

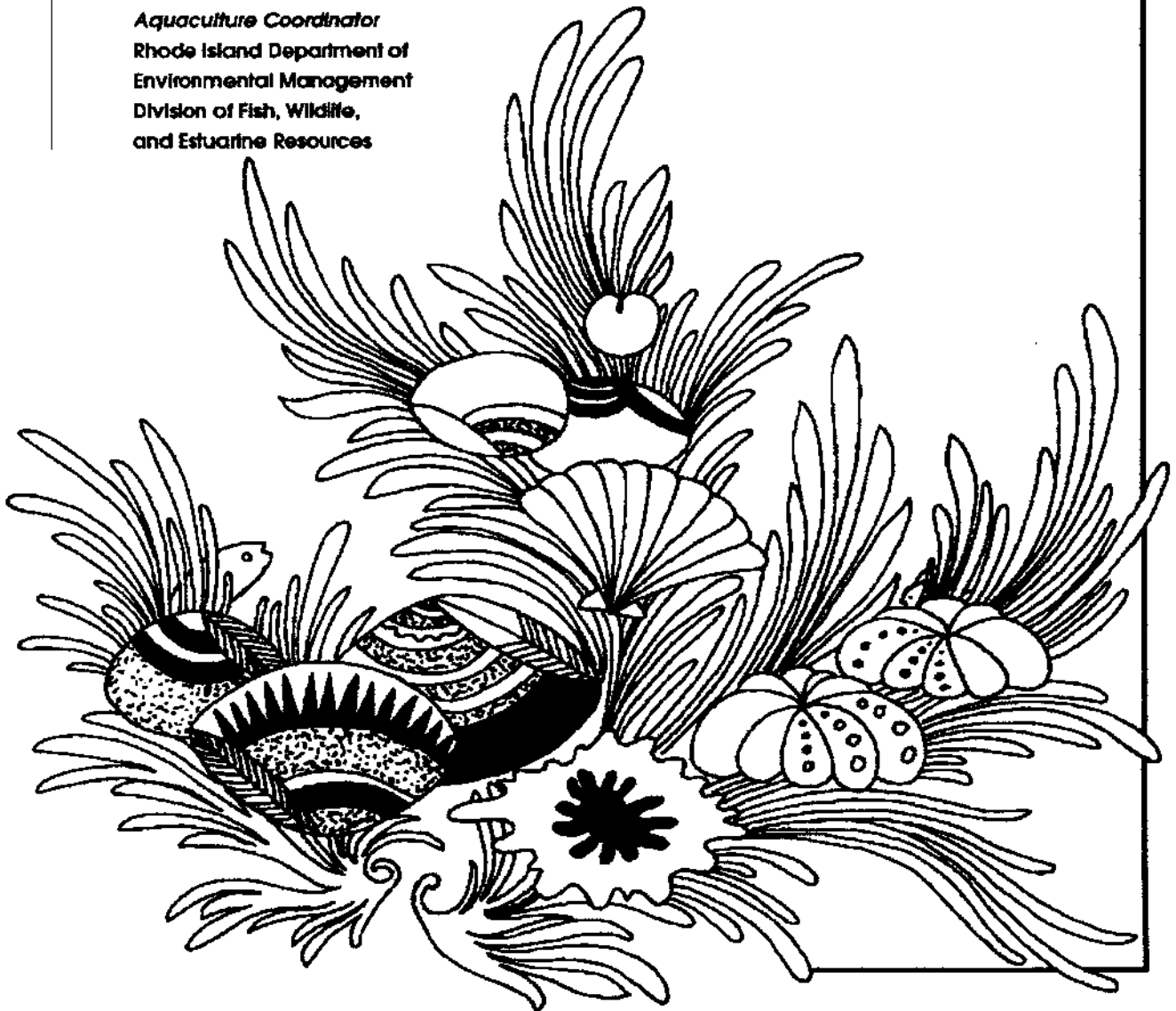
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PLANNING AN AQUACULTURE BUSINESS IN RHODE ISLAND: GETTING STARTED

LOAN COPY ONLY

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Division of Fish, Wildlife,
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This booklet is intended as a guide for prospective commercial aquaculturists in Rhode Island. Products, services, and commercial publications listed within are given for informational purposes only. Rhode Island Sea Grant, Rhode Island Cooperative Extension, and the Rhode Island Department of Environmental Management do not endorse any of these commercial products or services.

Additional copies of this publication are available from the Rhode Island Sea Grant Communications Office, University of Rhode Island Bay Campus, Narragansett, RI 02882-1197.

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Rhode Island Sea Grant Communications Office

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Arthur R. Ganz is Principal Marine Biologist with the Rhode Island Department of Environmental Management Division of Fish, Wildlife, and Estuarine Resources. Ganz is responsible for management of shellfish resources within the coastal waters of Rhode Island. He serves as the designated Aquaculture Coordinator for the State of Rhode Island.

