navigable waters, are to be considered in the affected state or local decision process (id sec. 617.9); but the submission of the statement under the federal law removes the obligation to submit one under the state law (id sec. 617.16).

#### Wetlands protection

Under the Tidal Wetlands Act, aquaculture activities of specified types (e.g., the erection of structures, or removal of soil) within or immediately adjacent to designated tidal wetlands, or "which may substantially impair or alter the natural condition of the tidal wetland area," may be conducted only with the approval of the Commissioner of Environmental Conservation (Environmental Conservation Law sections 25-0202, 25-0401, 25-0402). In acting on an application for a permit the commissioner must consider the compatibility of the proposed activity with "the public health and welfare, marine fisheries, shell-fisheries," and other factors (id sec. 25-0403).

Regulations authorized under the act are intended to allow only those uses of tidal wetlands and areas adjacent thereto that are compatible with the preservation, protection, and enhancement of the present and potential values of tidal wetlands (including but not limited to their value for marine food production), among other values (6 NYCRR sec. 661.1). Accordingly, the statute excludes from regulation the "depositing or removal of the natural products of the tidal wetlands by recreational or commercial fishing, shellfishing, [and] aquaculture . . . where otherwise legally permitted" (Environmental Conservation Law sections 25-0401[3]). The exemption of aquaculture is of questionable benefit because of limitations in the commissioner's definition of aquaculture as "the cultivation and harvesting of products that naturally are produced in the marine environment, including fish, shellfish, crustaceans and seaweed, and the installation of cribs, racks and in-water structures for cultivating such products, but . . . not . . . the construction of any building, any filling or dredging or the construction of any water regulating structures" (6 NYCRR sec. 661.4[d]).

Under a cooperative agreement with the Commissioner of Environmental Conservation to preserve or maintain tidal wetlands "in their natural or enhanced state," a local government may reserve the "right to operate or lease for operation shellfish beds lying within the area, and a reservation of the income from such operation or lease for the [local government] shall be allowed and not considered a violation of preservation and maintenance of a natural state" (Environmental Conservation Law sec. 25-0301[4]). The juxtaposition of the last savings clause with the provision relating to income is puzzling.

To some extent the burdens of multiple-permitting by federal, state and local agencies involving tidal wetlands are alleviated by regulations authorizing arrangements for joint processing of permit applications (6 NYCRR sections 660.13, 661.30), or by avoiding duplication to some extent where a wetland falls under both the Tidal Wetlands and Freshwater Wetlands acts (id sec. 66.20).

Similar permits are required under the Freshwater Wetlands Act for activities affecting freshwater wetlands of designated dimensions, but, as in the case of tidal wetlands, shellfishing and aquaculture are excluded (Environmental Conservation Law sec. 24-0701[1],[3]). However, unlike the regulations relating to tidal wetlands, the regulations under this Act do not contain a definition of "aquaculture." Of possible significance is the provision exempting specified farming activities from the freshwater wetlands permit requirements, but not exempting "structures not required for enhancement or maintenance of the agricultural productivity of the land and any filling activities" (id sec. 24-0701[4]). Impliedly, structures for the enhancement or maintenance of agricultural productivity do not require a permit. By analogy, it may be argued that structures for the enhancement of aquaculture may be similarly exempt; though the argument might be countered by the omission of similar language from the subsection exempting "aquaculture." Whether or not the ambiguities are deserving of legislative or administrative attention may depend on the extent to which aquaculture operations are likely to require use of freshwater wetlands.

#### Recommendation:

- Aquaculture should be defined as agriculture under the Freshwater Wetlands Law.

#### Local environmental controls

Regulations issued under the state's law governing the SPDES system authorize a local government to "adopt and enforce additional local laws, ordinances and regulations" relating to discharges into certain types of sewage disposal systems, "if not inconsistent with the provisions of the ECL or the [state] Sanitary Code" (6 NYCRR sec. 751.3[a][3][iii]). The scope of the activities embraced by the provision is not entirely clear. In any case, this limited recognition of local jurisdiction suggests that the state legislature intended to preempt the rest of the field of water quality control covered by state law.

Local governments are major participants in the state's environmental review system under SEQRA and the Freshwater Wetlands Act.

The state legislature has expressly opened the door to additional local regulation of both freshwater tidal wetlands, declaring that no provision of the state law "shall be deemed to remove from any local government any authority pertaining to the regulation of freshwater wetlands under the county, general

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city, general municipal, municipal home rule, town, village, or any other law" (Environmental Conservation Law sec. 24-0509). The Tidal Wetlands Act does not contain a similar provision; however, regulations promulgated under that Act state that no provision of the regulations "shall relieve any person from his obligation to comply in all respects with the provisions of any other Federal, state or local law or regulation, including but not limited to acquisition of any other required permit or approval" (6 NYCRR sec. 661.31).

### LAND USE CONTROLS; ZONING

In this state general land use control powers, particularly zoning powers, are delegated to local governments, with limited state intervention. The Long Island Regional Planning Board, in its 1979 "Assessment of Existing Mariculture Activities in the Long Island Coastal Zone and Potential for Future Growth," noted that only one of the towns of Nassau and Suffolk counties, the town of East Hampton, included a special provision for aquaculture in its zoning ordinance (Davies, Verberg, and Volpe, 1979, p. 28). The report also observed that the zoning ordinances of other Long Island towns might be construed as permitting certain types of aquaculture in various districts, though the absence of explicit mention of aquaculture in some of them creates uncertainties regarding their application (Davies, Verberg, and Volpe, 1979, pp. 28-31).

An important question for aquaculture in the marine district is the power of municipalities to impose zoning restrictions on offshore aquaculture activities. Kaplan identifies the important issues:

Does the zoning power enjoyed generally by a local government extend to activities on or above underwater lands within its borders? Beyond its borders? If the local government's zoning authority is deemed to apply generally to water-based uses, is it being exercised in a manner inconsistent in any respect with state regulatory laws? If not, may the local zoning extend to water-based activities conducted by the state on or over underwater lands owned by the state? Or conducted by a private entity on or over underwater lands leased from the state? (Kaplan, May 1984, p. 56)

On the first question, Kaplan finds that the zoning enabling statutes do not distinguish between uplands and underwater lands and the courts have not questioned that distinction. On the second, zoning powers do not extend beyond a town's borders without explicit statutory authority (Kaplan, May 1984, p. 57). Finally, if zoning laws are not inconsistent with state regulatory laws, Kaplan notes three traditional judicial tests for determining the limits of government zoning immunity: "(a) the eminent domain test, (b) a superior sovereign test, and (c) a test basing the result on whether the government's particular land use is governmental or proprietary in nature" (Kaplan, May 1984, p. 61). But, he finds, these tests have been discredited and an alternate test used which is a balancing-of-public-interests. This alternate test is not based on the "form of the opposing parties but on the substance of their conflict" (Kaplan, May 1984, p. 71). Whether private users of state lands are immune from local zoning depends on whether use limitations have been stipulated in a lease or grant of land; whether there is statutory guidance on the issue; or whether common law doctrine must be applied (Kaplan, May 1984, p. 79).

In the case of leases of underwater lands for shellfish cultivation granted either by the Commissioner of the Department of Environmental Conservation or by Suffolk County, no leases have yet been issued nor do the enabling statutes refer to local land use controls in authorizing the leases (Kaplan, May 1984, p. 85). But applying judicial rules of inconsistency of local laws with state statutes and preemption by the state of specific regulatory authority, Kaplan finds that leases under these laws would probably not be subject to local zoning restrictions (Kaplan, May 1984, pp. 92-94). However, the unsettled status of these issues could be a deterrent to aquaculture development.

The recently enacted Waterfront Revitalization and Coastal Resources Act offers state financial and other benefits to local governments to induce them to promote various state objectives in developing and regulating the use of their waterfront areas (Executive Law sections 910 et seq). The objectives include the "facilitation of appropriate industrial and commercial uses which require or can benefit substantially from a waterfront location, such as but not limited to waterborne transportation facilities and services, and support facilities for commercial fishing and aquaculture" (id sec. 915[5]). Whether or not this program leads to coastal area rezoning favorable to aquaculture remains to be seen. The results will depend in part on the emphasis placed on aquaculture by the Secretary of State, relative to emphasis on other competing types of development, in approving municipal projects submitted to the secretary under the law. The declaration of state policy with respect to particular activities can influence local governments to allocate adequate space for such activities in their zoning, or influence the courts in reviewing allegedly biased zoning restrictions. The favorable mention of aquaculture in the Waterfront Revitalization and Coastal Resources Act may not go far enough to achieve that result, given its context of a wide range of competing water-dependent uses being promoted by the law, and the limited areas that may be covered by the program.

Under the Agriculture and Markets Law, the creation of special agriculture districts to encourage the continued farming of valuable agricultural lands provides benefits to farmers of reduced real property tax assessments as well as relief from some local land use restrictions and regulations (Agriculture and Markets Law, sections 301, 303, 305). Furthermore, the definition of agriculture in this law serves as the basis of the definition of agriculture for purposes of Suffolk County development rights laws. Suffolk County, in order to preserve its farmlands, has purchased the development rights to tracts of land, in the County, including a few parcels with waterfront that are used for aquaculture. Future development of these lands is restricted to agriculture as defined in the Agriculture Districts Law.

At present, the agricultural districting law does not include aquaculture within the definition of agriculture. As a result, for example, aquaculturists have been restricted from using a number of waterfront sites in Suffolk County otherwise designated for agricultural use. Aquaculture and aquaculturists throughout the state might benefit in several ways from aquaculture being defined as agriculture in Agriculture and Markets Law, including agricultural districting provisions.

**Recommendations:**

- For the purpose of zoning codes, towns should define aquaculture as agriculture.

AQUACULTURE AND THE LAW

- The legislature should provide guidance as to the scope of town zoning authority over state-owned underwater lands leased for aquaculture from New York State or Suffolk County.
- Further study should be given to defining aquaculture as agriculture under the New York State Agriculture Districts Law.



IV

## Financing Aquaculture Development

#### IV. FINANCING AQUACULTURE DEVELOPMENT

Aquaculture development requires financial support for entry into commercial ventures and for growth of services and related businesses required by the ventures. Federal and state governments provide limited support in the form of direct loans to researchers and producers and to supporting services. Some private capital is available through traditional sources such as banks and venture capital companies, but a variety of factors negatively influence accessibility and cost of these funds.

#### INVESTMENT AND OPERATING COSTS

Producing a high volume of aquatic organisms at an economic rate requires significant inputs of energy and materials. Capital investment for start-up can range from several thousand dollars for a part-time trout producer upstate to several hundred thousand dollars for a commercial-scale shellfish hatchery on Long Island. Direct and indirect costs of operation vary by culture technology, geographic location, and species.

In general, the more intensive the culture technology the higher the start-up and operating cost. Intensive aquaculture produces a larger volume of plants and animals per area than extensive aquaculture, but requires greater inputs of energy and raw materials and increases the potential for disease to destroy a crop. Raceway and pond culture of trout, for example, produce about the same number of fish, but a raceway is a fraction of the size of a pond. In order to maintain the high density population of fish in the raceway, however, fresh water must be constantly circulated, removing waste and resupplying oxygen. Furthermore, all food must be supplied for the fish in the raceway, whereas fish in the pond obtain some food from the more natural environment. Feeds, now largely imported from out of state, are costly. Finally, fish cultured in high-density are more susceptible to disease and illness due to the stress of the unnatural population density as well as the greater ease with which disease may be transmitted among fish kept so close together.

Operating costs can be high depending on the location of the business. Across the state, aquaculturists variously require land, water, energy, and labor in addition to capital facilities. The cost of these resources depends on their supply and the demand for them. Land can be more easily obtained upstate than in New York's marine district where demand by developers for coastal property has pushed prices out of reach of the agri-food industry. Availability of fresh water will constrain development of some operations. In much of New York, for example, flowing fresh waters are often used for public and private recreation, scenic resources, public and private fishing as well as sources of potable water. Marine aquaculturists compete with recreationists, commerce, fishermen and others for use of the water surface and with coastal residents and developers for coastal lands. Such competition is expected to increase over time. Finally, aquaculture as presently practiced in New York is labor and energy intensive. Daily maintenance and feeding is done by hand, usually requiring a 24-hours-per-day, 7-days-per-week commitment. Culturists note that if a pump breaks in the middle of the night it must be fixed then or the crop could be quickly lost. In addition, large volumes of water must be pumped and sometimes heated, requiring considerable energy. On Long Island, the site of New York marine aquaculture, energy costs are almost double those of upstate. In part because of rising energy costs, one Long Island

## FINANCING AQUACULTURE DEVELOPMENT

aquaculture firm recently re-located the majority of the operation to a southern state offering an energy subsidy (Moeller, pers. comm., March 3, 1984).

### **Recommendation:**

- **Energy pricing and distribution policies should continue to recognize the dependency of aquaculture enterprises on availability and costs of electricity.**

Many indirect costs must also be borne. A significant cost of doing business is providing security for property. Bluepoints Company on Long Island, for example, employs several watchmen and a sophisticated electronic surveillance system to protect against poaching. Still, the company continues to lose shellfish. OURS-Delaco fish farmers in Delaware County estimate the cost of fish lost to theft may be as high as 25% of the total annual loss.

