

THE  
**STRATEGIC PLAN**  
FOR  
**AQUACULTURE DEVELOPMENT**  
IN  
**SOUTH CAROLINA**

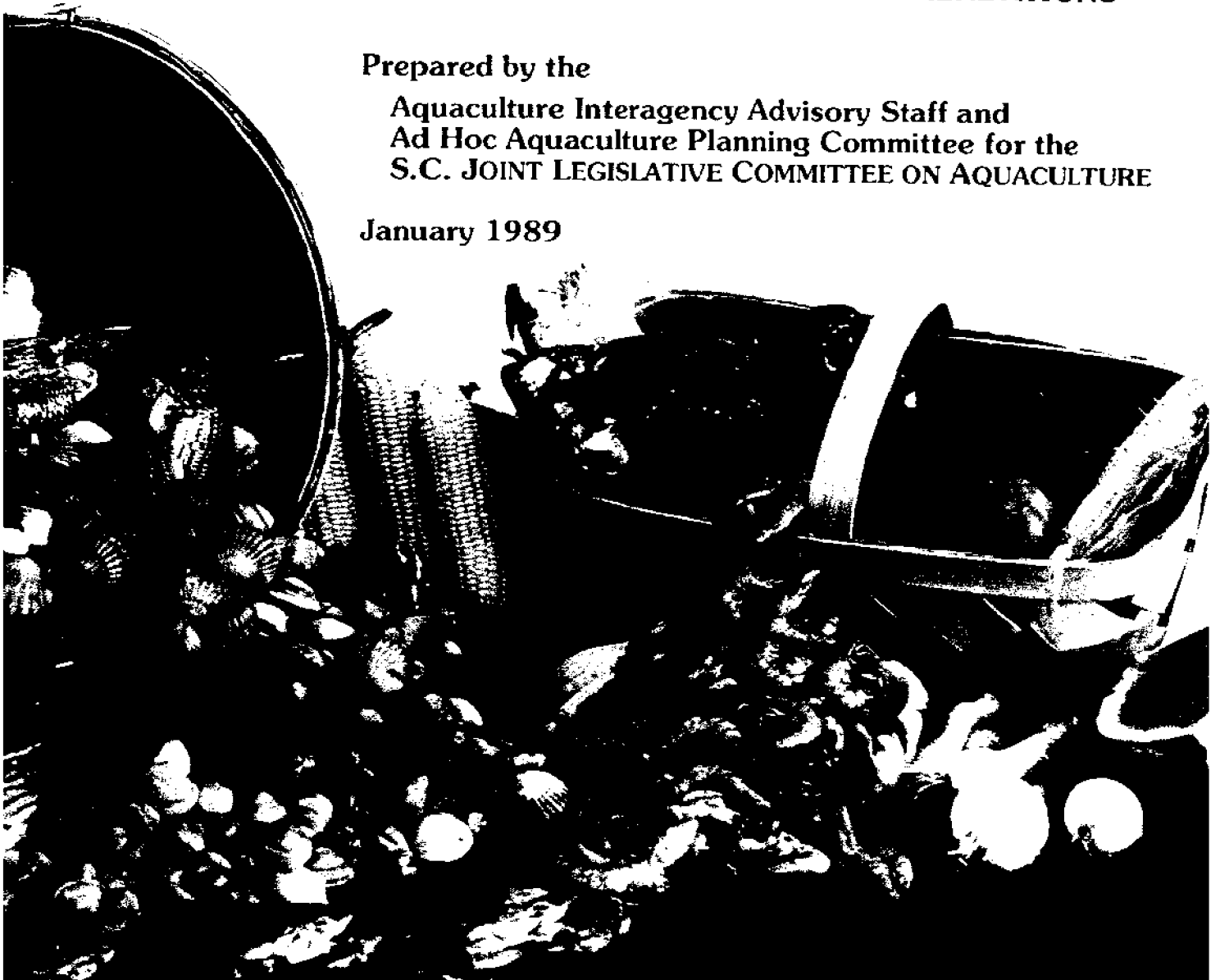
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VOLUME I: SUMMARY AND RECOMMENDATIONS

Prepared by the

Aquaculture Interagency Advisory Staff and  
Ad Hoc Aquaculture Planning Committee for the  
S.C. JOINT LEGISLATIVE COMMITTEE ON AQUACULTURE

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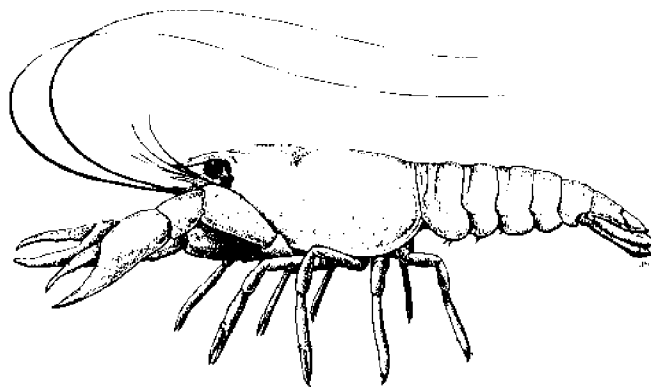
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## INTRODUCTION

AQUACULTURE, THE CONTROLLED CULTIVATION OF AQUATIC organisms, is of great economic significance to South Carolina's agricultural future. The South Carolina General Assembly states, in amendments to Title 2 of the 1976 State Code, that

“... aquaculture has the potential for augmenting existing commercial and recreational fisheries and for producing other renewable resources, thereby assisting the state of South Carolina in meeting its food needs and contributing to the reduction of foreign seafood imports into South Carolina and the United States. It is, therefore, in the state's interest, and it is the state's policy, to encourage the development of aquaculture in South Carolina.”