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This publication is based on the 1993 Alaska Sea Grant publication "Developing a Mariculture Business in Alaska: Information and Resources" by Ray RaLonde and Brian Paust (Alaska Sea Grant publication number AN-15). The authors are indebted to Alaska Sea Grant for providing an excellent model to follow. We thank the following individuals for their prompt and helpful reviews of early drafts of the manuscript: John Karlsson, R.I. Department of Environmental Management (DEM) Division of Fish, Wildlife, and Estuarine Resources; John Lawrence and Ken Ayars, DEM Division of Agriculture; Joseph Migliore and Alisa R. Richardson, DEM Division of Water Resources; John Ruwet, U.S. Department of Agriculture; Monica Stillman and Christine Godfrey, U.S. Army Corps of Engineers; James Boyd, R.I. Coastal Resources Management Council; Tom Halavik, U.S. Fish and Wildlife Service; Kenneth Kovach, R.I. Department of Health; William Watkins, U.S. Food and Drug Administration; and Kevin Brubaker, Governor's Office. A special thanks goes to the industry members of the Ocean State Aquaculture Association for their helpful comments on the manuscript.

PART I: PERMITS AND BUSINESS PLANNING

INTRODUCTION

Starting an aquaculture business is an exciting process, but for some, it can be a very confusing and frustrating endeavor. In Rhode Island, the aquaculture industry is regulated by several state agencies. Local municipalities give their advice and assent regarding projects, and, depending on the type and location of the project, federal agencies may become involved. The purpose of this publication is to provide a listing of resources and agencies that may be useful to those interested in starting an aquaculture business in Rhode Island.

At the time of printing of this manual, there were only six active commercial aquaculture operations in Rhode Island, and all but one produced bivalve mollusks (oysters, scallops, and quahogs). There was a single inland producer of freshwater trout. Nevertheless, with fisheries stocks declining in the coastal waters of Rhode Island since the late 1980s, and a steadily increasing consumer demand for seafood, aquaculture is becoming an attractive alternative source of seafood products.

INITIAL CONTACTS AND PRELIMINARY SCIENTIFIC PERMITTING

For starting an aquaculture business, several items of basic information must be collected to test the feasibility of your project and to complete the aquaculture permit application. The information gathered will provide the foundation for further development of your business. The Rhode Island Sea Grant Advisory Services publishes a considerable amount of information about marine and coastal issues in Rhode Island, as well as information about the biology of organisms that can be cultured in Rhode Island waters.

It is often advisable to undertake small-scale pilot studies of the culture species in potential culture sites. This can be done by issuance of a Scientific Collector's Permit by the Chief of the Rhode Island Department of Environmental Management, Division of Fish, Wildlife, and Estuarine Resources. Pilot studies, if done in coastal waters, are usually limited to areas of less than 50 square feet. Pilot studies in freshwater areas are not advisable without multiagency consultation and approval. It is strongly advised that you contact the key aquaculture permitting agencies (U.S. Army Corps of Engineers, the Department of Environmental Management divisions of Agriculture and Water Resources, and the Coastal Resources Management Council) with plans to conduct pilot studies. The state Aquaculture Coordinator can be helpful in obtaining and providing advice on how to apply for a permit to conduct these pilot studies. A Scientific Collector's Permit costs \$25 per calendar year and requires an end-of-the-year report on the outcome of your pilot studies.

HELPFUL INITIAL CONTACTS ARE:

Arthur R. Ganz
Aquaculture Coordinator
Department of Environmental Management
Coastal Fisheries Laboratory
1231 Succotash Road
Wakefield, RI 02879
(401) 783-2304 Fax (401) 783-2760

Carole Jaworski
Director of Communications
Rhode Island Sea Grant Communications Office
University of Rhode Island Bay Campus
Narragansett, RI 02882-1197
(401) 792-6842 Fax (401) 792-6817

Michael A. Rice
Aquaculture Specialist
Rhode Island Sea Grant Program and
Rhode Island Cooperative Extension
Department of Fisheries
Woodward Hall
University of Rhode Island
Kingston, RI 02881
(401) 792-2943 Fax (401) 792-4017

PERMIT APPLICATIONS

To start an aquatic farm in Rhode Island, you must first apply for, and receive, permits from the State of Rhode Island. Aquaculture projects that are in coastal or estuarine waters of Rhode Island, or are in the coastal zone—within 200 feet of a shoreline feature—fall under the jurisdiction of the Coastal Resources Management Council (CRMC) as lead agency. Additional information regarding CRMC jurisdiction, definitions of shoreline features, policies, and standards can be found in the publication *Rhode Island Coastal Resources Management Program*, available at the CRMC offices. Inland aquaculture projects, usually freshwater, fall under the jurisdiction of the Department of Environmental Management (DEM) Division of Agriculture as lead agency.