### **Recommendation:**

- **Legislation should be enacted to set tough penalties for theft of aquaculture produce or destruction of aquaculture facilities.**

Aquaculturists face a variety of costs associated with the regulatory environment. In general, regulations involve land and water use, fish and wildlife management, pollution management, health and safety, labor, transportation of stocks, and tax and financing. The New York State Office of Business Permits lists over 100 pages of information about permits that may be required by New York State of potential aquaculture applicants (NYS Office of Business Permits, 1983). While not all these regulations will apply to each venture, they are added to those required by the federal and local governments (key federal and local requirements are dealt with briefly in the section "Aquaculture and the Law").

### **Recommendation:**

- **The Office of Business Permits should make available a directory outlining the permit process for aquaculturists in New York State.**

The regulatory process creates additional costs for the aquaculturists in a number of ways. The process of acquiring permits may be expensive; complying with the regulations that apply after permits have been obtained may require additional capital investment for plant and equipment. Finally, diversion of management energy during the permit process creates an opportunity cost.

### **Recommendation:**

- **The Department of Agriculture and Markets should appoint an ombudsman to assist aquaculturists in obtaining permits and to provide information about undertaking aquaculture in New York.**

The number of permits any aquaculturist must obtain depends on the species cultured, the location of the operation, and type of equipment used. The process of determining which permits are required and obtaining them can be very expensive. A study of aquaculture in California determined that the permit process



took from 3 months to 7 1/2 years to complete at a cost of \$400 to \$34,000 (Feldman, 1978 p. 79). In New York, Multi-Aquaculture Systems, Inc. spent two years obtaining permits at an estimated cost of over \$200,000 in direct and indirect costs (Valenti, pers. comm., September 1, 1982). The California study concludes that the indirect costs of the permit process can be greatest. As a percentage of total capitalization, the largest direct cost of the permit process was 5.7%. Culturists were able to absorb that cost but found the loss of time, managerial energy, and the uncertainty surrounding the process to be excessive. Some of the culturists started other ventures in order to maintain income during the permit process (Feldman, 1978, p. 81).

Present agency permit statutes and procedures are not geared to efficient processing of applications involving mariculture facilities, e.g., finfish farms. This is perhaps due to a lack of experience and understanding on behalf of permit agency personnel in dealing with the field of mariculture. The duplication of effort and long delays experienced by MAS [Multi-Aquaculture Systems] due to existing permit procedures, especially the public hearings, will not help to attract other mariculture ventures to locate on L.I.. (Davies, Verberg, and Volpe, 1979, pp. 78-79)

## FINANCING FOR AQUACULTURISTS

### Federal financial assistance

A number of federal programs have provided direct financial support for commercial aquaculture ventures (see Table 7). Programs such as the Farmers Home Administration, the Farm Credit Administration, and the Small Business Administration have provided direct loans and other financial services. (Joint Subcommittee on Aquaculture, 1983, Vol. 1, pp. 31-42). Some of these and other programs which provide research or technical services support for aquaculturists have been reduced in scope and resources in the immediate past; some are scheduled for termination in the present Congressional budget discussions.

Financial assistance in the form of R&D, extension, training and technical services is discussed in Section 7.

### State and local financial assistance

The New York Job Development Authority, through its Special Purpose Fund, is able to provide loans for up to 40% of a total project cost for the financing of land and building acquisition and/or rehabilitation and the purchase of fixed-asset machinery and equipment. The issue of collateral is dealt with on a case-by-case basis. Providing collateral can, of course, be difficult for many people. JDA also administers several Revolving Loan Funds which may be appropriate lending sources for a portion of the financing for a commercial aquaculture project. It is important to remember however, that these JDA funds are not expressly for aquaculture and so the prospective aquaculturist will be competing with many others for the funds.

Funds for private development are also available on a limited basis through the New York State Science and Technology Foundation's Corporation for Innovation Development.

FINANCING AQUACULTURE DEVELOPMENT

Table 7

FEDERAL GOVERNMENT PROGRAMS WHICH HAVE SUPPORTED  
PRIVATE AQUACULTURE DEVELOPMENT

Agency/Program	Activity
United States Department of Agriculture Farmers Home Administration (FmHA) Federal Crop Insurance Corporation (FCIC)	Private development and operation, economic emergencies Crop insurance
United States Department of Interior Bureau of Indian Affairs	Capital construction funds for tribal enterprises
United States Department of Commerce Economic Development Administration (EDA)	Operating and development funds
Farm Credit Administration (FCA)	Loans to aquaculturists
Small Business Administration (SBA)	Guaranteed, immediate participation and direct loans

Modified from Joint Subcommittee on Aquaculture, 1983, Vol. 1.

**Private support**

An important source of funds for aquaculture in the U.S. has been major corporations. Through federal tax incentives, investments in emerging aquaculture ventures have been made rewarding especially in the areas of salmon ranching (Weyerhaeuser) and shrimp farming (Purina).

Private development capital is also available for aquaculture development through commercial banks and venture capitalists. However, a number of factors limit accessibility of these funds.

**FACTORS AFFECTING ACCESSIBILITY OF INVESTMENT FUNDS**

Aquaculture must be undertaken in an environment of high uncertainty caused by a number of factors ranging from the biological and technical to the social and political. This uncertainty creates risks for entrepreneurs and investors which is translated into high cost for start-up. A number of actions may reduce the risk directly, including research and development of newer, more efficient culture systems; reduced delays caused by the permitting process; and market research and development. Other actions may directly affect the financial markets for aquaculturists and investors, such as providing alternate sources of investment.

capital as well as increased information about aquaculture to traditional financial markets to encourage additional investment.

### Regulations

Costs associated with the regulatory environment are some of the greatest an aquaculturist might encounter. In addition, the regulatory environment creates great risk for the entrepreneur and investors. "These costs are limiting the access of aquaculturists to sources of investment capital and in doing so are adversely shaping the competitive structure of the industry" (Feldman, 1978, p. 81). Investors consider risk and liquidity of investment; yet the permit process increases risk in an already risky industry and decreases liquidity by increasing the length of time until the first harvest (Feldman, 1978, p. 82). In other states, these problems have resulted in the takeover of small businesses by large ventures with investment capital and expertise behind them.

### Recommendation:

- The Department of Environmental Conservation should direct the use of a joint hearing process when public hearings are required for the approval of two or more permits from various agencies whenever possible.

### Level of technology development

Aquaculture technology remains in large part an art as much as a science. Success depends on a variety of biological and technical factors including site of the facility, and quality of the water in terms of such variables as temperature and food content. More important, equipment is industry specific and is often unacceptable collateral for bankers (Valenti, pers. comm, September 1, 1982).

### Recommendation:

- The Department of Agriculture and Markets should establish a revolving loan fund for aquaculture start-up capital.

### Insurance

Most ventures operate under conditions of high risk from natural and man-made disasters including floods, pollution, and disease. Culturists need insurance, yet...

There are, at this stage of the industry, major problems in arranging insurance cover from the point of view of both the underwriter, who has to provide the cover, and the aquaculturist who needs protection. First of all, until very recently, there has hardly been any insurance underwriter willing to cover risks associated with aquaculture production at reasonable premium rates. The general lack of knowledge of insurance companies of the commercial and industrial characteristics of aquaculture and the nature of the risks that they are required to underwrite, has been a major handicap. Insurance covers have to be based on the principle of spreading

## FINANCING AQUACULTURE DEVELOPMENT

the cost of risks among the insured by charging premiums that in total exceed the losses that will have to be compensated. The twofold problem that stands in the way of the spread of aquaculture insurance is the lack of expertise among underwriters to assess risks and the scarcity of enterprises that are ready to participate in insurance schemes. (Pillay, 1977, p. 58)

In October of 1980, Section 518 of the Federal Crop Insurance Act (52 Stat. 72) was amended to broaden the definition of 'agricultural commodity' to include "aquacultural species (including but not limited to, any species of finfish, mollusk, crustacean, or other aquatic invertebrate, amphibian, reptile, or aquatic plant propagated or reared in a controlled or selected environment)." This effectively allows the Federal Crop Insurance Corporation to provide coverage for aquacultural species. However, it is left to the producers of each particular crop, on a regional basis, to petition the FCIC for specific coverage in their area. If a crop is sufficiently important, actuarial data are obtainable, and interest among the producers is strong, the FCIC will conduct a pilot study in order to create the actuarial tables.

### **Recommendation:**

- The Department of Agriculture and Markets should take the lead in assisting aquaculture producers to petition the Federal Crop Insurance Corporation for coverage.

### **Limited information**

Of significant concern is the lack of detailed information about aquaculture. The true nature of risk is difficult to identify and often remains unquantified. Few statistics are easily available; none are complete. Production, cost, and price data are available for some species in some areas but may include wild harvest information as well. Little information is available on supply and demand for cultured product. In April 1981 the United States Department of Agriculture's Economic Research Service published the first of three issues of what was to be a biannual report, "Aquaculture Outlook and Situation." The report presented economic data on aquaculture (although only for catfish and trout) and analyzed supply, demand, and price factors affecting the industry. Because of budget constraints only three reports were issued, the last in April 1982 (US Crop Reporting Board, 1982).

This lack of information leads to a conservative approach by the investment community. Investors seek to maximize information and minimize risk. With aquaculture, risk is high because of many factors, and perceived risk is increased by lack of information about the industry. As a result, traditional sources of investment such as banks will not provide loans for culturists, or the funds are provided at too great an interest rate. This problem is compounded by the aquaculturist's lack of collateral. Most traditional investors seek some form of collateral but the culturist uses equipment that has little market value outside of the specific culture operation.

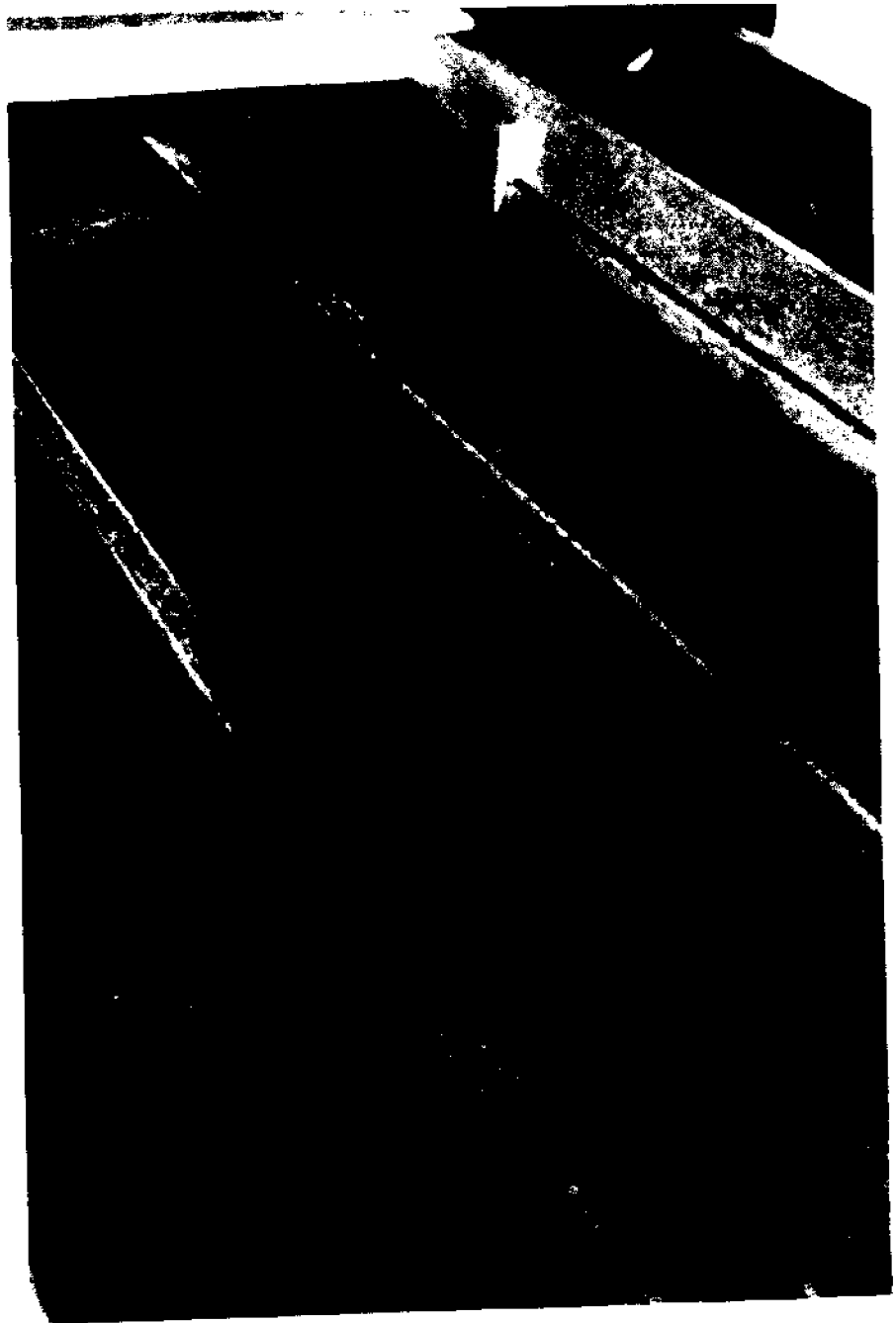
Furthermore, opportunities for investment remain hidden; investors and entrepreneurs have no easy access to information about potential businesses. For example, baitfish production through aquaculture can be profitable in New York. Some estimate that about a dozen operators already produce bait in New York for

## FINANCING AQUACULTURE DEVELOPMENT

the recreational fishing industry. But the sense is that a larger amount of baitfish is imported from southern states such as Arkansas. There is no way to easily assess the amount of local production versus imports or the market for the product because information, once kept centrally by the New York State Department of Environmental Conservation, is now maintained on a regional basis. Opportunities for investment cannot be readily identified without special information (Michael Duttweiler pers. comm., December 14, 1983).

