



A SURVEY OF PRIVATE COMMERCIAL MARINE AQUACULTURE IN THE NORTHEAST



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1.0 EXECUTIVE SUMMARY

Study Purpose

This final report is based on a five-month study of the private marine shellfish aquaculture industry in the ten coastal states from Maine south to Virginia.

The study was conducted by Profiles Research & Consulting Groups, Inc., from December, 1980 through March, 1981 under its contract with the National Marine Fisheries Service in Gloucester, Massachusetts.

The overall purpose of the study was to compile, for calendar year 1979, information concerning:

- . the number of producers,
- . the quantity and value of products,
- . water resources used,
- . acreage used,
- . facilities employed,
- . actual employment for the year 1979 and future manpower needs.

Study Summary

This section briefly summarizes the major findings and conclusions which are presented in detail throughout this report. We were able to determine through this study that the community of interest involved in private marine shellfish aquaculture is considerably larger than was predicted by the National Marine Fisheries Service. At present, some 257 businesses actively pursue marine shellfish aquaculture production in the states designated to be surveyed. They range in size from one-man cottage industries barely eking out an existence to vertically integrated aquaculture corporations reporting multi-million dollar gross annual sales. There are indications that there were considerably more shellfish aquaculturists in business three to ten years ago.

Conclusions

The major conclusions of this study are as follows:

- Pollution and disease have seriously depleted the number of shellfish aquaculturists active in production throughout the Northeast.
- Pollution control methods, themselves, have been nearly as detrimental as the pollution controlled, to some shellfish environments and populations.
- Depletion of natural seed stock has severely hampered expansion or maintenance of aquaculture production levels.
- Shellfish production had a total value of more than \$16 million from aquaculture efforts in 1979.
- The amount of acreage in aquaculture production often exceeds the total amount considered available by state authorities.
- The New England area exhibited the greatest number of culturing techniques and the more innovative adaptation of facilities; yield per acre is substantially greater. The New England shellfish aquaculture community is of more recent origin than that of the balance of the region studied. Individual aquaculturists in New England were more likely to have obtained advanced educational training, as well.
- There is a diversity of available methods for marketing shellfish aquaculture production. Few shellfish aquaculture producers have the market knowledge or the financial capability to take advantage of most of those methods.

Acknowledgements

Profiles wishes to express its appreciation for the cooperation received throughout this study from the National Marine Fisheries Service, state agencies, universities, associations and federal program representatives in the subject areas. Dr. George Flick, of Virginia Polytechnic Institute, was particularly helpful in assembling the community of interest.

We should especially like to thank Dr. Robert Hanks and Anthony P. Bocelle, who served as our Technical Advisor and Contracting Officer, respectively. Without their support and assistance we would have been unable to complete our task.

Profiles hopes this survey has been of assistance to the National Marine Fisheries Service in this important undertaking.

2.0 INTRODUCTION

2.1 Background and Purpose

In December, 1980, Profiles Research & Consulting Groups, Inc. was commissioned by the National Marine Fisheries Service to conduct a five-month study of the Private Marine Shellfish Aquaculture Industry in the Northeast. The ten coastal states of Maine, New Hampshire, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Delaware, Maryland and Virginia constituted the surveyed area. The study was concluded in March, 1981.

The purpose of this study was to compile information concerning:

1. The number of producers, 1979 (by state and by species);
2. The quantity and value of products, 1979 (by state and by species);
3. Water resources used, 1979;
4. Acreage used, 1979 (by state and by species);
5. Facilities used in private marine shellfish aquaculture, 1979;
6. Employment, 1979 (by state and by species); and
7. Present and future manpower training needs.

For the purpose of our survey, the term "Private Marine Shellfish Aquaculture" was defined as any business enterprise which propagates and/or rears shellfish in marine or brackish water environments. Lobster ponds where no feedings are done, shedding-out facilities for crabs, shellfish relaying, depuration and cultching-only operations were excluded.

2.2 Tasks by Methodology for this Study

The study by approach involved four (4) basic tasks:

- . Formation of the community of interest,
- . Formation of a questionnaire,
- . Conducting the interviews, and
- . The tabulation and presentation of findings and conclusions.