In recognition of the importance of aquaculture to the state and to foster growth of the industry, the South Carolina State Legislature created the South Carolina Joint Legislative Committee on Aquaculture (Title 2, Chapter 22 amendments, South Carolina Code of 1976). The Joint Committee is responsible for coordinating and planning all public aquaculture and mariculture development and research in South Carolina. The Joint Committee is also required to establish an interagency advisory staff to assist in the development of plans and programs related to aquaculture development. On June 20, 1985, the Joint Committee was formally established and charged (in Section 2-22-20) to:

1. Develop state policies and initiate legislative programs for aquaculture development in South Carolina.
2. Promote a general understanding of aquaculture among public agencies and the public sector.
3. Have staff prepare and periodically update a state aquaculture development plan which shall include an assessment of resources, opportunities and constraints ... The plan shall specifically foster interagency and institutional cooperation in the development of aquaculture.
4. Request staff review of proposals for aquaculture research in South

- Carolina to prevent duplication of effort.
5. Plan and encourage research and development programs aimed at developing new aquaculture and aquaculture related industries.

The establishment of the Interagency Advisory Staff, with membership composed of the S.C. Department of Agriculture, University of South Carolina, S.C. Coastal Council, S.C. Department of Health and Environmental Control, Clemson University, S.C. Wildlife and Marine Resources Department and the S.C. Sea Grant Consortium, was mandated to assist the Joint Committee in the development of the aquaculture development plan. Membership has also been extended to the S.C. State Development Board and the S.C. Water Resources Commission.

## **PURPOSE OF THE PLAN**

The purpose of the Strategic Plan for Aquaculture Development in South Carolina is to identify the relationship between the present status of the industry in the state and its potential for expansion. Areas of particular importance include the:

1. Identification of existing private and public sector aquaculture activities in South Carolina;
2. Determination of a realistic development program for commercial aquaculture and its required public sector assistance; and
3. Identification of constraints to aquaculture development in South Carolina and the formulation of a plan to remove constraints and stimulate commercial development.

South Carolina's traditional fisheries have always provided abundant yields of finfish, crustaceans and mollusks. Although these fisheries may be producing at or near their maximum potential, current demand for aquatic food products far outstrips production from traditional fisheries.

The development of a viable aquaculture industry is the state's best hope of securing a more competitive place in the rapidly expanding seafood market. It will also contribute to the economic diversification of South Carolina's important agriculture industry.

## **DEFINITION OF AQUACULTURE**

Aquaculture has been defined in many ways, but can basically be described as agriculture in an aquatic environment. In more technical terms, aquaculture has been described as the cultivation of aquatic organisms in a controlled environment. Thus, the term aquaculture can be used to describe the culture of animals and plants in marine and freshwater areas.

According to the South Carolina State Legislature:

"The term 'aquaculture' means the cultivation, production or marketing of domesticated aquatic organisms. The term 'domesticated aquatic organism' means any fish, aquatic invertebrate or aquatic plant that is spawned, produced or marketed as a cultivated crop in the waters of this state" (Amendment [c] of Section 40-17-40 of the 1976 Code).

**This definition will be used throughout the plan.**

## **AQUACULTURE IN SOUTH CAROLINA**

Aquaculture is not new to South Carolina, having been practiced since the latter half of the 18th century. Oysters (*Crassostrea virginica*), terrapin, carp (Family Cyprinidae) and shad (*Alosa sapidissima*) were cultured in the 19th century. Today, aquaculture is being practiced in 42 of the 46 counties in the state and species under cultivation include trout (e.g., *Salmo irideus*), carp, catfish (*Ictalurus* spp.), marine shrimp (*Penaeus* spp.), crawfish (*Procambarus* spp.), oysters, hard clams (*Mercenaria* spp.), blue crabs (*Callinectes sapidus*) and a number of bait fishes. Detailed information on the history and status of aquaculture in South Carolina is provided in Volume II.

## **FACTORS AFFECTING AQUACULTURE DEVELOPMENT**

Although interest in aquaculture has increased in South Carolina and the industry is expanding, there are a number of constraints on development which still need to be overcome. The aquaculture industry in South Carolina has been hindered by a lack of formal recognition. Unlike agriculture and commercial fishing operations, aquaculture does not yet enjoy specific benefits and protection under state law.

### **Regulatory Constraints**

The permitting process governing aquaculture enterprises is a major barrier to potential investors. Depending on the type of activity proposed, permits, certifications, licenses and variances may be required from local governments and state and federal agencies. In fact, more than a dozen government agencies may be involved. Furthermore, regulations designed to manage wild stock and hatchery-raised fisheries sometimes inadvertently inhibit aquaculture activities.

### **Environmental Concerns**

The state's freshwater and saltwater resources are relatively clean and suitable for aquaculture; however, because of the need for strict health standards for human consumption of bivalve shellfish, for example, some coastal areas remain unsuitable for harvest of these animals. High-density residential and commercial development along coastal and inland waterways will only worsen this problem.

### **Financial Needs**

Lack of recognition also hinders the financing of aquaculture operations. Although many avenues of funding are open to agriculturists, these are not always available to aquaculturists because aquaculture is generally considered a high risk business. Most of the state's aquaculture ventures have too short a history to provide documentation for reliable cost analyses. This adds to the difficulty in attracting investment capital.

### **Marketing Restrictions**

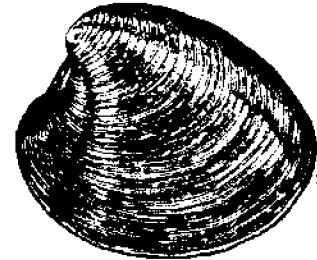
Other restrictions on aquaculture development in South Carolina include lack of market information, limited processing facilities, water resource quality, conflicts with other uses of the land, and technological gaps. Most of the state's aquaculture production is marketed locally. As the industry expands, broader markets and better distribution channels will be required to sustain industry profits. Currently, there is little processing of seafood or agriculture products in South Carolina; in-state processing could increase profits and also provide a new industry for the state.

### **Knowledge and Information**

Finally, aquaculture of some species is hindered by lack of knowledge. For example, culture of marine shrimp is limited by the difficulty of obtaining juveniles; research on hatchery methods and maturation technology could overcome this hindrance.