### **Recommendation:**

- The Department of Agriculture and Markets should collect and make available information about the aquaculture industry including total businesses, production, and years in operation.



V

# Attitudes Toward Aquaculture

## V. ATTITUDES TOWARD AQUACULTURE

New York's aquatic resources are used by many for commerce and recreation. Established users press to prevent introduction of new uses. Competition among the groups for access to aquatic space and resources can create friction. Attitudes of established groups significantly affect the development of additional uses because of the political importance of the older groups. These attitudes are often complex, reflecting users' perception of history and their assessment of present personal need. Further confusion is created because there is no clear definition of property rights in the aquatic environment.

### AQUATIC USES

#### Commercial fishing

Commercial fishing in the New York marine district comprises harvesting by a variety of fin- and shellfishermen. In nearshore areas where aquaculture ventures are most likely to be situated, the major fishery is for shellfish. The strongest opposition to private aquaculture stems from the shellfishermen interest group or "baymen" as they are locally known. The baymen's opposition to private commercial aquaculture arises from the nature of their business and from the historical conflicts between these two groups.

Commercial shellfishermen and finfishermen are strongly independent. Working on the water gives them a great sense of freedom in which hard work yields a satisfactory living and independent decision-making regulates both income and resources.

Baymen depend on access to public underwater lands for the harvest of the shellfish, but lands leased for aquaculture are off-limits to baymen. Culturists note that not all underwater areas are productive in the wild and not all are used by the shellfishermen; they note these areas could be set aside for the culturist. Baymen believe, however, that all areas are for public use and all are potentially productive. No area is to be abandoned, for it may be productive in the future.

Baymen work in an atmosphere of market instability for their shellfish. Their catch is sold to any of a number of buyers daily, for cash, at public docks. The buyers set the price daily depending on the supply and demand; this in turn depends on a number of factors including time of year, amount of land open for harvest, and number of baymen. Baymen have no storage facilities to hold their catch while hoping for a better price, so they are dependent on the buyers and day-to-day fluctuations. As a result, shellfishermen are very sensitive to fluctuations in the market. They believe that the introduction of aquaculture-produced shellfish in the market will cause a significant drop in price and drive them out of business.

Baymen perceive private commercial aquaculture as an outside force, representing the motives of alien "big business" to potentially control all public resources for personal gain. This belief stems in part from the early 1900s oyster industry when the larger operators were able to gain private control over large tracts of public lands. In the early aquaculture industry, individual oystermen obtained leases of land on which to cultivate seed oysters transplanted from other New York waters. But these practices began to require greater financial backing.

## ATTITUDES TOWARD AQUACULTURE

individuals became pressured by corporate interests and conflicts arose.

Because of the declining catch of seed oysters in the [Great South] Bay which required that seed be brought in from out of state, the individual planter gradually gave way to the large corporations which had the necessary capital. . . . These corporations acquired the leases of others thereby circumventing the law which said that an individual could only have one lease. The planters became increasingly powerful, leasing large areas of the Bay and also controlling the marketing of oysters. The baymen who worked the unleased Bay were in danger of being pushed off the Bay. (Kassner and Cramer, 1983, p. 8)

The historical conflict highlights three concerns of the baymen. First, they fear that big business will gain access to large tracts of underwater lands, excluding the baymen. Second, big business is associated with corporate outsiders whose interest in the community is less personal. Third, the baymen believe that the businesses will obtain the right to use mechanical harvesting devices which are illegal on public grounds where baymen work because the machines are too efficient, and leave the grounds barren.

Many of these concerns have also been expressed by shellfishermen in other states. However, some of those states are working with shellfishermen and aquaculturists to develop policies supportive of both industries. For example, in 1980, the Rhode Island General Assembly revised its aquaculture laws and developed a policy supportive of both aquaculture and traditional aquatic users. The state can offer permits and leases to undertake aquaculture in designated areas under prearranged conditions. The agreements contain penalties for violations and specify that the aquaculture operation will have no adverse impact on the adjacent marine life or on the "vitality of the indigenous fisheries of the state" (Olsen and Seavey, 1983, p. 82).

While the commercial fin- and shellfishermen are generally conservative about private aquaculture development, they are supportive of efforts to augment natural stocks of shellfish through public aquaculture operations. They believe these operations benefit the greater number of resource users, including both commercial and recreational fishermen (Murray, pers. comm., July 27, 1982).

### Recreational fishing

The recreational shellfishery consists of individuals working part-time with limited gear in nearshore areas to collect shellfish for their own use; the fishery is very small, amounting to a fraction of the total landed value of all shellfish in New York. Conflicts with aquaculturists are limited because of the small size of the recreational group.

Recreational marine finfishermen, on the other hand, support a multimillion-dollar-per-year-industry. Upstate, recreational finfishermen and associated businesses are an important industry in many local economies. While less visible, but nonetheless highly significant in the economy of the marine district of the state, saltwater recreational finfishermen are of increasing political importance. The sportfishermen believe, as do the commercial shellfishermen, that enterprises unfairly limiting access to the water column and bottom should be discouraged. However, if equitable access is assured, they believe private aquaculturists can provide an opportunity for relieving pressure on the wild animals (Muller, pers.



## ATTITUDES TOWARD AQUACULTURE

comm., August 4, 1982). This is an important opportunity as New York fishermen reach upper limits on the catch of such species as hard clam and striped bass.

Some culturists directly benefit recreational fishermen. In Great Peconic Bay, Coastal Farms Inc. clam culture racks act as an artificial reef, attracting fish. Fishermen can fish near the racks with no conflict with Coastal Farm's operations (Steidle, pers. comm., July 19, 1982).

### Navigation

While some boaters express concern that aquaculture will exclude their use of the water surface, current permitting requirements by the US Army Corps of Engineers and the US Coast Guard would not allow aquaculture to obstruct navigation.

### Property ownership

Much of the value of coastal residential districts lies in their aesthetics. Owners of residential property near the water fear development that will create unsightly views of the water or surrounding property. Affluent waterfront property owners may exert considerable influence on local government decisions (Koopman, pers. comm., September 15, 1983).

### Agriculture

In upper New York State, competition between farmers and aquaculturists will most likely occur over available land and water. Competition for land is not seen as a major obstacle because some lands are better suited for aquaculture, and many fish farmers also raise agricultural crops. However, competition for water will increase as aquaculture expands (Conte, 1983, p. 3). On the other hand, aquaculture can provide economic returns in an enterprise consistent with their agricultural lifestyle.

In the marine district, direct competition between farmers and aquaculturists is not seen as a problem. However, the setting aside of lands for agricultural use can restrict development of some coastal areas for aquaculture. Suffolk County has purchased the development rights to a number of coastal parcels in order to help keep valuable farmlands in production. Here other factors such as soil type are key in the designation of these lands as being agriculturally significant. Aquaculture is not specified as an agricultural use under the development rights program and aquaculturists may not build in those areas.

### Water supply

Conflicts between aquaculturists and suppliers of drinking waters have not emerged because of the extensive body of law and regulation protecting water quality. Aquacultural use of fresh waters will be limited to situations in which water quality is not degraded beyond limitations imposed by appropriate regulations. Aquaculturists may reduce effluent loading of fresh waters to acceptable limits through use of various technologies. This will increase their operating costs. Legislation enacted in 1984, The Water Resources Management Strategy Act, adds a new dimension reflecting increased concern not only for quality but quantity of drinking water supplies. The Department of Environmental Conservation will develop three documents in response to this legislation: 1) a Statewide Inventory of Water Supply Systems; 2) a Water Supply Financing

## ATTITUDES TOWARD AQUACULTURE

Capability Report; and 3) a Statewide Water Resources Management Strategy. This latter document could benefit aquaculture by identifying aquaculture as a way in which excess water supplies can be utilized for new economic development.

## OPPOSITION LIMITS DEVELOPMENT

Opposition from established aquatic user groups limits area available for aquacultural development. Competition and opposition is greatest in New York's marine district. While the state, Suffolk County, and local towns have the legal authorities to provide limited legal interests in public lands for private aquaculture ventures, no new interests have been granted in many years. In 1982 the town of Islip terminated underwater lease agreements with a private hatchery in Sayville. State, county, and town officials note that their jurisdictions have negative or no leasing policies consistent with legal authority to conduct a program, in part because of opposition from user groups and in part because no aquaculturists have sought leases. But aquaculturists note that they have sought leases and have been discouraged by lack of positive leasing policies (Survey of New York Culturists, 1982).

## MEDIATION OF CONFLICT

"Comprehensive and integrated planning, reconciling conflicting interests where they exist, is necessary to enable the most beneficial use of the areas. Aquaculture does not necessarily require exclusive use of the total environment and other uses can often be well accommodated" (Pillay, 1977, p. 66).

While many areas will be unsuitable for aquaculture development because the traditional use of the area is so heavy, aquaculture need not exclude all other users of an area. Many other activities are compatible with aquaculture or actually are benefited by it. If developed rationally, aquaculture can help preserve the way of life for recreational and commercial fishermen by relieving the pressure on the wild harvest species (Muller, pers. comm., August 31, 1983).

The key is to develop an allocation system for the multi-purpose use of coastal waters, whereby an optimal spatial arrangement can reduce incompatibilities and conflicts. Such a system could be designed to assure that one particular group or user would not exclude others. . . . What can be accomplished by State, County and town governments is the development of management plans for water areas in their respective areas of jurisdiction that include consideration of aquaculture as a priority use. (Davies, Verbarq, and Volpe, 1979, pp. 117-118)

A means of managing the common properties must be developed because distributional problems will arise. There will be economically efficient solutions, but it is important to select those solutions that are also socially acceptable to established user groups (Conrad, pers. comm., June 10, 1982).

Rhode Island has recently developed a management plan for their marine resources which acknowledges that serious conflict could occur between user groups but also envisages successful mediation (Narragansett Bay Fisheries Task Force, 1982, p. 6).

## ATTITUDES TOWARD AQUACULTURE

### Recommendations:

- The Department of State should assess the status and use of aquatic resources across the state to determine use intensity and conflict in conjunction with the Department of Environmental Conservation's Statewide Water Resources Management Strategy.
- The Department of State should develop a statewide management plan to allocate space for all users of aquatic resources.
- The state's Office of General Services, counties and towns should investigate the use of privately-owned underwater lands in the coastal zone for aquaculture and encourage their use in order to reduce conflicts associated with the use of publicly-owned underwater lands.



VI

Markets

## VI. MARKETS

A strong demand for aquatic products and the depletion of a number of commercially important wild fishery stocks suggests a strong market for locally grown products through existing channels. The United States is a net importer of fishery products. The trade deficit for all fishery products (edible and non-edible) for 1984 was over \$4 billion (National Marine Fisheries Service, January 1985, p. 2), placing it second only to oil as a commodity. Aquaculture could help decrease this deficit and meet local demands for several products. A number of exogenous market-related problems, however, could constrain industry development.

### DEMAND FOR SEAFOOD

Fish is becoming increasingly important in the American diet. US consumption of fish in 1981 was 2.96 billion pounds (13 pounds per capita), a 30% increase since 1970 (see Figure 2). Population growth accounted for only one-half of this increase; the remainder reflected greater per capita consumption of fish. Per capita consumption of fish is expected to grow at an average annual rate of 3.4% (Port Authority of New York and New Jersey, June 1981, p. 1).

Recent food consumption patterns have changed. Consumers are now eating more fish, poultry, fruits and vegetables, and low fat milk; and less red meat, eggs, whole milk, and butter. At the same time, average retail prices for seafood products have risen 26%, indicating that factors other than retail price have influenced increased consumer purchases of fish. Greater seafood consumption seems attributable to a growing consumer interest in nutrition. For example, the American Heart Association recommends a diet containing increased amounts of fish and poultry. Recent Sea Grant supported research by Dr. John Kinsella at Cornell University has also shown that fish oil in particular has a beneficial effect on reducing heart disease by reducing thromboses or clots. Per capita income increases bring a rise in expenditures on food consumed away from home. Recent statistics (1981) show that 61% of consumer seafood spending occurs in restaurants, 34% in retail stores, and 5% in institutional settings (Port Authority of New York and New Jersey, June 1981, p. 24).

The increase in seafood consumption cannot be wholly attributed to increased concern for nutrition or higher per capita income; demographic data indicate that relative changes in the number of people in groups with known preferences for nutritional foods, including seafoods, may be another underlying factor. Subpopulations preferring more nutritious foods are older families with no children; singles; and children aged 12 to 18 (Port Authority of New York and New Jersey, June 1981, pp. 26-27). In 1970 these groups accounted for 60% of the total regional population; in 1980 for 70%. This demographic trend may portend a future growth in the consumption of seafoods.