An application package for aquaculture in the coastal zone may be obtained from the CRMC offices in Wakefield or Providence, Rhode Island:

Coastal Resources Management Council
Oliver Stedman Government Center
Tower Hill Road
Wakefield, RI 02879
or
40 Fountain St.
Providence, RI 02908

Aquaculture in the coastal zone is governed by the General Laws of the State of Rhode Island Chapter 10, Section 20, Aquaculture, and CRMC procedures for permitting are outlined in the *State of Rhode Island Coastal Resources Management Program 1983, as Amended*. The CRMC management plan is commonly referred to as the "red book," and is available for a \$10 fee from either of the CRMC offices. In the coastal aquaculture permit application approval process, the advice and consent of a number of state, federal, and local agencies are required. These agencies include: R.I. DEM Division of Fish, Wildlife, and Estuarine Resources; Division of Water Resources; Rhode Island Marine Fisheries Council; U.S. Environmental Protection Agency (EPA); U.S. Army Corps of Engineers (COE); and the appropriate municipal conservation and waterfront advisory commis-

sions. A CRMC permit (assent) may be issued for the proposed aquaculture activity for a period not to exceed 10 years, and may be renewed by application for subsequent five-year periods. If the coastal aquaculture permit requires exclusive use of publicly held coastal or estuarine bottom, then an annual lease is required. The annual leasing fee is \$150 per acre for the first acre and \$100 for each additional acre. Once the time period on leases expires, the leases are renewable upon reapplication and CRMC review. The officially designated CRMC permitting staff members who are responsible for aquaculture are:

James Boyd or Doris Aschman
Coastal Resources Management Council
Oliver Stedman Government Center
Tower Hill Road
Wakefield, RI 02879
(401) 277-2476

Applying for aquaculture permits for inland fish farming requires contacting a number of agencies for a permit package. The first of these agencies is the DEM Division of Agriculture. Aquaculture falls under the Right to Farm Laws of Rhode Island (G.L.R.I. 2-23). According to Chapter 23, Section 4 of the Right to Farm Laws, aquaculture is included as an agricultural practice. Construction of ponds as a normal part of farming activities is governed by G.L.R.I. 2-1-22(f). This law designates the DEM Division of Agriculture as the lead agency for approving applications for the construction of farm ponds and drainage structures. Occasionally, aquaculture activities will involve the "State of Rhode Island Department of Environmental Management Rules and Regulations Governing the Administration and Enforcement of the Freshwater Wetlands Act—April 7, 1994." The DEM Division of Agriculture can furnish you with a copy of the pamphlet "Rules Related to Farming Activities and Wetlands," as well as a Freshwater Wetlands Application Package. Contact:

John Lawrence
Department of Environmental Management
Division of Agriculture
22 Hayes St.
Providence, RI 02908
(401) 277-2781

The Division of Agriculture can assist the farmer in resolving wetland issues with the DEM Division of Freshwater Wetlands. In addition to the freshwater wetlands application package, the Division of Agriculture has publications outlining the regulations regarding activities in freshwater wetlands. These include:

- "State of Rhode Island Department of Environmental Management Rules and Regulations Governing the Administration and Enforcement of the Freshwater Wetlands Act—April 7, 1994"
- General Laws of Rhode Island 1956, As Amended: Chapters 42-17.1, 42-35, and Section 2-1-18

If the potential for conducting aquaculture activities in freshwater wetlands exists, consider contacting the Division of Freshwater Wetlands directly:

Rhode Island Department of Environmental Management
Division of Freshwater Wetlands
291 Promenade St.
Providence, RI 02908-5767
(401) 277-6820

Most shore-based aquaculture facilities, whether freshwater or marine, usually discharge an effluent stream and thus require a discharge permit. But other forms of aquaculture, such as molluscan shellfish culture in tidal waters, may be exempted from the discharge permitting process. In the state of Rhode Island, aquaculture effluents are regulated by the DEM Division of Water Resources, and a Rhode Island Pollutant Discharge Elimination System (RIPDES) permit is required. The DEM Division of Water Resources is the only agency with the authority to determine if an aquaculture site is required to have a RIPDES permit. In many other states, aquaculture effluents are regulated by the federal government through the EPA, which administers the National Pollutant Discharge Elimination System (NPDES) permitting under the provisions of the Federal Clean Water Act. In Rhode Island, the EPA has delegated discharge permitting to the state, but retains oversight over the state program. At present, Rule 3 of the RIPDES regulations defines an Aquaculture Project as a "defined managed water area which uses discharges of pollutants into that designated area..." and Section 7.4 of the Rhode Island Water Regulations for Water Pollution Control states that "no new discharge shall be permitted into Class A or SA waters or into water designated Class B, C, D, SB, or SC which have attained Class A or SA quality."

The DEM Division of Water Resources can provide a number of documents that explain water discharge regulations as part of the RIPDES permit package. The RIPDES documents include:

- "Policy on the Implementation of the Antidegradation Provision of the Rhode Island Water Quality Regulations, 3rd Revision, March 1992"
- "Regulations for the Rhode Island Pollutant Discharge Elimination System"
- "Water Quality Regulations of Water Pollution Control"
- General Laws of Rhode Island 1956 As Amended: Chapters 46-12, 42-17.1, and 42-35

THE CONTACTS FOR EFFLUENT DISCHARGE REGULATIONS ARE:

Alisa R. Richardson
Principal Sanitary Engineer
Permits and Planning Section
Rhode Island Department of Environmental Management
Division of Water Resources
291 Promenade St.
Providence, RI 02908-5767
(401) 277-6519

David Turin
U.S. Environmental Protection Agency
Region 1, JFK Federal Building
1 Congress St.
Boston, MA 02203
(617) 565-3543
Responsible for water quality data from Rhode Island.

Edward Lavery
U.S. Environmental Protection Agency
Region 1, JFK Federal Building
1 Congress St.
Boston, MA 02203
(617) 565-3935
Responsible for EPA permitting in Rhode Island.