## **ORGANIZATION OF THE STRATEGIC PLAN**

The Strategic Plan for Aquaculture Development in South Carolina is organized into two volumes. Volume I provides a concise summary of the opportunities and constraints that face the industry in South Carolina and offers 41 recommendations to enhance the growth of aquaculture. Volume II presents the reader with more detailed information on the current status of the aquaculture industry; it is divided into six sections for quick information retrieval. The conceptual and structural organization of this plan was taken from "Aquaculture Development in New York State," a final report of the New York Sea Grant Institute to the New York State Legislature in 1985. The New York plan provided a comprehensive review of the basic issues and needs of aquaculture and served as an invaluable information source.



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## THE REGULATORY ENVIRONMENT

AQUACULTURE IS A FAIRLY NEW USE OF COASTAL AND INLAND resources in South Carolina. In order to be successful, a variety of natural resources may be required for each operation. Local, state and federal regulatory agencies seek to allocate these natural resource needs through a permitting system. By incorporating both agency and public comment in the permitting process, the interests of the aquaculture operator, other resource users and the general public can be considered.

These factors, however, combine to make the existing permitting process complex and time-consuming for the prospective aquaculturist. In most cases, several regulatory agencies are involved, and a number of permits, licenses and certifications are required. A streamlined permitting process has not yet been structured for aquaculture; therefore, extensive delays may occur between the conceptualization of the aquaculture operation and its realization as a functioning enterprise.

### ACCESS TO STATE LANDS AND NAVIGABLE WATERS

The state of South Carolina owns, in trust, an array of diverse resources, stretching from the mean high-water mark along the coast to the three-mile territorial limit of South Carolina coastal waters. As acknowledged in a 1982 report to the S.C. Coastal Council Committee on Leasing of Submerged Lands, underwater "property" is becoming a topic of expanding interest as the use of public lands by an ever-growing population continues to increase.

South Carolina exerts little control over the use of its submerged lands compared to some other coastal states. While the comprehensive S.C. Coastal Management Program does control activities in the waters of coastal South Carolina, there is no direct control, i.e., leasing of submerged lands by the state, except in the past



for oyster cultivation (up to May 1986), phosphate and sand mining, and the granting of rights-of-way for pipelines or utility lines. Particularly for aquaculture development, the state needs to evaluate the way it controls these lands to ensure proper management and use of the resource.

#### ***Recommendations***

- The S.C. State Legislature should reaffirm its support of aquaculture development in South Carolina.
- The S.C. State Legislature should establish, through legislation, a state-wide aquaculture leasing program. Subsequently, all language referring to 'culture', 'shellfish culture', and 'mariculture' should be removed from existing statutes (Section 1 and 3, Article 5 of Chapter 17, Title 50 of the 1976 Code of Laws).
- The S.C. State Legislature, through the state-wide aquaculture leasing program, should assign primary responsibility for making submerged lands and waters available for aquaculture development. A conference of relevant state agencies, including the S.C. Wildlife and Marine Resources Department - Marine Resources Division (SCWMRD-MRD), the S.C. Coastal Council and the S.C. Budget and Control Board, should be convened to identify this primary responsibility.
- The Primary Agency should be given the authority to issue leases of submerged bottom and/or the water column for shellfish, finfish, and plant aquaculture. The leases should convey a necessary degree of exclusivity to minimize the risks to the aquaculturist caused by pollution, vandalism, theft, and other forms of encroachment, while protecting common law rights of the public.
- The Primary Agency should, in consultation with academic and industrial parties, establish appropriate standards for the terms of aquaculture leases, including size and duration, and criteria for performance that outline production, use and resource protection within the lease, including the execution of performance bonds as a guarantee.
- The Primary Agency should consider the adoption of other aquaculture lease specifications, including fees, royalty payments, assignability and termination of lease agreements, also in consultation with academic and industrial parties.

## **PROTECTION OF NAVIGATION AND WATER RESOURCES**

The U.S. Army Corps of Engineers permit program seeks to prevent the unnecessary alteration or obstruction of navigable waters of the United States, and to protect and maintain the quality of the nation's water resources. The state of South Carolina also administers programs of its own to protect navigation and to regulate the placement of structures or dredge and fill into waters of the state. This responsibility is divided among three agencies: the S.C. Coastal Council regulates activities in "critical areas" along the coast; the S.C. Budget and Control Board has jurisdiction over the remainder of the state's submerged lands in non-critical areas; and the S.C. Department of Health and Environmental Control (SCDHEC) regulates the disposal of dredged or fill material statewide through its State Water Quality Certification Program.

Additionally, all concentrated aquatic animal production facilities, as defined in Section 122.55 of the Federal Register (Vol. 45, No. 98, pg. 33446), are point sources subject to the National Pollutant Discharge Elimination System (NPDES), according to the U.S. Environmental Protection Agency. The regula-

tion designates production levels below which an NPDES Permit may not be required. The state of South Carolina is a delegated state for administering the NPDES program.

The South Carolina Pollution Control Act (Section 48-1-100) requires that a permit be obtained by any person proposing to discharge wastes into waters of the state. Therefore, all proposed aquaculture facilities must submit a NPDES application to the SCDHEC.

***Recommendations***

- The S.C. State Legislature should request that representatives of the S.C. Department of Health and Environmental Control, S.C. Coastal Council and S.C. Water Resources Commission on behalf of the S.C. Budget and Control Board meet to develop a process by which a prospective aquaculturist need only prepare and submit one application form (containing the information required by all three agencies) for consideration by the state.
- The S.C. Department of Health and Environmental Control should clarify its NPDES Permit regulations for the aquaculture industry. This should be done once field tests and data analyses are completed by the S.C. Wildlife and Marine Resources Department, the University of South Carolina and Clemson University on a number of existing operations. The phrase "...an evaluation of the proposed discharge for water quality impacts" should be defined. Aquaculture is unique in that it involves the culture of aquatic organisms in waters not unlike the natural environment; this must be recognized within South Carolina's NPDES permitting system as it is in federal regulations.