The most critical and difficult task for this study became the identification of the community of interest. Preliminary research had indicated that there was no single, direct source for compilation of a comprehensive listing of shellfish aquaculture enterprises. In addition, initial contacts revealed that the community of interest was substantially larger than the 65 to 90 entities estimated by the National Marine Fisheries Service.

Consequently, Profiles used a multiple-referenced grid method which first consisted of the following eight (8) sources:

1. National Trade Associations

World Mariculture Society
United States Aquaculture Council
Shellfish Institute of North America

2. State and Regional Associations

New England Collaborative for Aquaculture
Maine Aquaculture Association
Rhode Island Aquaculture Association
Rhode Island Seafood Council
Virginia Packers and Planters Association - assimilated by:
Virginia Seafood Council

3. State Departments of Fish and Game, Commerce, Agriculture, Marine Resources Commissions and Marine Products Commissions

4. State Agents

5. Federal Government Agencies

U.S. Department of Agriculture, Science and Technology Division
National Marine Fisheries Service
Sea Grant Agencies

6. Trade Journals and Directories

Aquaculture Magazines' Buyers Guide
The Directory of Aquaculturists in the Northeast
Aquaculture Digest
SINA's Membership Directory

7. Universities

University of Rhode Island
Virginia Polytechnic Institute
University of Maryland
University of Delaware

8. Vendors and Competitors

2.3 Forming the Community of Interest

Research of the community of interest indicated the industry to be larger than expected. Considerable effort, therefore, was expended to refine the identification methodology. The extra step was necessitated by the community of interest's lack of accessibility. As indicated elsewhere, there is no single, direct means of access to the shellfish aquaculture community and many of the enterprises maintain intentionally low profiles. A list of the private marine shellfish aquaculture enterprises that were identified and interviewed for this survey is included in the Appendix as Exhibit A. It should be of considerable benefit to anyone doing future studies of marine shellfish aquaculture.

A list of contacts found to be particularly knowledgeable and helpful in the formation of the community of interest is also included. This will be found in the Appendix section as Exhibit B.

The combination of trade associations, regional interest groups, Sea Grant personnel and state licensing agencies yielded the bulk of the community of interest. In the five (5) southerly states, marine advisory agents were the only consistently high-quality sources of information.

2.4 Formation of the Questionnaire

The OMB questionnaire originally received by Profiles had previously been evaluated as unusable in its received form. An adaptation of Profiles revised questionnaire reflecting the uniqueness and peculiarities of the shellfish aquaculture industry was prepared, as shown in Exhibit C, in the Appendix section of this report.

2.5 Conducting the Interviews

The shellfish aquaculture community of interest proved significantly greater than anticipated. The contracted number of interviews to be performed within the industry serves as a statistical sample from which to project industry data. In order to generate a manageable and random base of interview subjects, a multiple tier mail-out procedure was devised. A copy of the letter and response card is included in the Appendix as part of Exhibits D.1 and D.2.

2.5.1 Random Selection Method

For states with fifty (50) or more identified shellfish Aquaculturists, the mailing was done in three tiers, one-third of the total in each mailing. States with more identified enterprises than fifteen (15), and less than fifty (50) were mailed questionnaires on a two tier basis, one-half the total in each mailing. States with less than fifteen (15) identified shellfish aquaculturists were canvassed by telephone until the required number of interview volunteers had been secured.

The multi-tiered mailing approach, while time consuming, generated sixty-six (66) qualified contacts willing to be interviewed. Twelve (12) respondents were unwilling to participate or disqualified themselves. Ten (10) of the letters were returned as undeliverable.

The overall mailing list totalled 603 names. From this base we were able to arrive at the final population of the community of interest. For the mailing process alone, positive response was 11 percent; negative response and undeliverable returns came to 3.6 percent. Total response to the mailings were 14.6 percent. A more detailed discussion of the multi-tier mail procedure appears in the Appendix as part of Exhibit E.

2.5.2 Actual Interview Procedure

Profiles contacted the identified interview participants by telephone to arrange appointments, sent a letter confirming the appointment date and then met with the representatives of the aquaculture entities for the personal interview in sixty six (66) cases. In twelve (12) cases the interview was conducted by telephone, as authorized by Dr. Hanks and Mr. Bocelle, our Technical Representative and Contracting Officer, respectively.