The COE regulates the placement of fixed, submerged, or floating structures in navigable waters throughout the United States. In addition, the COE has jurisdiction over discharge or placement of dredged or fill material. Many types of coastal and estuarine aquaculture operations fall under the regulatory responsibility of the COE. It is strongly advisable to begin the COE permitting process at the same time that the state and local permitting process is initiated. The COE acts as the lead federal agency for federal aquaculture permitting review and coordinates with the U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), and the EPA. Thus, reviews by these agencies are not separate reviews, but part of the COE permitting process. The COE uses the Title 33 Code of Federal Regulations, Parts 320-330, and the Federal Water Pollution Control Act Amendments of 1972, Section 404, as its basic guidelines. The nearest office of the COE can furnish you with the following documents:

- "Guide to Permit Applications"
- "Federal Manual for Identifying and Delineating Jurisdictional Wetlands"
- "Guidelines for the Placement of Fixed and Floating Structures in Navigable Waters of the United States Regulated by the New England Division Army Corps of Engineers"
- "Are You Planning Work in a Waterway or Wetland?"

THE CONTACT FOR COE PERMITTING IS:

Monica Stillman
Regulatory Branch
New England Division
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149
(800) 343-4789

The COE decision to issue or deny a permit for work in navigable waters includes a public interest review. This consists of an evaluation of the benefits and detriments of the project, which are balanced by consideration of effects of the project and its use on navigation, recreation, safety, wetlands, water quality, shoreline erosion and accretion, fish and wildlife values, aesthetics, and a variety of other public interest factors.

Usually towns and cities in Rhode Island will have environmental ordinances that specifically include aquaculture and/or fish hatcheries. For example, South Kingstown has a Groundwater Protection Overlay District Ordinance that specifically includes aquaculture as a regulated activity. Contact your local town or city planner and inquire about the existence of any ordinances that may pertain to the project. It may be necessary to apply for a local permit or variance and present the plans to appropriate oversight boards.