## **AQUATIC ORGANISMS AND THE LAW**

Many state regulations governing aquatic species have been developed to manage commercial and recreational fisheries. Recently, several laws have been passed allowing the culture of selected aquatic species; but on the whole, the regulation of aquaculture species is based on traditional fishery laws. This has resulted in some confusion as how best to govern the use of aquatic organisms in culture environments.

As a result, certain fishery regulations are inappropriately applied to species selected for aquaculture. More likely, however, are the cases where certain safeguards or screening of aquaculture species are not applied at all. This situation can be critical when looked at within the context of, for example, the importation of exotic species and disease transmittal.

***Recommendations***

- The S. C. State Legislature should empower the S.C. Wildlife and Marine Resources Department to establish regulations for the aquaculture of all species - fish, mollusks, crustaceans, plants - with potential in South Carolina.
- The S.C. Wildlife and Marine Resources Department should clarify and consolidate its rules and regulations regarding the aquaculture of marine organisms and establish policies which cover all salt and freshwater culture species - finfish, shellfish and crustaceans - with potential in South Carolina.
- The S.C. Wildlife and Marine Resources Department should establish a permitting mechanism for possession, importation and transportation of

species used in aquaculture. Species permits should stipulate the culturist's right to exclusive ownership of the species cultivated.

- The S.C. Wildlife and Marine Resources Department should undertake a critical review of its restrictions against the commercial aquaculture of game fish and should consider appropriate restrictions on the identification, transportation and marketing of cultured fish so as to allow commercial culture while minimizing illegal sales of wild gamefish.

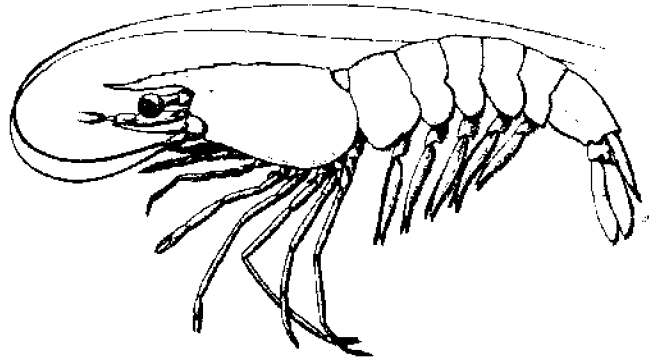
## **LOCAL GOVERNMENT REGULATIONS**

Municipal zoning regulations do not address aquaculture per se, but would probably recognize it as an agricultural land use if an operation were proposed. Although no specific zoning presently exists for aquaculture operations in the state, a local governing body could create such zoning as a means to promote aquaculture development in their community.

However, in coastal communities competition among land-use interests (e.g., aquaculture vs. industrial development) could create a restrictive zoning environment adverse to aquaculture development. In addition, once an aquaculture operation is in place, it may be subject to regulation by the broad police powers of the community.

### ***Recommendation***

- The ten Councils of Government (COG's) throughout South Carolina should identify and develop tools for municipalities to use in accommodating aquaculture into their planning and zoning activities. A model planning and zoning ordinance should be prepared by the S.C. Sea Grant Consortium, in cooperation with the COG's, and made available to municipalities.



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## THE BUSINESS ENVIRONMENT

### FINANCING AQUACULTURE OPERATIONS

The development of the aquaculture industry requires significant capital investment for startup of commercial operations and the support services and associated businesses related to these operations (NYSGI, 1985). To date, aquaculture in South Carolina has been characterized by small operations having only limited financial needs. However, the growth of aquaculture as a significant economic enterprise will depend on the availability of capital at reasonable rates. Funds exist with private individuals, investors and conventional lending sources at the state and federal levels. However, these funds have not been made available due to production and marketing risks associated with the industry, the lender's lack of knowledge of the aquaculture "business," and the problems inherent in the regulatory arena.

An aquaculturist requires land, water, energy and labor; his costs depend to a large degree on availability and existing demand (NYSGI, 1985). In South Carolina, land can be more easily obtained at inland locations, away from major rivers, lakes and the coast. The heavy demand for waterfront and coastal properties has created an expensive market beyond the reach of most aquaculture operations. The requirement of high quality waters for aquaculture operation adds additional constraints on its development. The chemical, physical and biological integrity of surface waters must be examined before such waters are used in aquaculture. Seventy-five percent of South Carolina's major rivers meet the 1982 federal goal of "fishable/swimmable" waters of Class AA and A (Knowles, 1988). On the other hand, one-third of the state's estuarine waters are currently closed to shellfish (bivalve mollusks) harvesting because of bacterial pollution. To this must be added the other industries and activities that compete for use of these waters, such as boating, swimming, recreational and commercial fishing, public demands on water supplies, and commerce. Competition for these

resources will only continue to intensify. Additionally, in South Carolina, the costs of energy and labor have begun to reach exorbitantly high levels; inadequate sources of utilities and labor may present problems in rural and undeveloped portions of the state.

***Recommendation***

- The appropriate state agencies, including the S.C. Wildlife and Marine Resources Department, the S.C. Coastal Council, the S.C. Department of Health and Environmental Control, and the S.C. Budget and Control Board, should develop a state-wide plan to allot space for all uses of aquatic resources with particular emphasis placed on aquaculture.

A number of indirect costs must also be absorbed by any aquaculture operation. A primary cost to the aquaculturist is providing security for the properties involved; theft of cultured animals is devastating to the viability of an operation. Edisto Shrimp Company of Edisto Island, S.C. must employ an off-duty policeman to protect against theft of cultured organisms from its marine shrimp farm. This has resulted in five arrests and convictions; however, the penalties were eventually reduced to small fines, which were hardly a deterrent.

***Recommendation***

- The S.C. State Legislature should enact legislation to protect property of aquaculture operations through the provision of severe penalties for theft and vandalism.