These consumption trends will have an important effect on New York's aquaculture industry. Fresh seafood is one of the most popular forms in the New York market. Over 70% of the fish traded annually at the Fulton Fish Market is fresh (Port Authority of New York and New Jersey, June 1981, p. 30). Aquaculturists serve primarily the fresh seafood market. Fresh products also command a premium price in the market because consumers perceive that they are of consistent high quality. Oysters, for example, are sold fresh in the shell, fresh shucked, frozen, or canned. Twenty percent of the US market consists of fresh

### U.S. Annual Per Capita Consumption of Commercial Fish and Shellfish 1960-1983

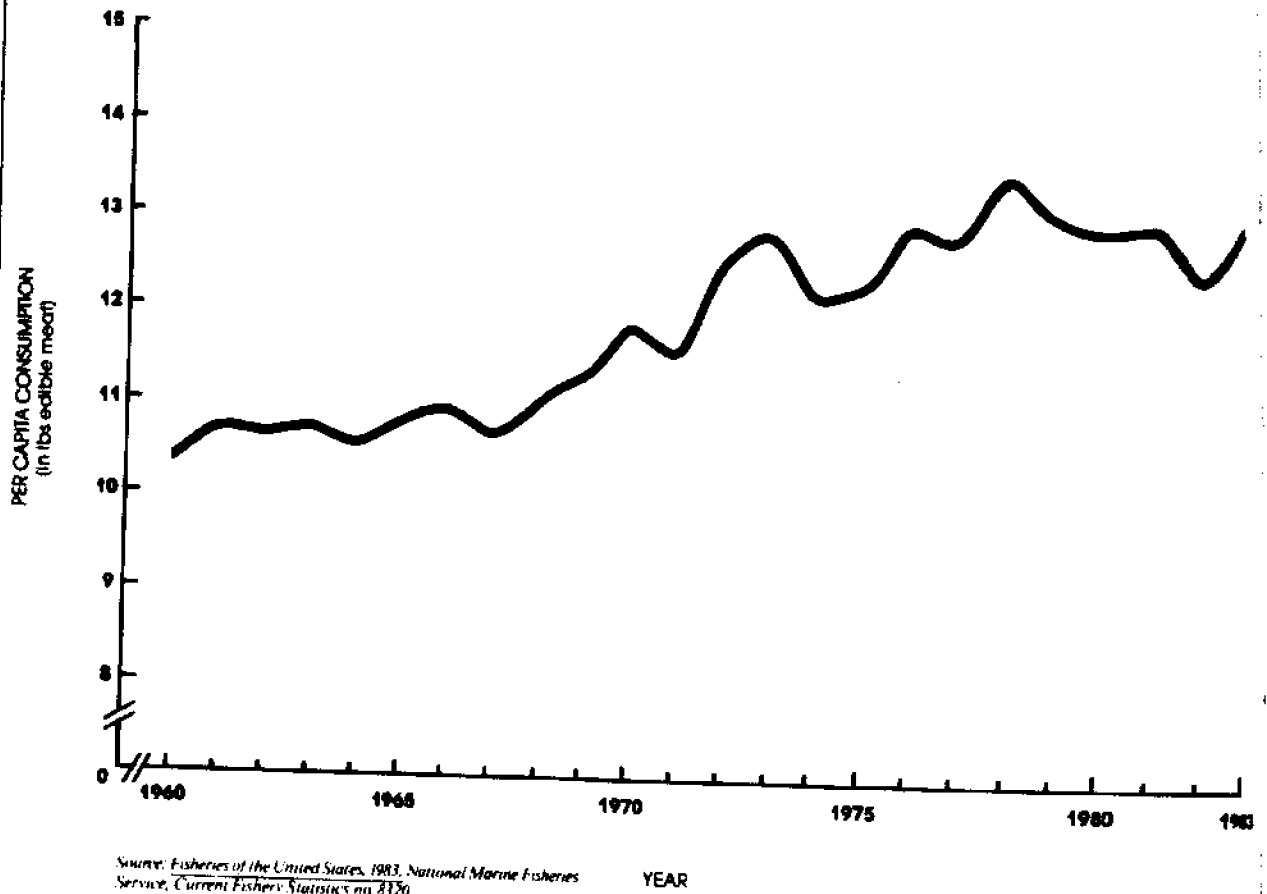


Figure 2

oysters for the half-shell trade. All of Long Island's aquacultured oysters are grown for this market. From 1970 to 1983, prices for half-shell oysters rose 11% whereas prices for shucked oysters fell 6% (Cline, pers. comm., March 15, 1984).

#### OUTLETS FOR NEW YORK PRODUCTS

There are at least three major markets for New York's aquatic products: regional, national, and international. While most of the aquaculture products are marketed locally or nationally, potential exists for developing new markets and for displacing products produced in other areas with those grown in New York. A marketing analysis conducted by the Port Authority of New York and New Jersey identified some of these opportunities which are outlined below (Port Authority of New York and New Jersey, June 1981).

Regarding state and local markets, the Port Authority has estimated the total market for fish in the Greater New York Metropolitan Area to be from \$1.0 to \$1.5 billion annually, corresponding to an annual regional fish consumption of 880 million to 1 billion pounds. These figures represent a 28% increase since 1976. Average annual household seafood expenditure in the region in 1979 was more than twice the national average. Per capita consumption of seafood in the New York metropolitan area is expected to increase at a higher rate than the national average. One explanation for this increase is the growing number of Asian immigrants, who, on average, consume two to three times the amount of fish eaten by blacks and whites. The high percentage of professional and managerial households in the region also plays a role in sustaining a strong seafood demand, as these households have been shown to consume relatively large quantities of seafood (Port Authority of New York and New Jersey, June 1981, pp. 23-27).

As for the national market, in 1981 US consumption of seafoods was approximately 2.7 billion pounds, 40% of which was imported product. The United States has registered a trade deficit in fishery products in each of the past 35 years. In 1980 our fish import:export ratio was 3:1. Increased aquaculture production could help the country re-capture domestic markets for a number of species including oysters, whose total imports exceeded 30 million pounds or almost 40% of the US supply in 1983 (US Department of Commerce, April 1984, p. 69).

International markets are less promising. There are several obstacles to expanding seafood exports including high production costs, few or no price supports, trade barriers in potential importing countries, and a very strong U.S. dollar. In short, U.S. aquaculture products can be competitive abroad when U.S. agriculture products are.

It would seem that the most promising export markets are in Europe. New York is well positioned as the center for major fish exports to Europe with more containerized cargo and air freight being shipped to Europe daily than any other East Coast city. Fishery production from many coastal regions of northern Europe and the Mediterranean has declined because of overharvesting, water pollution, and fishery conflicts. European fishing efforts were displaced off the US east coast by the Magnuson Fishery Conservation Act of 1976. However, most of the export opportunities in the near term will likely be filled by U.S. commercial fisheries rather than aquaculture. In addition, many countries are putting a great deal of effort into aquaculture of such specialty items as salmon in Scotland and Norway, mussels in Spain, etc. and may even have an economic and technological headstart

## MARKETS

on the U.S.

### OPPORTUNITIES FOR EXPANDING MARKETS THROUGH AQUACULTURE

Although in the near future most of the demand for aquatic products will be met by commercial fisheries, aquaculture could play an increasing role in the supply of some important species the wild harvest of which is constrained by biological limits on stocks. When adjusted for inflation, the landed value of New York's commercial fishery has remained relatively constant (Agriculture 2000, 1985, p. 59) although harvests of many of the more valuable species described below have declined substantially. Developing markets for important nonfood products such as marine biopolymers and marine pharmaceuticals offer new challenges because of US markets and extraction technology.

The New York oyster fishery of the 1800s was the state's most important shellfishery until disease, predation, environmental changes, and, to some degree, overharvest led to a dramatic decline in the stocks. Today, natural oyster reproduction in New York waters is very limited and the industry depends on hatchery production of seed stock and on seed stock imported from other states. Aquaculture now makes possible the production of a premium oyster in New York waters (see Figure 3).

New York's production of striped bass, a popular species sought by both commercial and recreational fishermen, has dropped in recent years due to a population decline in the coastal migratory stock and resulting increased regulation of fishing effort. PCB contamination has also caused the closure of certain areas in New York to striped bass fishing. Expansion in this fishery now seems unlikely. However, aquaculture production of the striped bass provides an alternative to the wild harvest. One operation on Long Island raises striped bass for local restaurant trade.

A study by the National Marine Fisheries Service projects that demand for salmon in the United States could be limited by supply (see Table 8 below).

Table 8

#### ESTIMATED US DEMAND FOR COMMERCIAL SALMON 1970-1995 (in pounds \* 1,000,000)

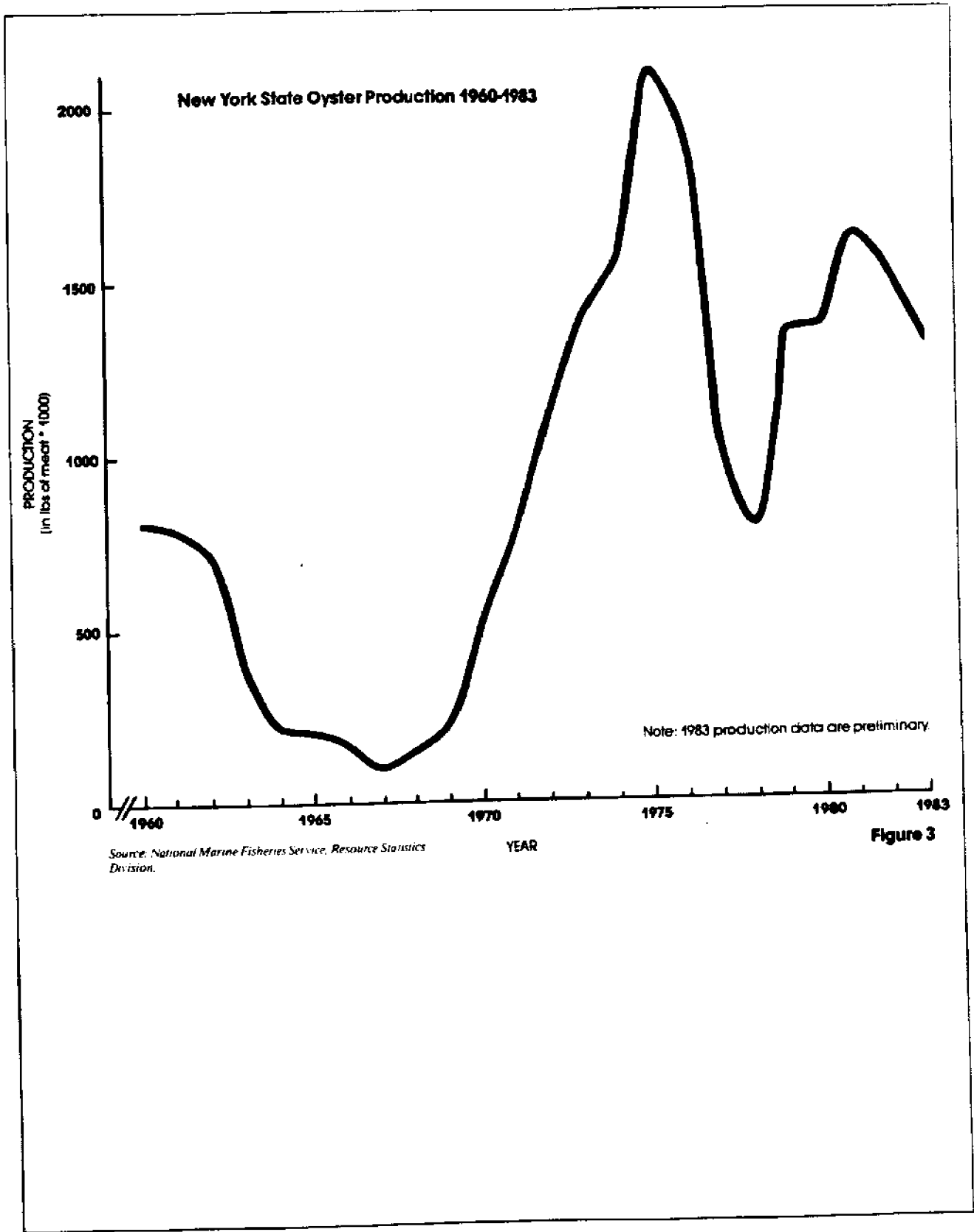
Year	Limited Supply(1)	Unlimited Supply(2)
1970	317	317
1975	325	338
1980	330	362
1985	335	389
1990	338	417
1995	346	474

(1) World maximum sustainable yield of 1,069 million pounds reached in 1975.

(2) Increase in supply made possible by culture activities and habitat maintenance/protection.

Adapted from Joint Subcommittee on Aquaculture, 1983, p. 112.





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Dependence on wild stocks alone could limit demand to 9% growth. Demand could increase almost 50% if aquaculture helps supply the market (National Marine Fisheries Service, in Joint Subcommittee on Aquaculture, 1983, p. 112). Again, the U.S. must be able to outcompete Norwegian and other cultured salmon imports if there is to be any gain to the U.S. industry.

New York's most important shellfishery, the hard clam, has declined from a production of 7.1 million pounds of meat in 1970 to 2.7 million pounds in 1984. Peak production in 1976 was over 9 million pounds (see Figure 4). During the same period the average shellfish harvested per permitted fisherman fell nearly 50% from 1425 thousand pounds of meat in 1970 to 733 thousand pounds in 1983 (see Figure 5). As a percentage of national production, New York production declined from 49% in 1970 to 27% in 1982 (see Figure 6). Aquaculture offers the opportunity to expand production.