**CHART 1
SITE SURVEY AND
PILOT STUDIES PROCESS**

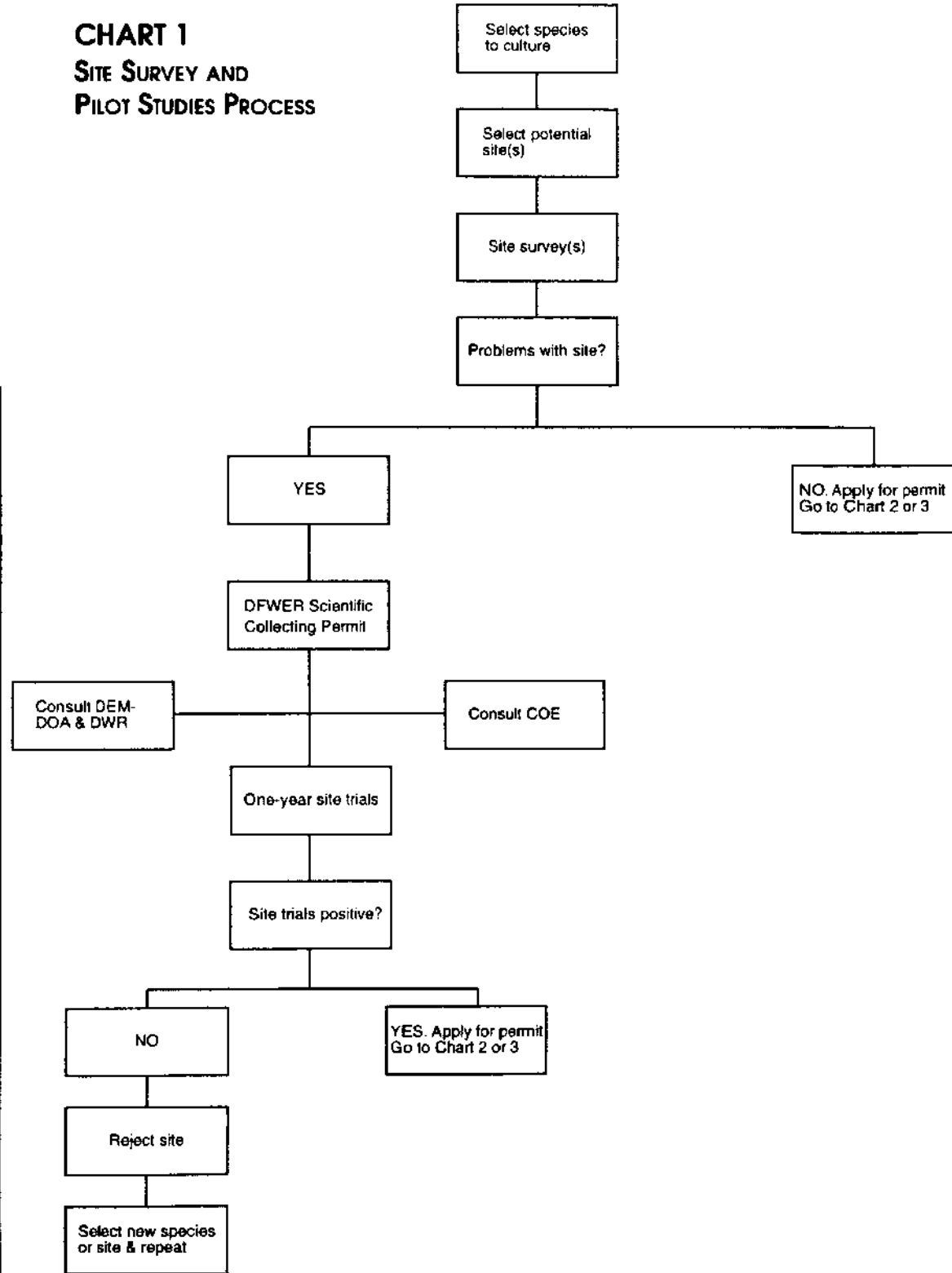
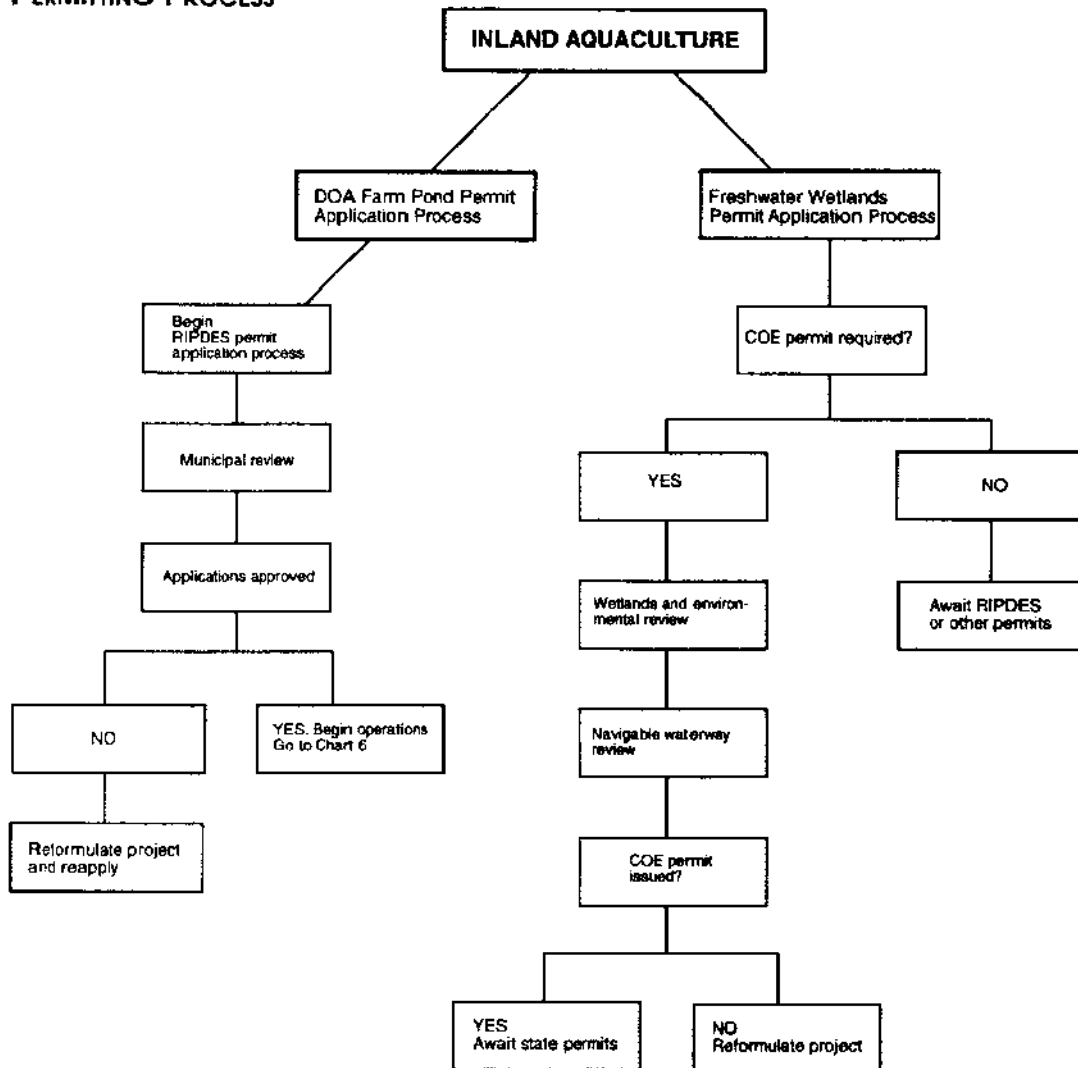