Another significant cost, which is often overlooked, is that associated with the existing regulatory framework in South Carolina. Permits, licenses, certifications and other permissions are required for activities involving access to state lands and navigable waters, protection of navigation and water resources, environmental controls (water quality and pollution, wetland protection, etc.), fish and wildlife management, and local controls and zoning. More than a dozen state and federal agencies can be involved in the regulation of aquaculture operations; however, each venture is different and requires a case-by-case analysis to determine what permits may be needed. Local municipalities (county, city, town, public service district) present another level of possible confusion, inasmuch as each has developed and implemented its own regulatory structure which usually does not recognize aquaculture in its land use classifications.

***Recommendation***

- The S.C. Sea Grant Consortium, with guidance from the Interagency Advisory Staff, should continue to revise and make available a guidebook outlining the permit process for aquaculturists in South Carolina.

It is likely that a prospective aquaculturist might have to correspond with local, state, and federal resource agencies in several different South Carolina cities in order to satisfy regulatory requirements. State and federal agency offices are located in such cities as Charleston, Columbia, Beaufort and Conway. In addition, several of the necessary permits and/or certifications may involve additional costs for compliance. The process of obtaining permits, especially if adjudicative hearings are necessary, is expensive and time-consuming. Indeed, once the capital is raised, delays in the receipt of required permits often prevents the culturist from using the capital to generate income.

***Recommendation***

- An Aquaculture Permit Assistance Office should be created to assist aqua-

culturists seeking to obtain permits and to provide information and guidance to those individuals and organizations interested in initiating aquaculture ventures in South Carolina.

As mentioned above, the number and types of permits needed will depend to a large degree on the species to be cultured, the technology to be used, and the size and location of the operation. The process by which an aquaculturist identifies what permits are needed and then obtains them can be very time-consuming and, in South Carolina, may take from 2 months to 3 years (or longer) to complete (DeVoe and Whetstone, 1987). An analysis of the costs associated with the permitting process has not been conducted; however, the indirect costs of the permit process might be greater than the direct costs (NYSGI, 1985). This is due in large part to the fact that few laws or regulations are designed specifically to promote or protect aquaculture. Many existing land-use restrictions and environmental regulations reduce economic incentives to aquaculture by creating uncertain delays in permit processing.

#### *Recommendations*

- The S.C. State Legislature should exempt aquaculture operations from traditional fisheries laws and regulations where appropriate, consolidate pertinent existing legislation regarding aquaculture, and develop legislation to fill in any gaps so as to balance the needs of the aquaculturist with those of other aquatic users.
- The S.C. State Legislature should develop a mechanism by which an applicant need only apply at a central location for all permits, licenses, etc., i.e. "one-stop permitting."

#### **Constraints on Obtaining Financing**

Many aquaculturists, from both the private and public sectors, believe that the greatest need in aquaculture today is financial. The current climate of scarce capital does not bode well for the aquaculture industry; high front-end costs for land, water and energy are also barriers to the development of aquaculture. It is this high-risk environment - in which the regulatory process delays start-up, technology is still being developed and refined, natural disasters could occur, and the level of information and experience is greatly limited - that presents problems for entrepreneurs and investors interested in initiating aquaculture ventures.

Aquaculture is a new and growing industry in South Carolina. Many aquaculturists, who do not have much experience, are now initiating new enterprises. Lenders and investors are unfamiliar with the industry and thus perceive it as high-risk. Lenders have generally been unwilling to provide loans to aquaculture. Consequently, capital has primarily been provided from private investors or the aquaculturist provides his own capital. As the industry expands, a variety of business capital sources will be approached. If aquaculture is to become a viable economic industry in South Carolina, there will need to be more capital available to fund industry expansion. Both lenders and investors will need to be educated about the industry, including its production and marketing aspects, as well as the risks associated with various types of aquaculture ventures. Information and technical assistance must be made available to lenders, investors and producers to improve management and planning skills.

#### *Recommendation*

- The Clemson Cooperative Extension Service, the S. C. Marine Extension Program, SCWMRD-Marine Resources Division and the University of

South Carolina should continue to generate Production Budgets and Economic Feasibility Updates for those species which have short to mid-term potential in South Carolina. They should also develop a coordinated mechanism to make the Budgets and Updates available to lenders, investors and entrepreneurs.

Aquaculture, as practiced today, is based both on scientific study and actual field experiences (NYSGI, 1985). Success of an aquaculture operation depends not only on a working knowledge of the technical and biological aspects of the system, but also of the site (location), environmental conditions, and quality of the area. Because of these factors, each operation is indeed different and establishing a track record for investment is difficult. A short-term tax and loan incentive program to stimulate investment to create large corporate operations would greatly assist the growth of the aquaculture industry.

#### ***Recommendations***

- The Tax Commission should establish a program of tax credits to stimulate investment in aquaculture to attract investors from inside and outside the state.
- The S.C. State Development Board should establish a revolving loan program for start-up capital for aquaculture to attract investment in South Carolina.

Most aquaculture businesses must operate with plans for contingencies. Catastrophic losses of property and product could result at anytime from storms, floods, power outages, pollution, and disease. Aquaculturists do indeed need insurance coverage; however, private insurance for this industry, while available, is quite costly. Federal crop insurance is currently available through the Federal Crop Insurance Act of 1976 (amended 1980). The Act authorizes the Federal Crop Insurance Corporation (FCIC) to insure producers of agricultural commodities against loss of the insured commodity due to unavoidable causes; these commodities include aquacultural species. However, FCIC insurance is not available unless the FCIC Board first determines that the income from the agricultural commodity in question constitutes an important part of the total agriculture income of the county where the applicant's operations are located (NYSGI, 1985).

#### ***Recommendation***

- The S.C. Department of Agriculture, with the assistance of the Clemson Cooperative Extension Service and the S.C. Wildlife and Marine Resources Department, should assist aquaculture producers in obtaining coverage from the Federal Crop Insurance Corporation.