Other specialty products can be produced here in New York. Demand for seaweeds for the manufacture of several important phycocolloids such as alginates, agar, and carrageenan, has grown rapidly in the past 10 years. In 1970, world trade in seaweeds and seaweed products was about \$50 million; in 1980 it was more than \$350 million (International Trade Centre, 1981, p. ix). The U.S. has the world's largest market however, it imports nearly all of its seaweed from developing countries. The U.S. demand for agar, alginates and carrageenan is about 1,000, 5,000 and 3,000 tons per year, respectively. The most promising genus to cultivate in New York is the brown kelp, *Laminaria*, which has good potential as a source for alginates. Alginates are used mainly in textile printing as washing- and light-resistant print paste thickeners and in food processing as emulsifying, stabilizing, and gelling agents. *Laminaria* can also be used as a feedstock for fermentation to methane (natural gas) or butane diol (a building block for synthetic rubber). But again, the competition from developing countries which give price supports and have cheap labor may be a formidable challenge. Thus cultivation of seaweed in New York will have to be for the purposes of highest value end products.

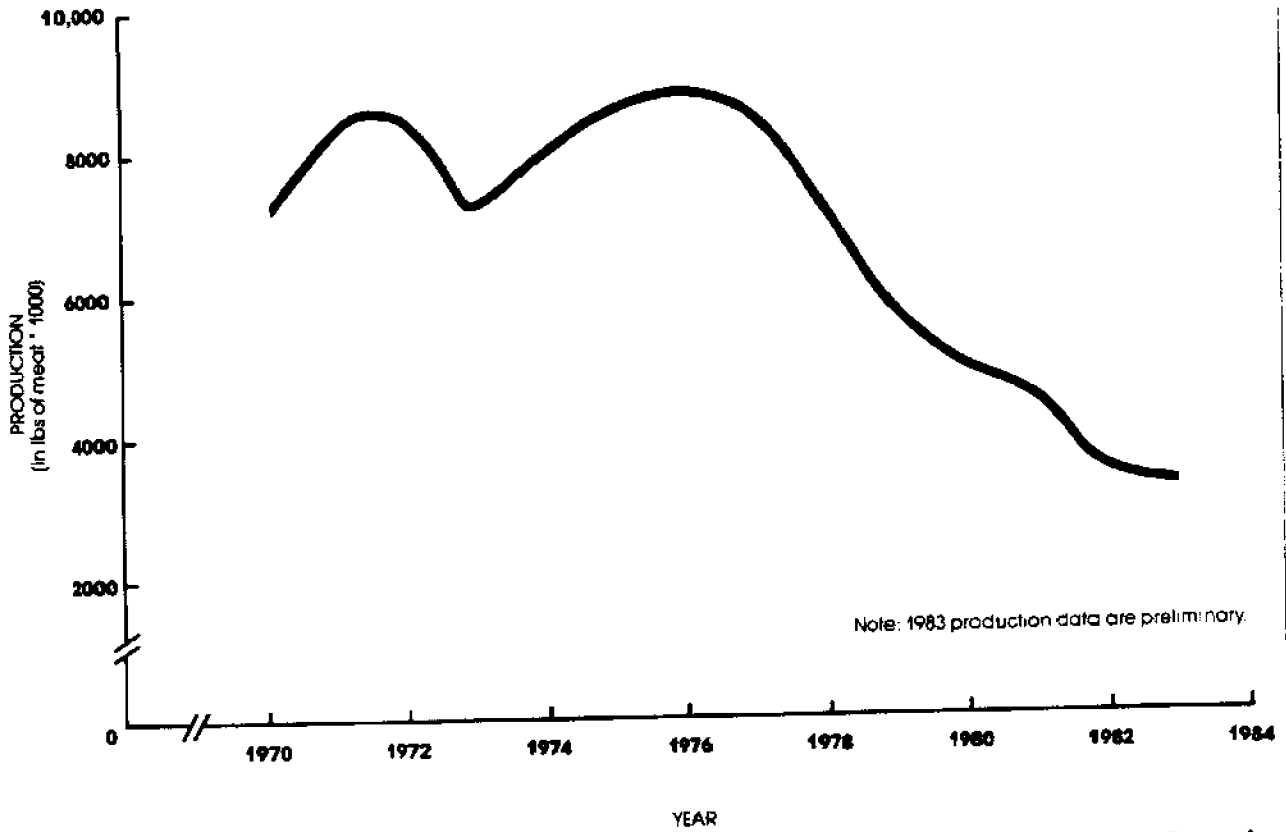
## CONSTRAINTS TO FUTURE MARKET DEVELOPMENT

While the market for New York cultured products extends across the nation, it is presently limited by production capability of the firms. In the future, however, "aquaculture should face fewer marketing problems than wild fish production, since it offers better possibilities for relating production to market opportunities. In fact, unlike the 'production-oriented marketing' in capture fisheries, aquaculture provides the challenge to apply modern concepts of 'market-oriented production'" (Pillay, 1977, p. 17). For example, spawning times could be manipulated to produce fish or shellfish out-of-season. But as the industry expands and production increases, it will be important to address a number of issues that can restrict development.

### Scarce market information

Market development will require information on the present market for aquaculture products. Information about supply and demand for seafood and some selected products can be gathered from existing data. Little detailed analysis of the market for particular aquaculture products has been conducted. While aquaculture products offer advantages over their wild harvest counterparts--such as uniform high quality, standard dimensions, and healthfulness--no analyses have

### Annual New York State Hard Clam Production 1970-1983



Source: National Marine Fisheries Service, Resource Statistics Division.

Figure 4

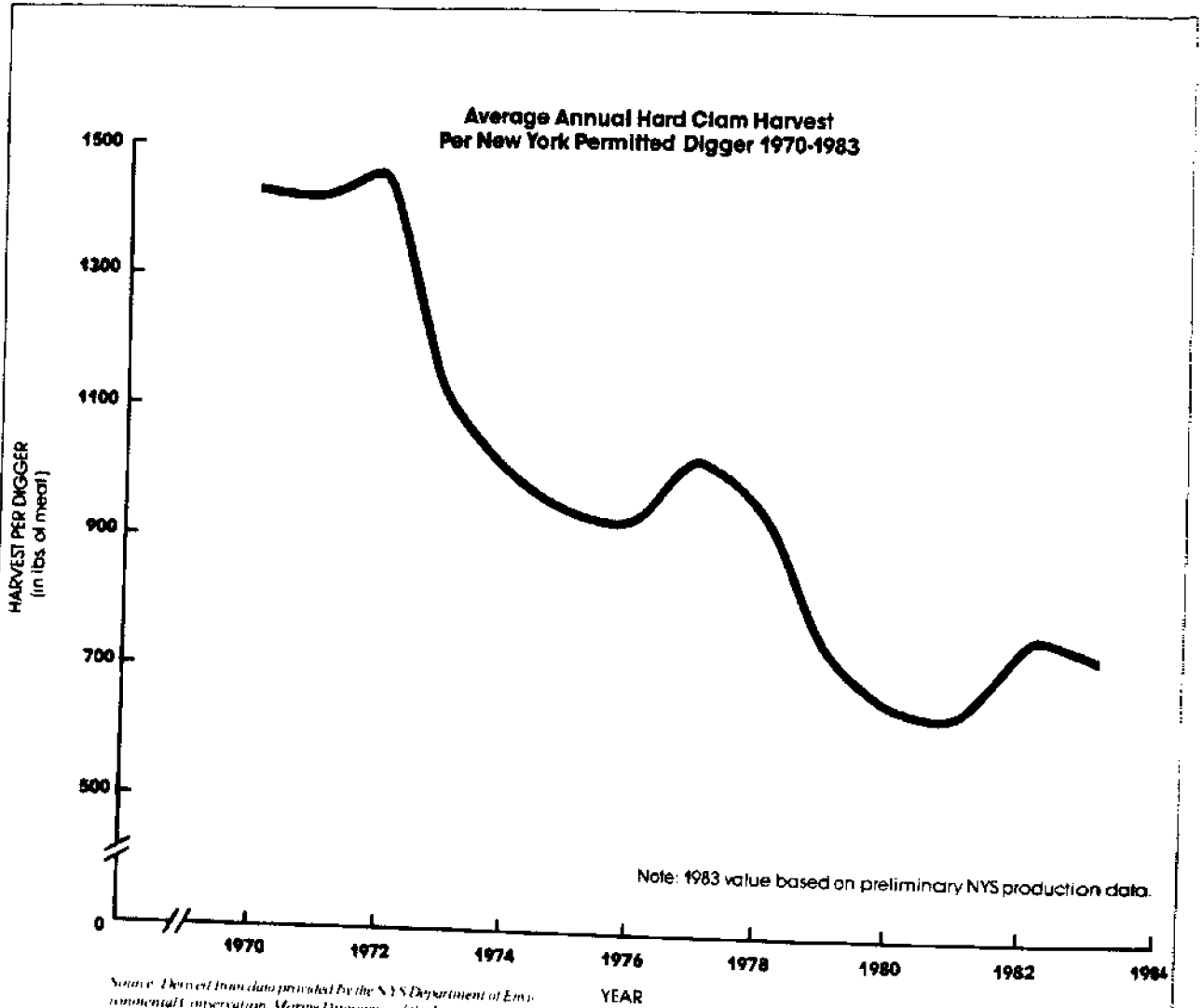
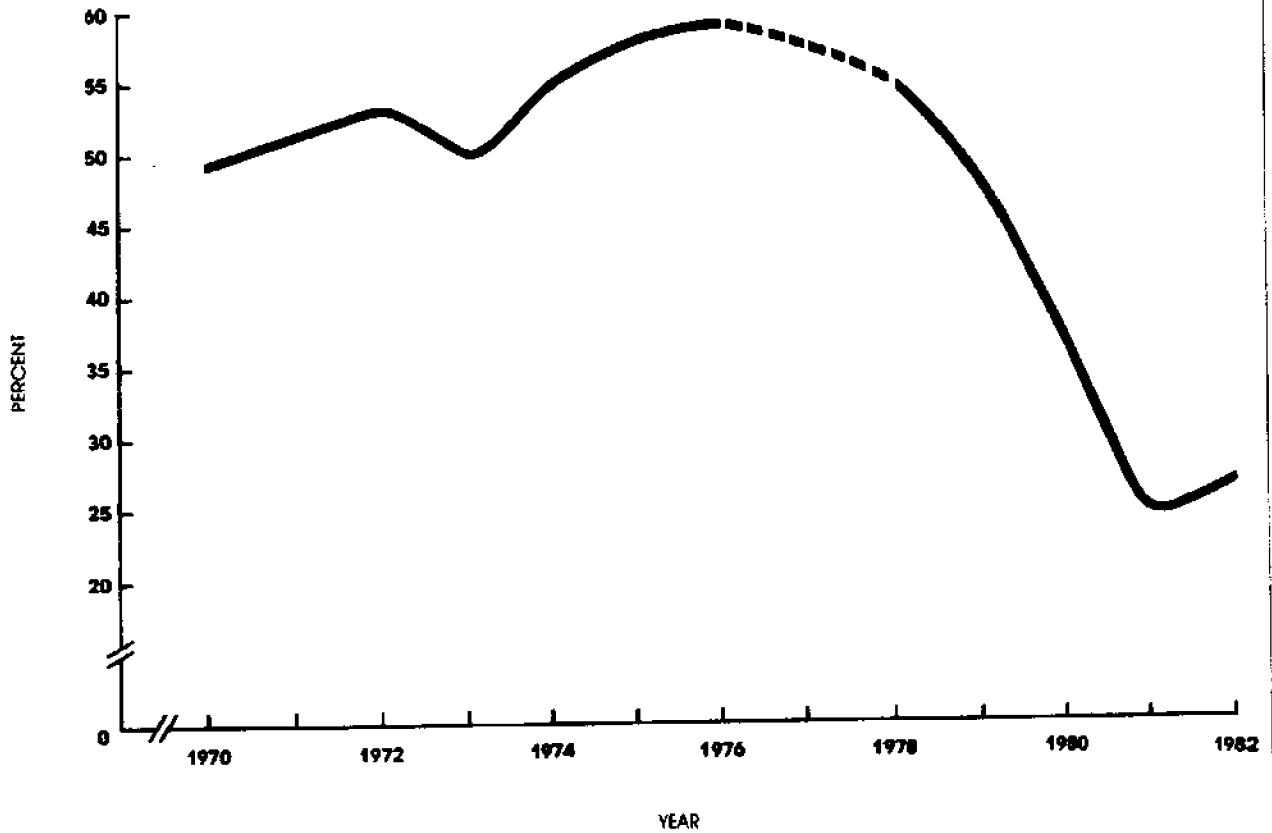


Figure 5

New York State Hard Clam Production as a Percent of National Production 1970-1982



Source: Derived from data provided by the National Marine Fisheries Service, Resource Statistics Division

Figure 6

## MARKETS

examined the relationship between these factors and the willingness of consumers to pay for them. For a limited time periodic assessments of the market for catfish and trout were published by the US Department of Agriculture (US Crop Reporting Board, "Aquaculture Outlook and Situation," April 1981, September 1981, April 1982; "Aquaculture: Catfish and Trout, Inventory and Sales," October 1980, April 1981; "Trout September 1, 1980 - August 31, 1981: Sales, Intentions, Expenditures," October 1981). These included information on supply, price, imports, and future trends, and were of help to investors, producers, and distributors in assessing the forces affecting the marketplace. In general, information is needed on the aquaculture product and its form: live, fresh, and processed; the use: private, commercial, and recreational; and the market chain.