Other than a refusal to divulge specific harvest information on the part of four (4) of the subjects, the interviews progressed smoothly. There was no discernable difference, in this survey, between the data gathered by telephone and that gathered through on-site interviews. Telephone interviews were conducted by the Project Managers.

The personal contact, even via telephone, enabled the interviewers to rephrase and clarify questions which were unclear. Profiles' interviewers evaluated all the interviews as being of high quality. The responses were technically clear and provided the data necessary to study completion.

3.0 FINDINGS

3.1 Major Findings

Of primary importance is the fact that there are significantly more private, commercial shellfish aquaculturists than had been expected. A community of 257 active shellfish growers was identified. National Marine Fisheries Service projections had indicated a community of interest in the range of 65 to 90 enterprises. Even so, the number of active shellfish growers is greatly reduced from that of five to ten years ago.

There are two distinct sub-communities in the shellfish aquaculture industry as represented in the 10 coastal states of the Northeast. From Virginia north to, and including, New Jersey, the industry is almost entirely bottom culture and oyster (Crassostrea virginica) oriented. There are a handful of hard clam (Mercenaria mercenaria) entrepreneurs on the Atlantic shore of New Jersey and one infant firm growing hard and soft shelled clams in Virginia. On the eastern shore of Virginia, we were able to identify one oyster hatchery and one hard clam hatchery. These two enterprises refused to participate in the survey for reasons of confidentiality. The one infant firm growing hard and soft clams on Mobjack bay did participate in the survey.

In this region the individual enterprises are, properly, planters. Seed oysters from a limited variety of commercial sources or privately held collecting sites are bottom planted on leased or owned oyster beds. Three years later, these and any naturally occurring oysters are, hopefully, harvested at market size.

From New Jersey northward through Maine, the industry is more technology influenced. Methods developed in other parts of the world, notably the Orient, are used to produce the maximum crop from a limited amount of productive coastal waters. Capital risk is greater in these types of ventures

and the northern enterprises appear more labor intensive. However, yield and value of harvest per acre is substantially higher in the northern region. Environmental manipulation apparently results in lowered susceptibility to natural predation and sedimental pollution. Concentrated producing areas are also more easily patrolled.

Throughout much of the region, natural aquaculture difficulties are compounded by archaic and cumbersome state leasing laws and attitudes. Particularly in Delaware, Maryland and Virginia, existing statutes and regulations force shellfish aquaculture enterprises to circumvent the law in order to produce quantities sufficient for profitable operation.

Special interest groups have combined with official apathy in much of the Northeast, to the detriment of shellfish aquaculture. As a result the industry is hamstrung with regard to a substantial number of concerns:

- . Timely processing of lease applications.
- . Implementation of improved harvesting technology.
- . Restrictions on growth and marketing of readily acceptable food species classified "exotic" by interest groups.
- . Chemical agents used in pollution control which, themselves, decimate shellfish populations.
- . The individual shellfish aquaculturist's need for start-up and development capital in order to establish, or further develop, viable commercial activity.

Throughout the Northeast there is a detectable undercurrent of animosity between the commercial fishermen and shellfish harvesters on one side, and the commercial shellfish aquaculturists on the other. The fishermen predate the aquaculturists, as a group, and are jealous of their rights of access to water columns and bottoms. They are also better organized, more numerous and apparently more politically cognizant. As a result, most proposed developments beneficial to the aquaculture community at state levels have been defeated or diluted to the point of ineffectuality before passage.

Particularly in the southern section of the subject area, there is near community-wide resistance to new methods and techniques by existing shellfish planters. Reluctance to use hatchery-produced seed and resistance to offbottom culturing methods typify this attitude. Failure in virtually all instances to respond directly to markets other than fresh consumption or shucking stock is also typical.

3.2 Trends Within the Industry

The most compelling situation is the ever-increasing demand for seed stock of the various species, as existing aquaculturists attempt organizational growth and new enterprises enter the field. Natural seed sources are gradually being depleted. Historic failures notwithstanding, hatchery stock with good survival rates will have to be developed and utilized for commercial production. Aquaculturists in the northern states have already accepted this eventuality. Their counterparts in the rest of the region may gradually be recognizing the necessity of such accomodation.