Information on the aquaculture industry in the United States is quite limited; the same is true for South Carolina. Detailed information on production, cost, and price data is available only for a few cultured species in South Carolina (e.g. catfish, crawfish, and marine shrimp). This is due primarily to three factors: (1) the fragmented and diverse nature of the industry; (2) the very limited and, in some cases, non-existent track record of many potential aquaculture operations, and (3) the lack of a record-keeping and reporting mechanism to provide annual production and cost figures. Additionally, the current proprietary nature of aquaculture technology, techniques, and markets has understandably made producers reluctant to provide detailed information to public sector researchers. Add to this the fact that little is known about market supply and demand for cultured products, and the information gap widens.

The financial community thus perceives aquaculture ventures as very high-risk investments. Traditional lending institutions do not usually lend money to start-up companies and those who do charge higher interest rates (Raymond Rhodes, SCWMRD, personal communication). The aquaculturists' lack of adequate collateral exacerbates this situation (NYSGI, 1985).

Furthermore, information on the practicality and profitability of aquaculture operations remains scarce. Investment interests are usually not aware of the opportunities that exist in this industry. Data on the contribution of local aquaculture firms (and commercial fisheries) to the supply of seafood retailed in South Carolina and elsewhere are not available; the contribution to seafood production by outside firms (U.S. and international) also is not known. This information is necessary in order to develop a positive investment climate.

#### *Recommendations*

- The S.C. State Legislature should empower the S.C. Wildlife and Marine Resources Department to collect and make available information on total production and product value for the aquaculture industry, where such information would be protected under a confidentiality clause as is done in the commercial fishing industry.
- The S.C. State Development Board, working with S.C. Wildlife and Marine Resources Department, S.C. Department of Agriculture, S.C. Sea Grant Consortium and the universities, should develop and implement an information campaign to promote in-state and outside investment in South Carolina aquaculture operations.

## **MARKETING AQUACULTURE PRODUCTS**

The seafood industry in the United States represents an important segment of the nation's economy. The National Marine Fisheries Service (NOAA, U.S. Department of Commerce) estimates that the seafood industry contributed about \$10 billion to the annual gross national product and employed more than 300,000 individuals in 1985 (GAO, 1986). However, while seafood exports in 1987 exceeded \$1.5 billion, seafood imports reached a record \$5.7 billion, resulting in a record \$4.2 billion trade deficit (USDA, 1988).

The reasons for this are essentially two-fold. First, the vast majority of U.S. fishermen concentrate their harvesting on a small number of high-value species; for instance, in South Carolina, the penaeid shrimp fishery is by far the most significant. This has led to the depletion (or leveling off) of a number of commercially important fishery wild stocks. Coupled with this is the trend by the American consumer to purchase more seafood. The resultant demand for an ever-decreasing supply of wildstock seafood has underscored the potential importance of aquaculture as a supplemental source of fishery protein. Indeed, according to the U.S. Department of Agriculture (1988), cultured seafood products accounted for 7 percent of the total seafood consumed in the United States in 1987.

#### **Constraints on Market Improvement**

Aquaculture in South Carolina is just reaching the point now that production and marketing options must be considered jointly. Currently, most South Carolina producers market their products locally to meet local demand. However, if aquaculture is to develop as a major economic enterprise, other marketing channels must be identified and developed. Efforts to develop opportunities in the



Atlanta, Georgia market in the mid-term, and the Northeast and mid-Atlantic markets in the long-term, can provide the basis for continued and healthy growth of the industry. Of course, local marketing efforts, focusing on restaurants, catering outfits, ethnic markets, sale to live haulers, sale to retail outlets, farmer's markets and recreational pond stocking, should not be ignored.

Although information exists on production and processing of wild-stock fisheries, little data are available on many cultured products. There is a lack of information on quantity and type of seafood consumed by South Carolinians. Furthermore, information on the amount of South Carolina fisheries products entering national and international markets is speculative. Without the data, investors, producers, and distributors do not have adequate information to assess the forces affecting the marketplace. Studies need to be conducted to reflect changing and current economic conditions and to predict future market preferences.

#### *Recommendations*

- The S.C. Department of Agriculture, the SCWMRD-Seafood Marketing Section and Clemson University should collect, analyze and publish information about the existing seafood marketing structure and the market potential for aquaculture products in South Carolina.
- The S.C. Sea Grant Consortium should identify necessary market research and extension programs to assist aquaculture producers.

The growth of the South Carolina aquaculture industry will be accelerated only through the identification and development of expanded markets. Marketing channels for species such as marine shrimp and hard clams are currently unlimited; however, future production of these and other species will depend on market expansion. Without market development, increased aquaculture production could result in oversupplies of seafood products, limiting continued industry growth (NYSGI, 1985). Additionally, market development can also reduce potential conflicts between cultured and traditionally-harvested products, a concern expressed by members of South Carolina's commercial fishing industry.

#### *Recommendations*

- The S.C. State Development Board and the S.C. Department of Agriculture should, with the assistance of the SCWMRD-Marine Resources Division, promote South Carolina as a prime location for the development of aquaculture.
- The Governor's Office of Energy, Agriculture and Natural Resources should establish an advisory council consisting of representatives of industry, government and academia to provide advice to the state to ensure that aquaculture market development activities and policies continue to reflect industry characteristics and needs.
- The S.C. Department of Agriculture and SCWMRD-Marine Resources Division should assist the aquaculture industry in promoting its products through the establishment and use of trademark and other specialized marketing efforts.

The South Carolina aquaculture industry consists primarily of independent culturists. Growers are faced with problems when trying to compete in large markets. The individual culturist does not produce enough product to supply the market. Structural mechanisms such as joint ventures and cooperatives might provide the means whereby individual producers can jointly purchase and share large items of equipment, feed and seed, and work together to provide enough product at the right time for the market to absorb. These structures provide cul-

tourists more control over all aspects of their industry - production, processing and marketing - while maintaining the benefits of a decentralized industry.