### **Recommendation:**

- The Department of Agriculture and Markets should collect, analyze, and make available information about aquaculture products in the market and encourage the USDA to do so on a national level.

### **Unplanned market development**

While more popular products such as the hard clam and oyster will find unlimited markets in the short run, long-term prospects could be improved if market development keeps pace with an increase in production. If new markets are not developed, increased production can create an oversupply of aquatic products that will limit potential for new business development. Market development can also help decrease competition between aquaculture and wild harvest products, a competition that shellfishermen fear could harm their business.

In addition, many of the present markets have been developed individually by the existing businesses. As a result, valuable information is proprietary. This type of market development is very expensive for the producer. Incoming small businesses will have difficulty competing with the larger, established operations.

### **Recommendations:**

- The Department of Agriculture and Markets should be designated the lead agency for promotion of aquaculture and should promote New York State as a place for aquaculture development.
- The Department of Agriculture and Markets should establish an industry-government advisory panel to provide advice to the state in developing aquaculture marketing programs and policies.
- The Department of Agriculture and Markets should assist aquaculturists in promoting New York State aquaculture products through the use of special trademark and other marketing programs.

### **Inaccessibility of markets**

It can be difficult for individual culturists to compete in large markets. The individual may not produce enough to supply the market without working

cooperatively with other producers. The cooperative can purchase materials in large quantities and share some equipment such as harvesting and processing machines to achieve economies of scale; the group can establish cooperative harvesting, processing, and marketing arrangements to achieve vertical integration.

In Delaware County the OURS-Delaco fish farming project competes economically in the local markets because members work cooperatively in ordering young animals and feed, harvesting, processing, and marketing. (Titus, pers. comm., July 13, 1982).

**Recommendation:**

- The Department of Agriculture and Markets should help interested aquaculturists to establish producer cooperatives.

**Limited product development**

As new products are developed, markets for New York aquaculture products could be increased. Aquaculturists can learn from the experience of the poultry industry. Although poultry is different in that it has no wild competitor and its cultivation was thoroughly understood before newer products were developed, markets could be developed as new products from cultured fish and shellfish become available (Baker, pers. comm., June 10, 1982).

**Recommendation:**

- Research and development of new aquaculture products should be a priority research area of the state's universities.

**Quality control**

Quality control can play an important role in marketing of aquaculture products. Aquaculture, because it is a controlled cultivation of plants and animals, can assure consistently high quality products. Existing operations in New York such as the Bluepoints and F.M. Flower companies already exploit this opportunity in marketing their product. Buyers anticipate and pay a premium price for these products (Survey of New York Aquaculturists, 1982). While new ventures can continue to set individual quality standards, for consistency it is more desirable for the industry to adopt uniform standards (Hawaii Department of Planning and Economic Development, 1978, p. 122).

In addition, storage and shipping practices for fresh seafood have traditionally been very poor, causing a loss in quality of the products from harvest to market. As New York's aquatic production increases because of aquaculture, markets outside of New York will be tapped. Storage and shipping practices should be improved to take advantage of export market opportunities (Regenstein, pers. comm., December 14, 1983).

**Recommendation:**

- The Department of Agriculture and Markets should assist New York aquaculturists in setting, advertising and maintaining quality standards for aquaculture products.



VII

## Research and Technology Transfer



## VII. RESEARCH AND TECHNOLOGY TRANSFER

### INTRODUCTION

Aquaculture is in much the same position as agriculture was a century ago. Practitioners are few, scattered, often unorganized, and lack financial resources to obtain technical information or special skills required for improvement of their industry. Persons seeking entry to aquaculture find it difficult to acquire necessary skills because few training programs or courses are offered and the opportunities to learn from existing culturists are limited.

Many aquaculturists see the academic community as a source of both the research and training required by aquaculture, just as the land grant colleges, or colleges of agriculture and of veterinary medicine, have served agriculture over the last century. It was with this concept in mind that the US Congress enacted the Sea Grant Colleges and Programs Act of 1966 (P.L. 93-73). In that legislation, Congress found...

that aquaculture, as with agriculture on land, and the gainful use of marine resources can substantially benefit the United States, and ultimately the people of the world, by providing greater economic opportunities, including expanded employment and commerce; the enjoyment and use of our marine resources; new sources of food; and new means for the development of marine resources. (section 202 (c))

That legislation provided funds for universities and colleges to engage in education, training, research, demonstration projects, publications, and other methods to assist the nation and the states in the development of coastal resources. Subsequent versions of the legislation, most recently the National Sea Grant College Program Act of 1978, do not carry the reference to aquaculture.

Although its national budget is small--\$39 million for all Sea Grant education, training, research, and advisory services in the 29 coastal states compared with over ten times that for comparable functions carried out in the 50 states and 3 territories in support of agriculture--Sea Grant has had a significant effect within the academic community in stimulating thinking about aquaculture and its needs.

In New York State, the New York Sea Grant Institute, a cooperative activity of Cornell University and the State University of New York, is the Sea Grant college and, in this capacity, sponsors research and supports an extension program in both marine and Great Lakes resource development. In 1984, over 30% of the Sea Grant Institute's \$2 million federal budget was expended in aquaculture research. About 10% of its budget for extension activities is spent on aquaculture and related activities. These funds, augmented by small state appropriations, provide research in aquatic animal disease, aquatic animal culture, basic biological research on cultured species, and investigations into social, legal, and economic aspects of aquaculture.

In addition to research and extension education specifically directed toward aquaculture, the Sea Grant Institute supports activities in seafood science and marketing and a variety of other related marine resource subjects. The Sea Grant Institute also managed the New York State Marine Biomass Project, an investigation

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into the feasibility of utilizing macroalgae (seaweeds), grown as a cultivated crop, as a feedstock for the production of methane (natural gas) or neutral solvents such as alcohols that have value either as energy sources or as chemical feedstocks. This research led to a test farm located in Long Island Sound.

These activities, however promising, barely begin to address the needs of a developing industry:

...aquaculture is a multi-disciplinary science including fishery biology, ecology, animal physiology, pathology, animal nutrition, feed technology, soil science, water chemistry, farm engineering and farm economics. However, despite a history of almost 4,000 years, the present technology of aquaculture has been largely developed by trial and error rather than by scientific research. This accounts for the empirical nature of many of the culture practices and the generally low level of technology. When compared with agriculture, which has benefited by over 100 years of research, experimentation and field trials, aquaculture as a science can be said to be only in its very infancy. (Pillay, 1977, p. 46)

At present the culture of only a few species has been developed to a stage of economic feasibility. These include such well-known shellfish as the hard clam and the American oyster and, among finfish, several salmonid species especially trout. Much research has been devoted to bringing other shellfish, particularly scallops and the American lobster, and various species of shrimp to a production stage. This research is promising; but all of it has focussed on the culture of highly valued crops. More attention should be given to research on improved aquaculture technologies, more efficient culture systems, nutrition, genetics, controlling animal health, preventing predation, and improving reproductive potential. Furthermore, expanded efforts in technology transfer, including education, extension, and demonstration projects, are required.

### RESEARCH NEEDS

Research on aquaculture must be supported by public funds, particularly at this critical, early stage of development of the industry. Most firms are too small and too marginal to finance research and development at the scale needed; and many firms that could or would like to sponsor research would consider the results proprietary. Yet, as mentioned in Section IV, these large firms such as ConAgra and Weyerhaeuser can be an important source of operating (though not research) funds.

#### Federal support for research

Sources of public funds for aquaculture research are currently limited. Although, the federal government has funded a broad range of services from research and development to disease diagnosis and environmental analysis. Housed in the Departments of Agriculture, Interior, Commerce, and Energy, the National Science Foundation, and the National Institutes of Health, these services were worth over \$30 million in fiscal year 1982. These services provide a basis of support for the commercial industry as well as other state and federal aquaculture activities (Joint Subcommittee on Aquaculture, 1983, Vol. 1, pp. 31-36).

## RESEARCH AND TECHNOLOGY TRANSFER

The Department of Agriculture supports aquaculture research through its competitive grants program and certain other programs. Available funding is modest. Principal research is on freshwater culture particularly in relationship to other farming activities.

The Department of Interior supports some freshwater fish culture research, but available funds are very limited and have been under threat of federal budget cuts. The National Fisheries Center of the Department of Interior's Fish and Wildlife Service located in Leestown, West Virginia, conducts this research through its National Fishery Research and Development Laboratory in Wellboro, Pennsylvania; the Tunison Laboratory of Fish Nutrition in Cortland, New York; and the National Fish Health Research Laboratory in Keanesville, West Virginia. The Tunison Laboratory has been of invaluable help to New York aquaculturists and researchers. The laboratory has carried out fundamental research on fish nutrition resulting in substantial improvements in feeds for cultured fish. This laboratory has been scheduled for termination and has suffered budget cuts in recent years.

The Department of Commerce spends about \$5 million annually through the National Marine Fisheries Service for aquaculture, and about \$4 million annually through the National Sea Grant College Program. The National Sea Grant College Program has been scheduled for termination in each of the fiscal years of the present administration. However Congress has always restored at least level funding of the program. Aquaculture research in the National Marine Fisheries Service also gets scheduled for termination each year.

The National Marine Fisheries Service Research Laboratory at Milford, Connecticut has been of great value to New York aquaculturists. This laboratory has had a long and significant history in shellfish culture. The Milford Laboratory pioneered in culture of microalgae as a shellfish food, in cultivation of oysters and other shellfish, in shellfish pathology, and in basic shellfish nutrition and biology. For the past three years, however, this laboratory has been instructed to alter its mission, terminating aquaculture-related research, and has suffered budget reductions.

The Department of Energy, through its Solar Energy Research Institute (SERI), conducts research on land-based, saltwater aquaculture. SERI has a sizable research program on development of oil-yielding microalgae which can be grown in saline waters (salt lakes, springs and marshes) of American southwest deserts (Aquatic Species Program, Proceedings of April 1984 meeting, SERI, p.1).

Additional agencies which provide financial support for aquaculture research in the academic community are the National Science Foundation and the National Institutes of Health. The former does not make research grants in aquaculture but will support basic biological studies of value to aquaculture. Research on animal diseases of potential significance to public health may be supported by the National Institutes of Health, not when the focus is animal disease per se but rather when there are implications for the understanding of basic biological processes (see Table 9).

### Recommendation:

- The federal government, through the state's congressional delegation, should be encouraged to provide support both for established laboratories and for academic research in aquaculture.

RESEARCH AND TECHNOLOGY TRANSFER

Table 9

FEDERAL GOVERNMENT PROGRAMS IN SUPPORT OF AQUACULTURE BY ACTIVITY

Agency/ Program	Activity Funded
<b>United States Department of Agriculture</b>	
Agriculture Marketing Service	Market research grants
Agriculture Research Service	Research and development
Animal and Plant Health Inspection Service	Disease diagnostic service
Cooperative State Research Service	Research
Extension Service	Extension and outreach
Foreign Agriculture Service	Product promotion
National Agricultural Library	Library services
Soil Conservation Service	Technical services
Statistical Reporting Service	Aquaculture economic surveys
<b>United States Department of Interior</b>	
Fish and Wildlife Service	Research, hatcheries, extension
Bureau of Indian Affairs	Capital construction funds, education
<b>United States Department of Commerce</b>	
National Oceanic & Atmospheric Administration	Research and development
National Marine Fisheries Service	Research, education, extension
Office of Sea Grant	
<b>National Science Foundation</b>	Research

Modified from Joint Subcommittee on Aquaculture, 1983, Vol. 1.

**State research in aquaculture**

At present, the only continuous support from the state of New York for aquaculture research is indirectly contained in appropriations to the New York Sea Grant Institute and in support of a few aquaculture-related faculty positions in the State University of New York at Stony Brook and the NYS College of Veterinary Medicine at Cornell. Several other academic campuses across the state conduct aquaculture research but the funding is derived from the federal agencies previously noted.

As mentioned in Section II, the state did make a one time appropriation of \$1 million to the Department of Agriculture and Markets for aquaculture research and demonstration. Three-quarters of this money was transferred to the Urban

## RESEARCH AND TECHNOLOGY TRANSFER

Development Corporation (UDC) for the same purpose except that the UDC projects will all be on Long Island. In April 1985 the state also made a modest appropriation to SUNY at Stony Brook for development of a Living Marine Resources Institute which will have aquaculture research as a major component. Finally, the state's Energy Research and Development Authority spent about \$600,000 over the past five years for seaweed culture research. The Authority has recently terminated its support for this project.

### **Recommendation:**

- **The state and academic institutions should support a program of research directed at increasing the effectiveness of the aquaculture industry in the state.**

### **State research capabilities**

#### **Existing academic research facilities**

Research facilities for freshwater aquaculture exist at only a few academic institutions. The College of Agriculture and Life Sciences at Cornell University has carried out research on fish culture. While its facilities have had only limited use in the recent past, there are ponds and hatchery installations which could be used. Cooperation between the College and the Tunison Laboratory of the US Fish and Wildlife Service has been excellent, and sharing of Tunison's superior facilities has been undertaken in the past. Freshwater field research stations and facilities exist within the state university system, but these are relatively limited and are not presently geared for culture research.