While most state governments have been apathetic-to-antagonistic with regard to the commercial shellfish aquaculture industry, two in particular have started to encourage the concept. Maine has for five years organized workshops and training, enabling individuals to enter aquaculture. Start-up loans and other assistance have been provided as well. Of the assisted growers interviewed for the survey, ten percent (10%) say they will not continue their activity. Within the past year, New Hampshire has enacted aquaculture legislation favorable to the fledgling industry in that state.

In some isolated areas, talk of accommodation between the aquaculturists and commercial and sport fishermen is a hopeful sign. Meaningful communication between the "farmer" and "hunter" groups must occur before quantum leaps in aquaculture technology and production can be made.

Persistent disease and pollution problems continue throughout the region. Despite progress made thus far, MSX seems to be recurring in the Chesapeake Bay area. Industrial water and sedimental pollution are still at unsafe levels in many areas. In numerous instances pollution treatment methods are poisonous to shellfish. Continued study and work on these problems is required.

3.3 Facilities

Very few facilities are used from New Jersey south through Virginia; none in actual production. The two identified hatcheries in Maryland use small buildings with assorted tanks for larval growth. Juveniles are transferred to trays in natural waters as soon as possible. The industry in the southern sector relies upon bottom culture entirely for growth to market size.

From New York north through Maine, the industry is increasingly technology influenced. Floats, rafts, trays, longlines and lantern nets are used in various combination for oyster and clam growout. Tubes and seed collecting ropes are commonly used for mussels. Perhaps of greatest importance, though, is the increasingly sophisticated nursery and hatchery operations. Several firms have begun hatchery development for operational self-sufficiency. Others produce seed of species as a market product. Each operator seems to prefer a specific type and size of tank for algal, larval and juvenile development. Not all of the hatcheries use conicles, despite the design advantage. Cost appears to be the major deterrent.

3.4 Water Resources Used

Very few of the commercial shellfish aquaculturists actually regulate or control the water resource. The shellfish hatcheries monitor and control temperature, to an extent, and flow. Crustacean enterprises, whether producing for human consumption or bio-assay specimens do regulate flow and temperature. Virtually no feeding of any type was observed throughout the survey. An exception was observance of shrimp grown and fed to trout cultured in the same facility.

3.5 Quantity and Value of Products

The predominant species produced by the private commercial shellfish aquaculture industry is the American Oyster (Crassostrea virginica). Of the ten states in the Northeast subject area, nine produce this species. Only New Hampshire does not. The American Oyster harvest totals 1,500,000 bushels, over 13 million hatchery seed and generates \$14,786,324 in market value throughout the region.

On a state by state basis, Virginia produced nearly 615,000 bushels of C. virginica, worth over \$5 million. The lone responding clam grower, with two ponds and an impoundment--all man made--produced no harvest.

Maryland produced over 163,000 bushels of market oysters worth nearly \$2 million. It should be noted that due to unwieldy lease statutes, many planters "administer" multiple leases, which Maryland grants only to individuals. As a result of this cumbersome process, it was impossible to determine harvest figures with exactitude. One operator, alone, is reported to have harvested and processed more than \$2,500,000 worth of oysters. It is fair to estimate that at least half that amount was wild harvested. The two private, commercial hatcheries in Maryland produced 3,750,000 seed worth \$50,875.

In Delaware, growers reported oyster harvest of almost 40,000 bushels, worth over \$375,000. New Jersey, sharing the Delaware Bay, reported a 622,928 bushel oyster crop. Market value was nearly \$5,500,000. New Jersey's clam industry, based on our statistical sample, reported no harvest figures.

In New York, shellfish growers were unwilling to release crop data, either in terms of bushels or dollars. Seed production alone, nearly all of which was for internal consumption, was substantial. Seed value for C. virginica was \$1,064,425, estimated, for seed and eyed larvae. M. mercenaria seed worth \$1,323,530 was produced, also for internal consumption.

Connecticut shellfish growers, entirely C. virginica, refused to divulge crop information. Although the total crop was sizeable, little of it was generated by aquaculture, as defined by the survey. Because of pollution levels in Long Island Sound and environs, depuration relaying plays an important part in the shellfish industry of the area.

Rhode Island growers harvested over 4 million C. virginica, by count, as seed worth \$8,500.