***Recommendations***

- The S.C. Department of Agriculture should provide assistance to aquaculturists interested in developing coordinating arrangements, including producer cooperatives, joint ventures and market orders.
- The S.C. Department of Agriculture should explore the possibilities of establishing joint processing facilities to accommodate agriculture, seafood and aquaculture products.

Fresh, whole products are not the only way to market aquaculture commodities. With the development of a variety of product forms, new markets in and outside of South Carolina can be penetrated. In Louisiana, for example, research has led to the development of a "soft-shelled crawfish" product, desirable because it allows for broader distribution to markets beyond what the fresh product could reach.

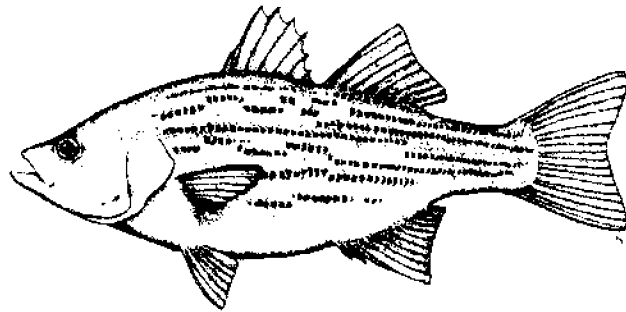
***Recommendation***

- The state's research institutions should identify (with the assistance of the aquaculture industry) and undertake programs to develop new food and nonfood product forms for South Carolina aquaculture products.

It is imperative, regardless of the species, that aquaculture products be of high and consistent quality. Today's consumers are better educated and more quality-conscious than ever before. Therefore, wholesalers and retailers are forced to buy the highest quality products in order to meet the consumers' discriminating tastes. According to the U.S. Department of Agriculture (1988), most aquaculture processors maintain high quality standards through self-inspection programs. Nevertheless, it may benefit aquaculturists in South Carolina if the industry as a whole were to establish uniform standards. Such standards should not only be set in production, but also in processing and transportation.

***Recommendation***

- The S.C. Department of Agriculture, with the assistance of the S.C. Wildlife and Marine Resources Department and the S.C. Department of Health and Environmental Control, should assist the South Carolina aquaculture industry in establishing necessary product specification (quality) standards for aquaculture products.



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## RESEARCH, EXTENSION AND EDUCATION

THE DEVELOPMENT OF THE AQUACULTURE INDUSTRY DEPENDS to a great extent on the generation, analysis and delivery of new data and information. Because aquaculture is still an immature endeavor, relatively few financially viable operations exist. These entrepreneurs are generally unorganized and lack the necessary resources to generate and interpret technical information required to improve their economic situation (NYSGI, 1985). They are also faced with a similar dilemma when seeking this information from universities, colleges and technical centers; few comprehensive programs and courses are available. Thus, those seeking entry into the industry have difficulty acquiring the skills necessary to succeed (NYSGI, 1985).

The National Aquaculture Development Plan (Joint Subcommittee on Aquaculture, 1983) underscored the need for additional efforts in research, education and training. The plan identifies the following areas where research information on culture species is lacking: life history and general biology; genetics and reproduction; growth and behavior; nutrition and diets; environmental requirements; facility engineering and construction; control of disease and parasites; production of seed stock; and predation and mortality. It also identifies the inadequacy of pilot-scale testing and demonstration facilities, limited effectiveness of information transfer and technical assistance programs, and the shortage of trained aquacultural workers as important constraints hindering the growth of the industry.

Academia can be the source of research, education, and training required by aquaculture, as it has been for the agriculture industry over the last century. South Carolina has already taken steps to address many of these needs and opportunities. Nevertheless, a coordinated and comprehensive framework for aquaculture research, education and technical assistance programs has yet to be established.

*Recommendation*

- The S.C. Joint Legislative Committee on Aquaculture should establish a mechanism (e.g., an institute) to focus and coordinate existing research and educational programs in the state. It should identify and obtain resources to broaden existing aquaculture programs and to develop new areas of expertise.

## **RESEARCH PROGRAMS**

Much research in aquaculture is yet to be conducted. The aquaculture industry is at a point where it does not yet have the resources available to address many of the information needs it has. Most South Carolina companies are without the resources to finance research and development projects. Those that sponsor research usually consider the results proprietary. Therefore, the public sector might be the most appropriate source of research funding at this point.

A review of federal and state programs that support aquaculture research is included in Volume II.

## **EXTENSION & TECHNOLOGY TRANSFER PROGRAMS**

Knowledge generated from research programs must somehow be communicated in a form most useful to the aquaculture industry. Training and extension programs serve as a primary means of transferring this knowledge into practical use and constitute a necessary link between the information "generators" and "users."

**Extension Needs**

To enhance and improve aquaculture extension in South Carolina, intensive training in aquaculture should be provided to area extension agents. Providing them with water quality test kits would help extend inexpensive analytical support services to aquaculturists. The agents should also have access to marketing summaries so they may advise operators where to sell their product.

*Recommendation*

- The S.C. State Legislature should provide funding to support training programs for state personnel involved in aquaculture extension work at research and education institutions located throughout the state. Such training should include programs in stocking, harvesting, processing, marketing and financing.

## **STATE EDUCATION AND TRAINING CAPABILITIES**

A vital aspect of any state's research capability is its commitment to educate and train people for the variety of occupations upon which aquaculture research and the industry depend. An important measure of South Carolina's capabilities is an assessment of human resources and educational programs, as well as research facilities dedicated to aquaculture in the state. Commitment to excellence in aquaculture education requires the attraction of high-caliber faculty and students to ensure productive research and the economic vitality of the industry. To bring about such excellence, it is necessary for the state to coordinate its diverse educational programs so that it may gain national and international prominence in aquaculture research and obtain support from federal and private sources.

### **Education and Training Needs**

Individuals interested in aquaculture generally have had extensive experience and training in either academia or business and industry (NYSGI, 1985). Nevertheless, the conduct of aquaculture as a profitable agribusiness requires diverse skills and advanced levels of training. Industry growth will place greater demands on South Carolina's educational system.