Marine aquaculture facilities exist primarily in the Flax Pond Laboratory of the State University of New York at Stony Brook. This facility has limitations imposed by its saltwater supply, drawn from a tidal wetland, Flax Pond. However, it is scheduled for upgrading using a portion of the funds recently appropriated for establishment of the Living Marine Resources Institute. Instructional laboratories are located at the Cedar Beach campus of Suffolk County Community College. These are perhaps the most modern in the state, but are designed primarily for instruction. The important role of facilities such as these should not be underestimated:

Perhaps equally important has been the active part the State [Hawaii] has played in the demonstration of the scientific and economic feasibility of commercial pond culture. State personnel have worked closely with private farmers and have provided the technical expertise necessary for success. This type of close working relationship has been augmented by the State's provision of a broad array of free extension/advisory services and stocking material at cost after the farmer has become established. (Hawaii Department of Planning and Economic Development, 1978, p. 28)

### **Recommendation:**

- **Expanded research facilities should be created at key institutions such as Cornell University and the State University of New York to provide for aquaculture research and aquaculture demonstration projects.**

## RESEARCH AND TECHNOLOGY TRANSFER

### State agency exotic species importation monitoring

New York must keep up its record of vigilance toward the importation of exotic species. Such species may, as in terrestrial experiences, become pests on local desired organisms (cultured and wild) or may be vectors of disease. New York's waters, through natural phenomena not completely understood, have been comparatively free from shellfish diseases such as MSX which is widespread south of New York and paralytical shellfish poisoning (known as red tide) which frequently occurs north of New York. Such diseases have killed shellfish stocks or made them unsealable. "The introduction of exotic stocks and species and the frequent local transfer of stocks create a potential for the introduction of disease, parasites, competitors and injurious genetic strains" (National Academy of Sciences, 1978, p. 4).

#### Recommendation:

- The Department of Environmental Conservation should increase its capability to monitor the importation of exotic organisms and its capability to assess these as possible disease vectors.

### Disease diagnosis and control

Aquaculture's importance has been recognized by significant changes in the last decade within the academic community of the state. In the NYS College of Veterinary Medicine, the Department of Avian Disease was renamed the Department of Avian and Aquatic Disease and two faculty positions were established dealing with aquatic pathology. Those positions had been vacant for some time as a result of budgetary constraints but have recently been refilled. The College of Veterinary Medicine collaborates with the Marine Biological Laboratory, Woods Hole, Massachusetts and the School of Veterinary Medicine, University of Pennsylvania, in AQUAVET, a training program for aquatic veterinary medicine, and in the marine animal disease diagnostic service at the Marine Biological Laboratory. Yet disease remains one of the most important sources of economic loss to culturists and none of the capabilities mentioned provide the necessary services to the industry for control of disease among cultured organisms or to the consumer in assuring a healthful product.

Pathogens may cause disastrous problems in many types of intensive aquaculture activities. A dense stocking rate may induce stress problems and increase susceptibility to diseases. (Ackefors and Rosen, 1979, p. 38)

The Bluepoints Company of Long Island finds disease control in the hatchery one of its greatest technical problems (Usinger, pers. comm., July 8, 1982). Established culturists expressed a strong desire for a public program of disease diagnosis and treatment (Relyea, pers. comm., July 9, 1982; and Usinger, pers. comm., July 8, 1982).

#### Recommendation:

- Shellfish disease diagnosis services, urgently needed by the shellfish culture industry and the Department of Environmental Conservation, should be provided by the New York State College of Veterinary Medicine.

### Water pollution control

High quality water is essential for aquaculture. Contamination by substances injurious to human health can render organisms unsaleable, and the organisms themselves may be adversely affected by toxic substances. This is particularly true of the younger stages of most marine organisms and organisms raised in high densities typical of aquaculture. Contamination of waters by domestic sewage such that the coliform bacteria levels are above the standard levels allowed under state law for shellfish cultivation would close production. New York's waters have been degraded in past years, and programs to improve water quality through construction of sewerage and sewage treatment plants will be critical for expansion of aquaculture into waters now closed for shellfishing. Reduction of existing contaminant loads in waters such as Lake Ontario and Lake Erie and the Hudson River is desirable although no technology exists to accomplish the task. Effective enforcement of existing laws and regulations with regard to improper disposal of toxic wastes is necessary to prohibit further degradation of coastal waters.

### Expanding areas of research capability

The Marine Sciences Research Center of the State University of New York at Stony Brook has recruited several faculty in aquaculture who, with the Sea Grant professorships in shellfish biology and in marine phycozoology, form an excellent nucleus for aquacultural research. Recent advances in genetic engineering and biotechnology argue for further strengthening of this promising beginning.

However, research and development capabilities in engineering and engineering systems applied to aquaculture are conspicuously lacking within the academic community. The importance of this type of research is underscored by the present and projected high cost of energy on Long Island:

Cost of production using many available culture systems is high. Existing ventures are often labor and energy intensive, and technology varies with the operation. Efficiencies may be gained through increased mechanization of stock handling, harvesting, and processing. In addition, development of energy efficient systems for pumping and heating water, and for heating facilities is critical. (Maine State Planning Office, 1980, pp. 12-13)

### Recommendation:

- Capabilities of the university community to provide research in the fields of aquaculture of both fresh and marine species, including but not limited to biology, genetics, pathology, engineering, nutrition, animal management, and food science, should be strengthened.

### Future research needs

Special attention must be paid to providing for continuing research flexibility and for developing additional research capability as aquaculture expands. Some of these research and development opportunities may expand economic opportunities for existing New York enterprises. For example, feeds constitute a major cost to the fish culturist. Development of more economical feeds providing

## RESEARCH AND TECHNOLOGY TRANSFER

essential nutrition is always of priority. Where such feeds might be locally produced from agricultural by-products could have important economic benefits to both culturist and the food production sector.

### Recommendation:

- The Sea Grant Institute should establish a forum for continuing discussion between the research community and the developing aquacultural industry to insure that research and development programs are focussed on needs of the industry and reflect current opportunities for introductions of new technologies and concepts.

## TECHNOLOGY TRANSFER

### Extension and technical services

Research alone is not sufficient. Information must be transferred to those who need it; hence the need for training and extension programs. Although the Department of Environmental Conservation's shellfish program and finfish hatchery program emphasize management of wild aquatic stocks, aquaculturists can benefit from the Department's expertise. On the federal level, there is also the National Fisheries Center which provides training, information, and demonstration on freshwater finfish culture.

Most technical services are provided from the public sector. However, a growing number of entrepreneurs provide some research and technical services for a fee. In New York, some aquaculturists provide part-time consulting services (Survey of New York Culturists, 1982). The Directory of Aquaculturists in the Northeast lists over 60 professionals in seven northeastern states who provide consulting services or informal information assistance (Maine Aquaculture Association, 1980).

The basic technology for intensive production . . . is in place, but industry growth is presently limited by inadequate information to producers and potential producers. A primary need is for an effective aquaculture extension program. (Missouri Aquaculture Advisory Council, p. 5)

Furthermore, the cost of obtaining the appropriate expertise from consulting firms may be too great for many new businesses. For these reasons, the provision of analytical support services is a valuable area for State assistance to beginning farmers. (Hawaii Department of Planning and Economic Development, 1978 p. 31)

The State of New York is well served by its Sea Grant Extension Program and Cooperative Extension Service. While both have modest programs in technology transfer and education in aquaculture, stronger, more visible technological enhancement will be required for a vigorous industry. Existing programs of these educational services deal with shellfish culture technology (Sea Grant Extension; 4-E "Clam Club" programs) and fish farming (Sea Grant Extension; Cooperative Extension). Needed is an enhanced capability of providing for demonstration projects of new technologies. Such demonstration projects could be an important



adjunct of training programs for new entrants to the industry.

**Recommendations:**

- Capabilities of existing technology transfer programs such as Sea Grant Extension Program and the Cooperative Extension Service need to be strengthened to better serve aquaculturists. This should include, where appropriate, transfer of technology from top aquaculture producing countries. The capability of these programs to provide for demonstration scale projects should be the objective of this strengthening.
- Guides to assist potential aquaculturists in getting started should be developed cooperatively by the Sea Grant Institute, Cornell Cooperative Extension, the Office of Business Permits, and the Department of Agriculture and Markets. Such guides should provide information on site selection, obtaining permits and licenses and obtaining necessary financing.

**Education**

Aquaculture is a scientifically complex business. Aquaculturists are generally persons who have had long practical experience and training or those who have advanced training in universities or colleges. Existing educational programs cater principally to the latter group. Lacking are programs for retraining of those seeking to enter aquaculture but lacking time or financial resources for full educational programs. The future of aquaculture will depend, in part on the interest of today's young people. They will need to learn about opportunities in aquaculture and about the requirements of the business.

**Recommendations:**

- Additional education programs through organizations such as BOCES (Board of Cooperative Educational Services) should be developed and existing programs strengthened to provide for retraining opportunities to culturists and for developing skilled technical support persons for the aquaculture industry.
- Youth education programs such as those offered by 4-H and similar organizations which teach elements of shellfish and finfish (as appropriate) culture as a means of introducing young people to aquaculture as an occupation and as a means of supplying quality seafoods should be expanded.



VIII

## Summary of Recommendations

## VIII. SUMMARY OF RECOMMENDATIONS

The following is a summary of the recommendations of this study. They are arranged by agency or organization affected, and, in cases where the recommendation affects more than one organization, the recommendation is listed separately for each.

### **The New York State Legislature should:**

- establish a policy in support of aquaculture development in New York State;
- define aquaculture as agriculture under the New York State Agriculture Districts Law;
- assure that aquaculture facilities not be equated with industrial facilities under New York State Environmental Conservation Law, water pollution discharge statutes;
- define aquaculture as agriculture under the Freshwater Wetlands Law;
- amend special state statutes authorizing some Long Island towns to lease town-owned underwater lands for shellfish cultivation to include leasing for finfish and plant aquaculture;
- clarify the allocation of regulatory powers among state and local governments regarding control over local navigable waters;
- provide guidance as to the scope of town zoning authority over state-owned underwater lands leased for aquaculture from New York State or Suffolk County;
- reconcile section 32 of the New York State Navigation Law and section 15-0503 of New York State Environmental Conservation Law which address permitting of construction of docks and other structures in the waters of New York State to clarify their authority and scope regarding which waters and what structures are covered under each law;
- enact legislation to set tough penalties for theft of aquaculture produce or destruction of aquaculture facilities;
- strengthen the capabilities of existing technology transfer programs such as Sea Grant Extension Program and the Cooperative Extension Service to better serve aquaculture. The capability of these programs to provide for demonstration scale projects should be the objective of this strengthening.

### **The New York State Department of Agriculture and Markets should:**

- undertake responsibility as the lead agency for promotion of aquaculture and promote New York State as a place for aquaculture development;
- appoint an ombudsman to assist aquaculturists in obtaining permits and to provide information about undertaking aquaculture in New York;

## SUMMARY OF RECOMMENDATIONS

- establish a revolving loan fund for aquaculture start-up capital;
- conduct further study on whether aquaculture should be defined as agriculture under New York Agriculture Districts Law;
- take the lead in assisting aquaculturists to petition the Federal Crop Insurance Corporation for coverage of their specific crops;
- collect and make available information about the aquaculture industry including total businesses, production, and years in operation;
- collect, analyze, and make available information about aquaculture products in the market;
- establish an industry-government advisory panel to provide advice to the state in developing aquaculture marketing programs and policies;
- assist aquaculturists in promoting New York State aquaculture products through the use of special trademark and other marketing programs;
- assist interested aquaculturists to establish producer cooperatives;
- assist New York aquaculturists in setting, advertising, and maintaining quality standards for aquaculture products.

### **The New York State Department of Environmental Conservation should:**

- participate in a conference to clearly identify lead responsibility for making underwater lands available for aquaculture development in New York. The conference should include also the Office of General Services and Suffolk County;
- through the conference, assure that the lead agency be given unique authority to make leases of lands for shellfish, finfish, and plant aquaculture of sizes up to a maximum of 100 acres for up to 20 years;
- through the conference, assure that the lead agency be given the authority to revoke and renew leases of underwater lands for aquaculture based on performance criteria to be established by the lead agency with guidance from industry and other interested departments;
- through the conference, assure that the lead agency establish other terms of the lease including rents, transferability, and disposition of improvements to the leased land upon termination of the lease with guidance from industry and other interested departments;
- clarify aquaculture permitting laws to specify whether proof of legal access to underwater lands is required before a permit will be granted;
- reconcile section 32 of the New York State Navigation Law and section 15-0503 of New York State Environmental Conservation Law which address permitting of construction of docks and other structures in the waters of New York State to clarify their authority and scope regarding which waters and what structures are covered under each law;

## SUMMARY OF RECOMMENDATIONS

- assure that aquaculture facilities not be equated with industrial facilities under New York State Environmental Conservation Law, water pollution discharge statutes;
- define aquaculture as agriculture under the Freshwater Wetlands Law;
- direct the use of a joint hearing process when public hearings are required for the approval of two or more permits from various agencies whenever possible;
- increase its capability to monitor the importation of exotic organisms and its capability to assess these as possible disease vectors.