Massachusetts reported nearly 29,000 bushels of C. virginica worth \$692,000. The M. mercenaria harvest, 16 million by count, as seed, brought \$224,454. M. rosenbergii, 1,161 count for \$30 thousand; M. edulis, 500 bushels worth \$10,000; M. bahia - 42,348 count worth \$30,000; N. americana, 9,030 count worth \$7,675; and P. pugio, 8,945 count worth \$5,367. The three latter species were cultured for research purposes.

The New Hampshire grower reported no harvest in 1979, but has marketed O. edulis since that time.

Maine shellfish aquaculturists produced 846 bushels of M. edulis worth \$20,641.00. The O. edulis crop, seed and market, was 50 million count worth \$868,820. C. virginica, seed and market, by count, 5 million plus worth \$38,153. Cultured bay scallop and quahog were not harvested in 1979.

3.6 Employment Now and Projected

The private commercial shellfish aquaculture industry utilized 1,264 employees in 1979 in the 10 Coastal Northeastern states. Projected employment increases from 1979 base over the next three years are modest. Graphically presented, they are:

	Estimated Two Year Increase <u>1981</u>		Projected Total Increase <u>1982</u>		Projected Total Increase <u>1983</u>	
		<u>%</u>		<u>%</u>		<u>%</u>
Laborer	86	7.0%	94	7.5%	104	8.2%
Technician	47	4.0%	49	4.0%	49	4.0%
Technologist	4	0.3%	5	0.4%	7	0.5%
Scientist	<u>1</u>	<u>.08%</u>	<u>1</u>	<u>.08%</u>	<u>2</u>	<u>.15%</u>
	138	11.38%	149	11.98%	162	12.85%

Assuming these projections to be accurate, the shellfish aquaculture industry in the Northeast will employ 1,426 personnel--exclusive of owners, partners and unpaid family members--in 1983.

4.0 CONCLUSIONS

4.1 Major Conclusions

A significantly larger than expected community of marine shellfish aquaculturists was identified. Whether by accident or design, a large percentage of the enterprises maintained an extremely low profile. Most of the individual shellfish aquaculturists were suspicious of government intervention, regardless of intent. This study of the marine shellfish aquaculture industry in the Northeast generated the following conclusions:

4.1.1 There is a demonstrated need for organization.

No single, reliable conduit exists through which to establish contact with the industry. The proliferation of associations and trade groups, regionally segmented or product affiliated, appear not to be fully responsive to the needs of the shellfish aquaculturists. State government functionaries, with very few exceptions, are well intentioned but ill-informed regarding identity, location, or commercial aspect of large segments of the community of interest.

A region-wide organization of commercial shellfish aquaculturists could communicate developmental, economic and legal information to members. Such an organization could also undertake the major public education and marketing programs seen as advisable. Lobbying efforts with respect to species culturable, leasegrounds and pollution cleanup efforts could be handled. Advocacy and representation at hearings involving state agencies and special interest groups would be of paramount importance. Identification and securement of grant or development funds could also be an important function.

4.1.2 Shellfish Aquaculture enterprises need vertical integration.

The vertically-integrated operator will lessen or eliminate dependence on uncontrollable market factors. By producing hatchery seed for internal use, dependence upon the supply of naturally occurring set is eliminated. In-house processing and marketing of harvest will generate independence from traditional distribution networks. Marketing independence will greatly facilitate development of new markets and innovative penetration of established ones.

Of the entire shellfish aquaculture community, only a few are what might be called "vertically integrated" operations. Of this half dozen or so, three deserve specific mention:

J.W. Ferguson & Sons, Remlik, Virginia is a bottom culturing enterprise typical of their area. They have developed and integrated processing and packing operations within their enterprise, not at all typical of the industry at large. Their marketing efforts far outstrip any that were observed during the course of the survey.

Frank M. Flowers & Sons, in Bayville, New York has developed a sophisticated hatchery operation. They are able to supply their internal seeding requirements and sell seed oysters to outside enterprises, as well. They, too, have extensive growout bottoms and have developed above average marketing capability.