Technical and academic training programs can address the educational needs of today. However, to assure that the aquaculture industry remains visible in the future, school-aged children need to be made aware of aquaculture, its principles and its role in providing job opportunities and meeting the demands of consumers for quality seafood products.

In combination, adequate resources exist in South Carolina to begin building needed education and training programs to service the growing aquaculture industry. However, reallocation of existing resources and additional new resources will be required to provide the necessary expertise.

The cooperation and coordination of all of the state's educational institutions are essential to provide adequate education and training at minimal cost.

### **Recommendations**

- Academic degree programs should be strengthened to provide the educational exposure and training necessary for the growth of the aquaculture industry. Cooperative programs among the state's academic institutions should be strongly encouraged. It is recognized that these cooperative efforts will require new faculty positions.
- Educational programs for young people, such as those offered by 4-H, should be broadened to introduce young people to the opportunities afforded by aquaculture.
- The S.C. Board of Technical and Comprehensive Education (SCBTCE) should develop and offer vocational/technical training in aquaculture to meet the skilled labor needs of the industry.

Additionally, there are more specific education and training programs that should be made available: short courses and specialized training, technical training and a number of special courses.

**Short Courses/Specialized Training Courses** A program of short and specialized training courses could easily be established and offered at locations throughout the state on a rotational basis. The programs could be offered for Continuing Education Units or "In-Service Training" for high school teachers, TEC faculty, aquafarm managers, and university and international students. Courses should include genetics, aquatic diseases, pond construction, design and management, fresh and saltwater culture, water quality and chemistry, engineering and maintenance, small business management, and financing and marketing. Instructors are available for all elements except water quality and chemistry; these instructors would be drawn from Clemson University, the University of South Carolina and SCWMRD-Marine Resources Research Institute. A mechanism for coordination and management of these programs must be developed.

**Technical Training** In response to perceived needs, the SCBTCE system is moving ahead with the establishment of "introductory" level courses as part of its Agronomy (Field Crops) Production curriculum. The first programs will be offered at the Technical College of the Lowcountry (formerly Beaufort

Technical College). Additionally, it is clear that other courses will be developed as training needs of the aquaculture industry are identified in different geographical sections of the state.

### **Special Programs**

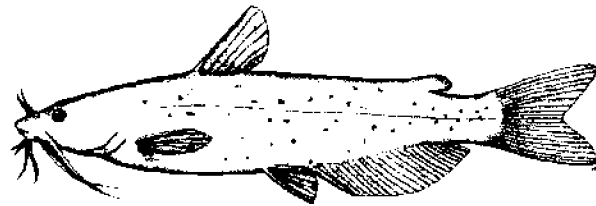
*Comprehensive Curricula: Aquamester.* The purpose of Aquamester would be to provide access to a core curriculum of courses in an intensive format. Cooperating institutions (for example, Clemson University and the University of South Carolina) would offer up to four core courses (senior undergraduate/graduate level) that could be completed over a five-week period beginning in May of each year. The site selected for the courses would rotate each year.

*Faculty Exchange.* To take maximum advantage of university faculty resources and develop complementary capabilities (to avoid duplication), a Faculty Exchange Program is proposed. The program would enable faculty members to spend a semester in residence at sister institutions to teach and develop short-term research programs for students.

*Practicum/Internships.* To augment training received at institutions of higher education and to serve as a major component of specialized courses, a "hands-on" program emphasizing field experience is proposed. Facilities at Clemson University, SCWMRD (e.g., the Dennis Center) and the University of South Carolina are conducive to and could be made available for such a program. Efforts to develop experience-based programs in concert with private aquaculture firms should also be explored.

### **Recommendations**

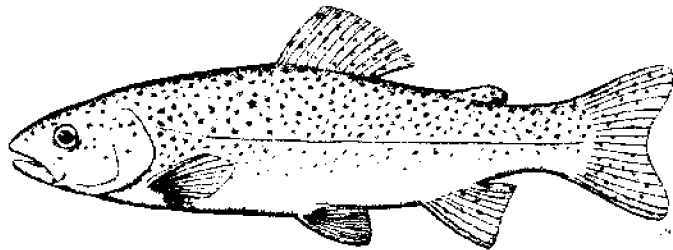
- The State's universities and colleges should develop institutional plans to enhance their respective programs and capabilities in the field of aquaculture.
- The S.C. Board of Technical and Comprehensive Education should develop a plan for identifying and establishing innovative training programs for potential aquaculturists. The Board should specifically seek to establish joint training programs with the private aquaculture industry.



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## LITERATURE CITED

- DeVoe, M. R. and J. M. Whetstone. 1987. An interim guide to aquaculture permitting in South Carolina. Report No. SC-SG-TR-84-2. The South Carolina Sea Grant Consortium, Charleston, SC. 28 pp.
- Joint Subcommittee on Aquaculture of the Federal Coordinating Council on Science, Engineering and Technology. 1983. National Aquaculture Development Plan, Vol. 1. Washington, DC. 67 pp.
- Knowles, S.C. 1988. Statewide Water Quality Assessment: A Report to Congress. Office of Environmental Quality Control, S.C. Department of Health and Environmental Control, Columbia, S.C. 165 pp.
- New York Sea Grant Institute of the State University of New York and Cornell University. 1985. Aquaculture development in New York State, Final Report. Albany, New York. 93 pp.
- S.C. Coastal Council. 1982. The programs of coastal states for the leasing of submerged lands. A report to the South Carolina Coastal Council Committee on Leasing of Submerged Lands, Columbia, S.C. 27 pp. (unpublished).
- United States Department of Agriculture. 1988. Aquaculture Situation and Outlook Report. Economic Research Service Pub. No. AQUA 1. 39 pp.
- United States General Accounting Office. 1986. Seafood marketing: Opportunities to improve the U.S. position. Briefing Report to the Honorable Ted Stevens, U.S. Senate, No. GAO/RCED-87-11BR. Washington, DC. 58 pp.



## APPENDIX

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