### **The New York State Office of General Services should:**

- participate in a conference to clearly identify lead responsibility for making underwater lands available for aquaculture development in New York. The conference should include also the Department of Environmental Conservation and Suffolk County;
- through the conference, assure that the lead agency be given unique authority to make leases of lands for shellfish, finfish, and plant aquaculture of sizes up to a maximum of 100 acres for up to 20 years;
- through the conference, assure that the lead agency be given the authority to revoke and renew leases of underwater lands for aquaculture based on performance criteria to be established by the lead agency with guidance from industry and other interested departments;
- through the conference, assure that the lead agency establish other terms of the lease including rents, transferability, and disposition of improvements to the leased land upon termination of the lease with guidance from industry and other interested departments;
- reconcile section 32 of the New York State Navigation Law and section 15-0503 of New York State Environmental Conservation Law which address permitting of construction of docks and other structures in the waters of New York State to clarify their authority and scope regarding which waters and what structures are covered under each law;
- investigate the use of privately-owned underwater lands in the coastal zone for aquaculture and encourage their use in order to reduce conflicts associated with the use of publicly-owned underwater lands.

### **The New York State Department of State should:**

- assess the status and use of aquatic resources across the state to determine use intensity and conflict in conjunction with the Department of Environmental Conservation's Statewide Water Resources Management Strategy;
- develop a statewide management plan to allocate space for all users of aquatic resources;

## SUMMARY OF RECOMMENDATIONS

### **The New York State Office of Business Permits should:**

- make available a directory outlining the permit process for aquaculturists in New York State;

- with cooperation from the Sea Grant Institute, Cornell Cooperative Extension, and the Department of Agriculture and Markets, develop other guides to assist potential aquaculturists in getting started. Such guides should provide information on site selection, obtaining permits and licenses and obtaining necessary financing.

### **The New York State Energy Office should:**

- in formulating energy policy, continue to recognize the dependency of aquaculture enterprises on availability and costs of electricity.

### **Suffolk County should:**

- participate in a conference to clearly identify lead responsibility for making underwater lands available for aquaculture development in New York. The conference should include also the Department of Environmental Conservation and the Office of General Services;

- through the conference, assure that the lead agency be given unique authority to make leases of lands for shellfish, finfish, and plant aquaculture of sizes up to a maximum of 100 acres for up to 20 years;

- through the conference, assure that the lead agency be given the authority to revoke and renew leases of underwater lands for aquaculture based on performance criteria to be established by the lead agency with guidance from industry and other interested departments;

- through the conference, assure that the lead agency establish other terms of the lease including rents, transferability, and disposition of improvements to the leased land upon termination of the lease with guidance from industry and other interested departments.

- investigate the use of privately-owned underwater lands in the coastal zone for aquaculture and encourage their use in order to reduce conflicts associated with the use of publicly-owned underwater lands.

### **Local New York towns should:**

- define aquaculture as agriculture for the purpose of zoning codes;

- in the case of Long Island towns, investigate their authority for making leases of town-owned underwater land for aquaculture and adopt policies that will encourage local development.

- investigate the use of privately-owned underwater lands in the coastal zone for aquaculture and encourage their use in order to reduce conflicts associated with the use of publicly-owned underwater lands.

## SUMMARY OF RECOMMENDATIONS

### The academic community should:

- establish research and development of new aquaculture products as a priority research area of the state's universities;
- support a program of research directed at increasing the effectiveness of the aquaculture industry in the state;
- through the facilities of the New York State College of Veterinary Medicine, provide aquatic animal disease diagnosis services (for shellfish as well as finfish), which are urgently needed by the culture industry and the Department of Environmental Conservation;
- create expanded research facilities at key institutions such as the State University of New York and Cornell University to provide for aquacultural research and aquaculture demonstration projects;
- strengthen capabilities of the university community to provide research in the fields of aquaculture of both fresh and marine species, including but not limited to biology, genetics, pathology, engineering, nutrition, animal management, and food science;
- through the leadership of the Sea Grant Institute, establish a forum for continuing discussion between the research community and the developing aquaculture industry to insure that research and development programs are focussed on needs of the industry and reflect current opportunities for introductions of new technologies and concepts;
- through the cooperative efforts of the Sea Grant Institute, Cornell Cooperative Extension, the Office of Business Permits, and the Department of Agriculture and Markets, develop other guides to assist potential aquaculturists in getting started. Such guides should provide information on site selection, obtaining permits and licenses, and obtaining necessary financing;
- develop additional and strengthen existing educational programs through organizations such as BOCES (Board of Cooperative Educational Services) to provide for retraining opportunities to culturists and for developing skilled technical support persons for the aquaculture industry;
- encourage expansion of youth education programs such as those offered by 4-H and similar organizations which teach elements of shellfish and finfish culture (as appropriate) as a means of introducing young people to aquaculture as an occupation and as a means of supplying quality seafoods.

### The state's congressional delegation should:

- urge the federal government to provide support both for established laboratories and for academic research in aquaculture.

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# Appendix A

## 1983 Statewide Aquaculture Planning Act

### STATE OF NEW YORK

S. 774--A

A. 882--A

1983-1984 Regular Sessions

## SENATE--ASSEMBLY

(Prefiled)

January 5, 1983

IN SENATE -- Introduced by Sen. LAVALLE -- read twice and ordered printed, and when printed to be committed to the Committee on Agriculture -- committee discharged, bill amended, ordered reprinted as amended and recommitted to said committee

IN ASSEMBLY -- Introduced by M. of A. JACOBS, FERRIS, HINCHEY -- read once and referred to the Committee on Agriculture -- committee discharged, bill amended, ordered reprinted as amended and recommitted to said committee

AN ACT authorizing the New York Sea Grant Institute of the State University of New York and Cornell University and the College of Agriculture and Life Sciences at Cornell University to undertake a study to prepare and develop a statewide aquaculture plan

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

1 Section 1. The legislature finds that there is significant potential  
2 for growth in the aquacultural industry of New York; that this potential  
3 provides an opportunity for local economic development and expansion in  
4 the commercial cultivation of marine and fresh-water finfish, shellfish  
5 and plants for human consumption to provide another local food source  
6 for consumers. Development of aquaculture would create additional em-  
7 ployment opportunities in an industry that is compatible with the  
8 economy and lifestyle of many of the state's coastal and inland rural  
9 areas.  
10 Further, the legislature finds that factors such as lack of access to  
11 risk capital, lack of secure access to underwater lands, water columns

EXPLANATION--Matter in italics (underscored) is new; matter in brackets [ ] is old law to be omitted.

LBD01654-04-3

1 and coastal wetlands, limited processing facilities, a need for biological  
2 research and deficiencies in laws and regulations are inhibiting investment  
3 in aquacultural enterprises.

4 The legislature, therefore, declares that in order to effectively support  
5 the growth of this important industry, there is a need for realistic state  
6 aquaculture planning, balancing the legitimate interests of the recreational,  
7 commercial fishing, shellfish and aquacultural industries, with the common  
8 property resources of the state and setting out a plan for research and  
9 development to foster the expansion of aquaculture.

10 § 2. The New York Sea Grant Institute of the State University of New  
11 York and Cornell University and the College of Agriculture and Life  
12 Sciences at Cornell University is hereby authorized to undertake a study  
13 to prepare and develop a statewide aquaculture plan. Such an economic  
14 development plan shall delineate and critically analyze the current  
15 status of the state's aquaculture industry and examine alternative state  
16 actions to support expansion of the industry. Such a study shall include,  
17 but not be limited to:

18 a. Determining the potential for aquacultural products in terms of  
19 need and markets;

20 b. Reviewing the species of finfish, shellfish and plants available  
21 for aquacultural production and marketing mechanisms which are now  
22 available;

23 c. Determining the potential for investment by farmers and fishermen,  
24 local and out-of-state businesses;

25 d. Identifying existing barriers to the aquaculture industry and making  
26 recommendations appropriate to the removal of such barriers;

27 e. Identifying state agencies and public and private research and educational  
28 institutions concerned with research, education, regulation, promotion  
29 and marketing functions related to aquaculture;

30 f. Recommending governmental and non-governmental mechanisms which can  
31 assist and enhance aquacultural activity through extension and transfer  
32 of existing and new technologies, practices and information; and

33 g. Assessing the current state of technology in commercial and public  
34 aquaculture and making recommendations for upgrading this technology to  
35 state of the art levels.

36 Within one year from the date on which such study is undertaken, the  
37 New York Sea Grant Institute and the College of Agriculture and Life  
38 Sciences at Cornell University shall complete such study and development  
39 of a statewide aquaculture plan and shall report the results of such  
40 study, and make appropriate recommendations to the governor and the  
41 legislature. Such other educational and research institutions determined  
42 to have an interest in the findings of the study shall receive the  
43 materials and documents transmitted to the governor and the legislature.

44 § 3. This act shall take effect immediately.

# Appendix B

## Plan Reviewers

### **AQUACULTURE INDUSTRY**

Dr. Cyrus Adler, President  
Green Eagle Enterprises  
New York, New York

Dr. Anthony D'Agostino  
New York Aquarium  
Brooklyn, New York

Mr. Robert Ferretti, Vice President  
Long Island Oyster Farms  
Greenport, New York

Mr. Bill Hart, Manager  
Shellfish Inc.  
West Sayville, New York

Dr. George Matthiessen, President  
Ocean Pond Inc.  
Fisher's Island, New York

Dr. Henry Moeller  
Hydro-Botanicals Co., Inc.  
Southampton, New York

Mr. John Mulhall, President  
Long Island Oyster Farms  
Greenport, New York

Mr. David Relyea, Biologist  
F.M. Flower and Sons Oyster Co.  
Bayville, New York

Mr. Bradden Smith, Manager  
Shinnecock Tribal Oyster Project  
Southampton, New York

Mr. Chuck Steidle, President  
Coastal Farms  
Watermill, New York

Mr. William Swan, President  
Coastal Aquaculture Inc.  
Hampton Bays, New York

Mr. Doug Titus, Director  
Fish Farming Project, OURS-Delaco Association Inc.  
Delhi, New York

Mr. Emil Usinger, Executive Vice President  
Bluepoints Co.  
West Sayville, New York

#### **COMMERCIAL AND RECREATIONAL FISHING**

Mr. William Canaday  
Islip Baymen's Association  
Islip, New York

Mr. Vincent Daly  
Long Island Green Seal Program  
Lindenhurst, New York

Dr. William Muller, Editor  
Long Island Fisherman  
Sag Harbor, New York

Mr. William Murphy  
Huntington Baymen's Association  
Huntington, New York

Mr. Pat Murray  
West End Baymen's Association  
Bohemia, New York

#### **LOCAL GOVERNMENT**

Mr. Stuart Buckner, Waterways Management Supervisor  
Department of Environmental Control  
Town of Islip  
Islip, New York

Mr. Richard Corwith  
Board of Trustees of the Freeholders and Commonalty  
Town of Southampton  
Southampton, New York

Mr. Thomas Doheny, Director of Conservation  
Department of Conservation and Waterways  
Town of Hempstead  
Hempstead, New York

Mr. Kenneth Feustel, Assistant Waterways Management Supervisor  
Department of Environmental Control  
Town of Babylon  
Lindenhurst, New York

Dr. Malcolm Hair, Director  
Division of Natural Resources  
Town of East Hampton  
East Hampton, New York

Mr. Richard Hanley, Assistant Director  
Community Development Agency  
Town of Riverhead  
Riverhead, New York

Mr. Jeffrey Kassner, Bay Management Specialist  
Department of Environmental Protection  
Town of Brookhaven  
Patchogue, New York

Mr. Richard Koopman, Sr. Environmental Analyst  
Department of Environmental Control  
Town of Huntington  
Huntington, New York

Mr. James McMahon  
Office of the Supervisor  
Town of Southold  
Southold, New York

Mr. Mal Nevel, Supervisor  
Town of Shelter Island  
Shelter Island, New York

Mr. Larry Penney, Director  
Natural Resources  
Town of Easthampton  
Easthampton, New York

Mr. Kevin Quinn, Environmental Control Specialist  
Town of North Hempstead  
Manhasset, New York

Mr. Steven C. Ressler, Bay Constable  
Town of Smithtown  
Kings Park, New York

Mr. Thomas Rewinski, President  
Board of Trustees of the Freeholders and Commonalty  
Town of Southampton  
Southampton, New York

Mr. Paul Stoutenberg, President  
Trustees of the Town of Southold  
Southold, New York



Mr. James Strella, Environmental Control Specialist  
Bureau of Conservation and Waterways  
Town of Oyster Bay  
Syosset, New York

Mr. Edward Warner  
Board of Trustees of the Freeholders and Commonalty  
Town of Southampton  
Southampton, New York

#### **COUNTY GOVERNMENT**

Mr. DeWitt Davies, Principal Planner  
Long Island Regional Planning Board  
Hauppauge, New York

Mr. John Follis, Deputy Director  
Nassau County Planning Commission  
Mineola, New York

Dr. Lee Koppelman, Director  
Long Island Regional Planning Board  
Hauppauge, New York

Dr. Robert Nuzzi, Chief  
Marine Monitoring Unit  
Suffolk County Department of Health  
Riverhead, New York

#### **NEW YORK STATE AGENCIES**

Mr. Alan Bauder, Real Property Examiner  
NYS Office of General Services  
Albany, New York

Mr. Philip Bradway  
Division of Marketing  
NYS Department of Agriculture and Markets  
Albany, New York

Mr. Gordon Colvin, Director  
Marine Division  
NYS Department of Environmental Conservation  
Stony Brook, New York

Mr. James Coon, Acting Director  
Division of Local Government Services  
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