Spinney Creek Oyster Company, in Kittery, Maine is an environment manipulating culturist. Their entire production (*Ostrea edulis*) is accomplished in floats, trays and lantern nets. Seed stock is purchased for growout, seasonally. Of particular note is their successful entrance into the high profit European export and domestic half-shell market. Though their processing facilities are not extensive, the organization has been able to successfully develop a marketplace for product within their handling capability at very high profit yield.

4.1.3 Smaller growers should consider formation of Cooperatives.

Commercial fishermen have enjoyed considerable success through utilization of cooperatives for processing and marketing of the community catch. Especially in areas not conducive to large-scale shellfish aquaculture, cooperatives formation should be investigated. Such entities could operate

hatcheries, or purchase seed stock in economic quantities. Processing, packing and distribution should be another major function provided for the individual growers not capable of the capital outlay necessary to develop such facilities. Including local commercial fishermen in such cooperative enterprises bears investigation.

4.1.4 Continued research must continue and developments must be implemented.

Whatever else may be involved, true aquaculture presupposes manipulation of the organism's life cycle in some favorable manner. In commercial terms, this could mean bringing the organism to market size in less time than required naturally. Or it could mean rearing 90% of species larvae to market size in the normally required time. The marine shellfish aquaculture industry in the northeast may require a technical breakthrough to accomplish any envisioned quantum leap in production. This may become especially true if pollution control efforts do not successfully restore large amounts of bottom and water column to market shellfish production.

Domestic research at the commercial level has developed some promising equipment. These developments are generally unknown beyond the developer's immediate locale. A method for disseminating such information to the community at large needs to be established.

Our domestic shellfish aquaculture community should continue to learn from more technically advanced shellfish industries outside the United States, notably those in the Orient. Implementation of techniques, methods and equipment developed abroad, adapted as necessary, should continue to help the industry's growth. Recent European developments in molluscan culture may hold promise for our shellfish industry.

Above all, apathy and entrenched conservatism at state levels with regard to technical developments implementable within the shellfish aquaculture industry must be contended with. Specifically, difficulties have been encountered in gaining approval to use escalator harvesters in Virginia and Maryland. Another current example is the inability of Massachusetts and Rhode Island growers to gain approval for raising O. edulis.

Methods of containment must be devised for the special interest groups antagonistic toward the shellfish aquaculture industry on general principle alone. Interest groups committed to specific methods and procedures as a historic matter of course must also be dealt with.

Finally, within the shellfish aquaculture industry, itself, a large proportion of planters are committed to time honored methods. Demonstrating the statistical relationship between these methods and the failure rate of such enterprises may succeed in convincing them of the necessity of utilizing technically improved methods.

4.2 Future Trends

As the world's supply of edible wild finfish and shellfish becomes further depleted through demonstrated overfishing, the importance of aquaculture will become more generally recognized. Total wild fishery catch tonnage has held even, or moderately increased, in the recent few years. But the fleet must travel further to harvest, utilizing the 200 mile zone, and the number of vessels active in the fishery is diminishing. In coming years a progressively larger portion of protein foodstuffs will necessarily be produced by aquaculturists and from underutilized species. At this point, though, the majority of northeastern aquaculture production supplies only the very expensive specialty and gourmet markets. Cultured species cannot be sold at the prevailing market price of wild harvested catches if the culturing enterprise is to receive a reasonable return on investment.

Private, commercial marine shellfish aquaculture is not as prohibitively expensive to start up and maintain as is finfish growing. It is still beyond the reach of most entrepreneurs, financially and technically, without a fair amount of assistance. And the risk is very great. During the average three year growout period, drought, floods, disease, natural predators, pollution or poachers may decimate his crop. One severe storm may carry the off-bottom culturist's entire investment out to sea. Even if insured against such loss, the setback in terms of time and dollars invested can be devastating.

In spite of the risks, the industry appears stable and expects growth. That growth must be encouraged if the latent promise of protein supply for the nation's food marketplace is to be realized.

Manipulation of the environment in order to minimize crop loss or accelerate market growout requires the development and implementation of still more sophisticated equipment and techniques. In turn, this should gradually reduce the market cost of cultured marine shellfish. Increased scarcity will force the market cost of wild harvested shellfish up, providing harvesting operations do not become subsidized. Continued marketing efforts will educate the public to the desirability of a cultured product. Limited efforts, to date, have shown encouraging results.