CHART 2
INLAND AQUACULTURE
PERMITTING PROCESS



**CHART 3
COASTAL AQUACULTURE
PERMITTING PROCESS**

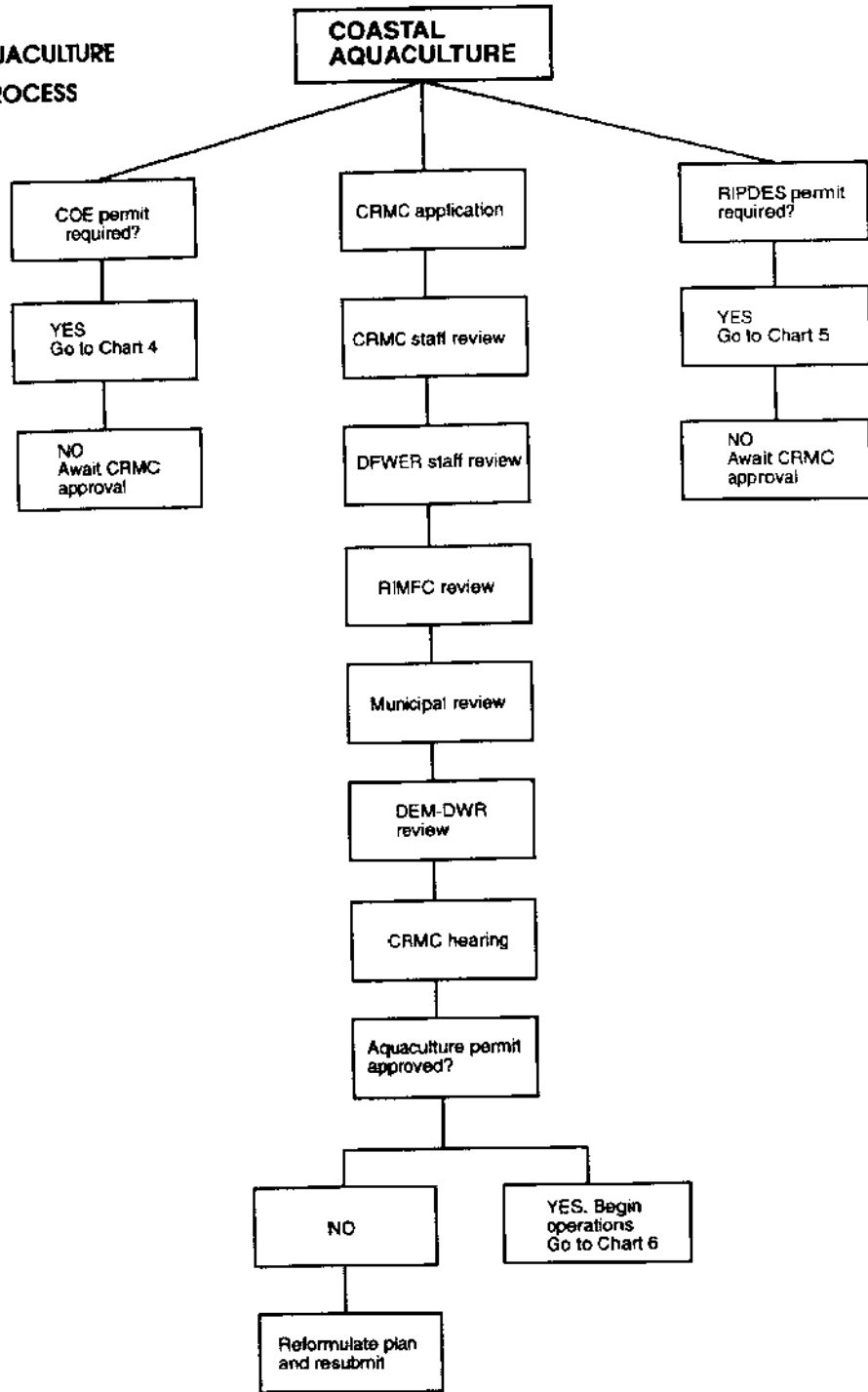


CHART 4
ARMY CORPS OF ENGINEERS
PERMITTING PROCESS

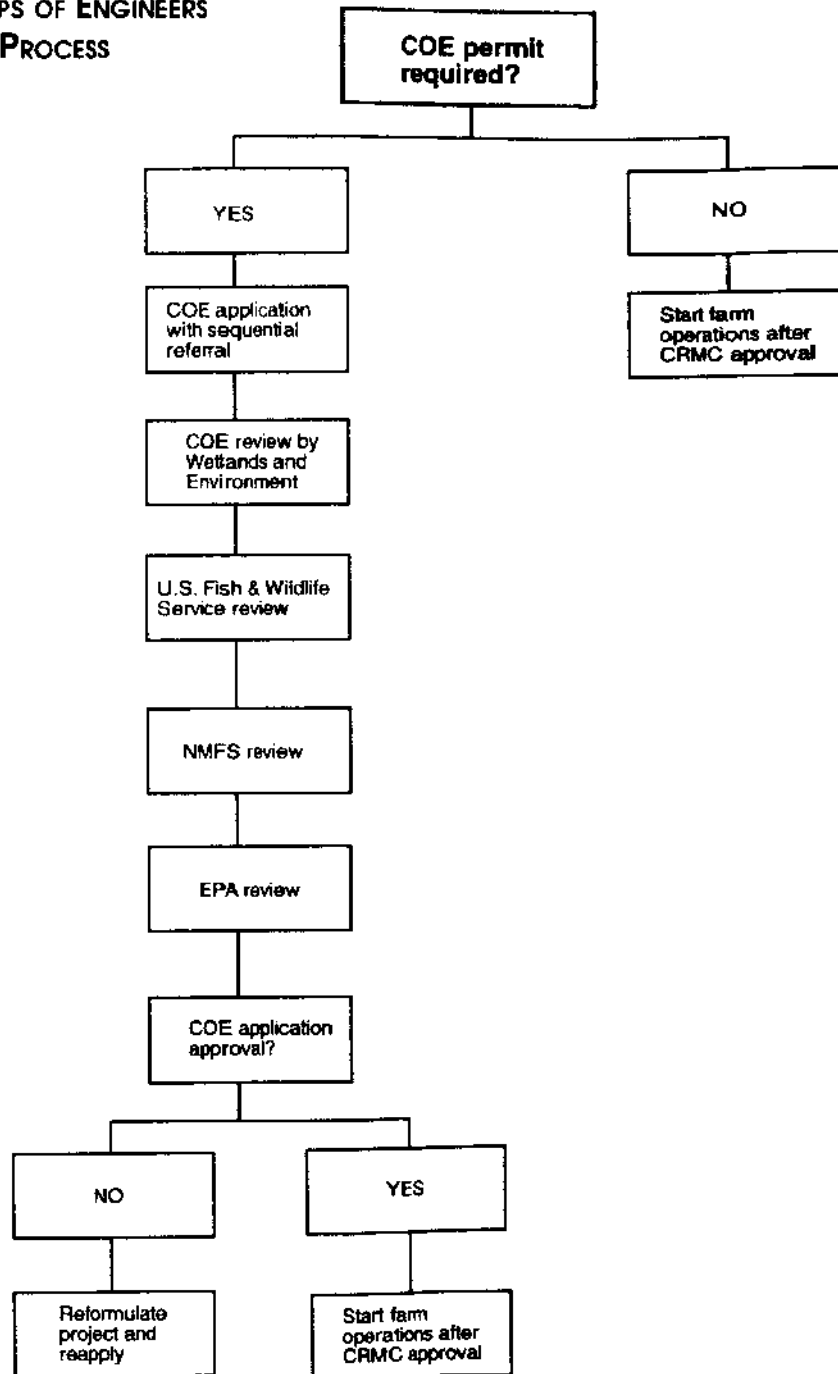


CHART 5
RIPDES PERMITTING
PROCESS

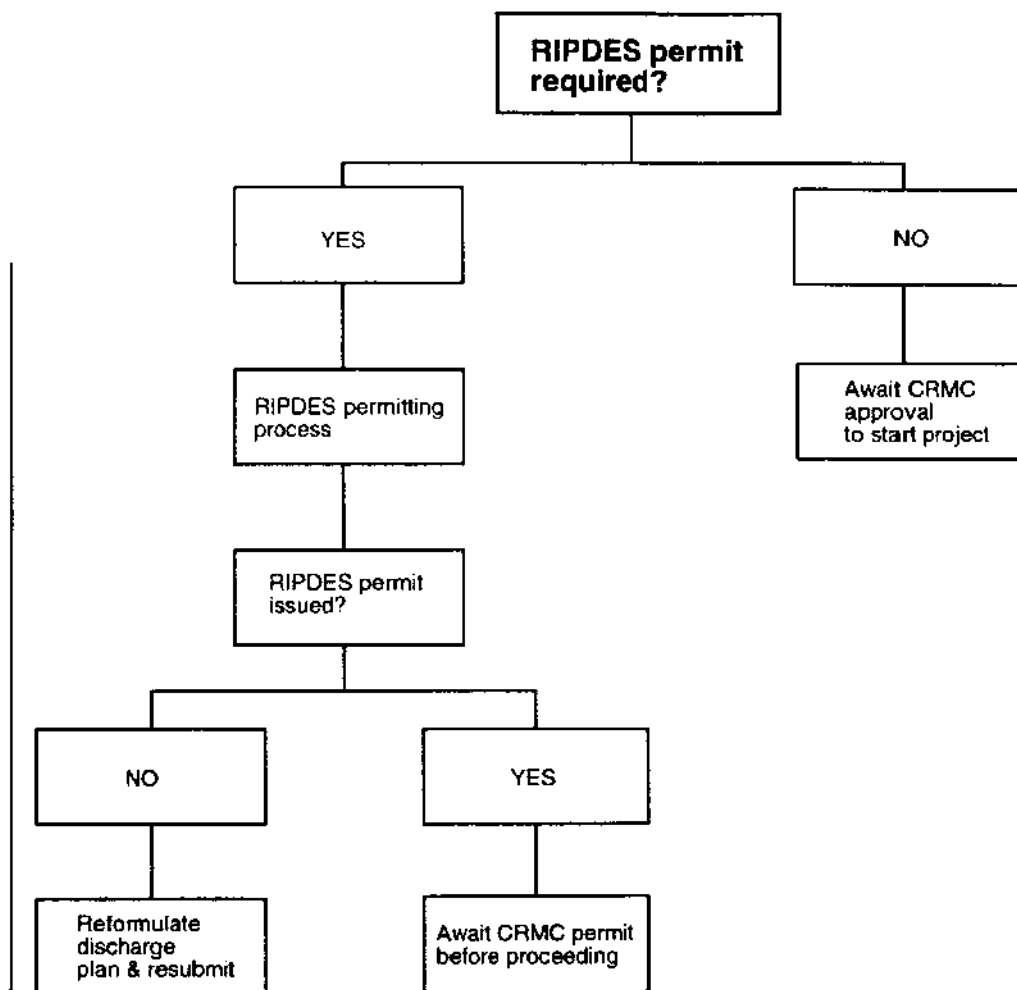
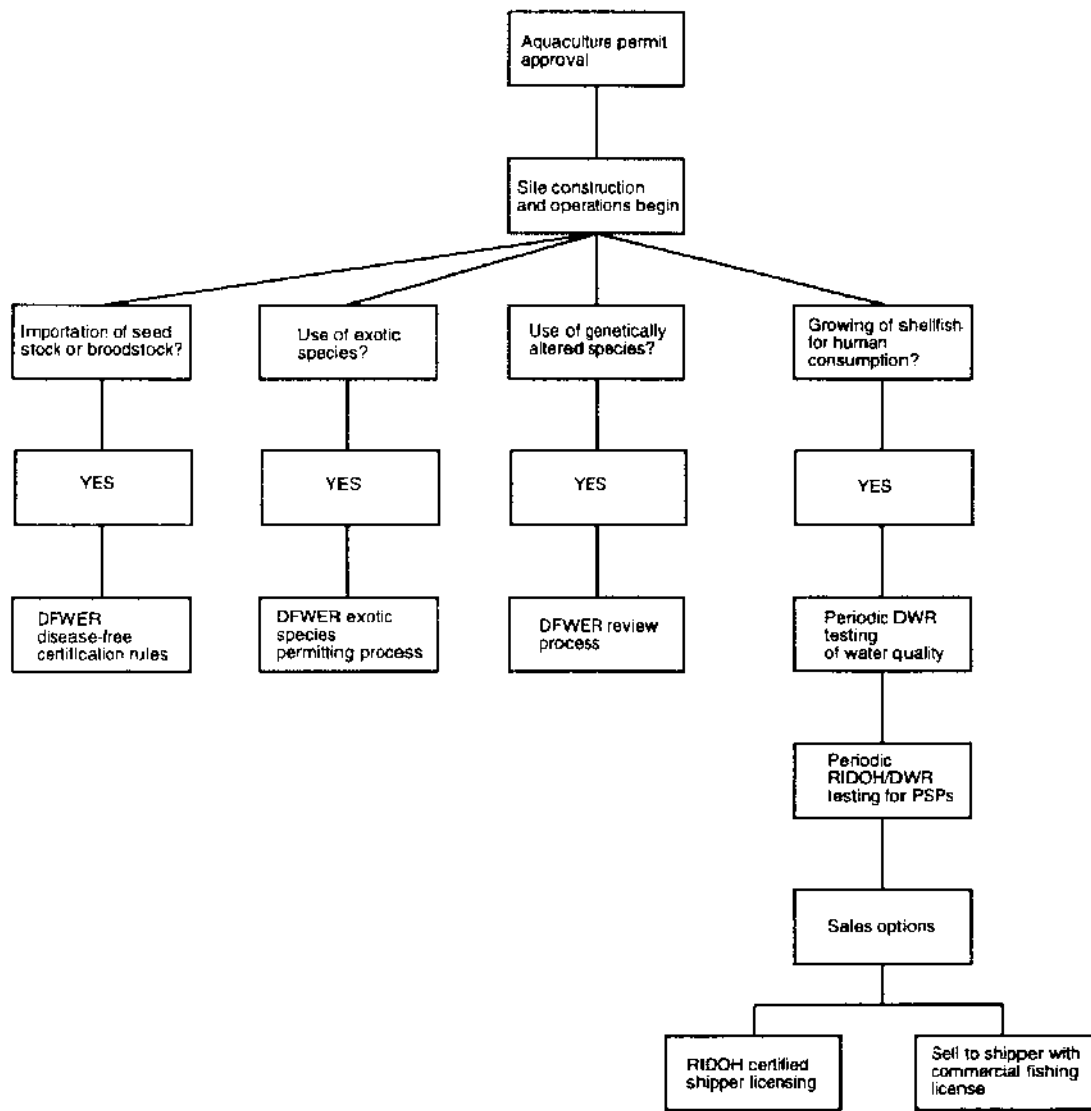


CHART 6
OPERATIONAL REGULATIONS AND
PERMITS FOR AQUACULTURE



MAPS AND CHARTS

As part of the permit application, a map of the site must be included. Nautical charts produced by the National Oceanic and Atmospheric Administration (NOAA) are available at many marine supply and marina stores throughout the state. If you do not know the chart number needed, obtain a free copy of the chart catalog titled "United States, Atlantic and Gulf Coasts, Catalog Number 1" from a local sales agent, or if they are out-of-stock, the free catalog can be obtained directly from the NOAA distribution center:

Distribution Branch
NOS-NOAA
ACF Warehouse, Room 210
6501 Lafayette Ave.
Riverdale, MD 20737-1199
(301) 436-6990

The dates of the latest chart editions are available from the distribution center staff.

Standard 7.5 - minute series topographic quadrangle maps produced by the U.S. Geological Survey are excellent for pinpointing your project site in either inland or coastal aquaculture permit applications. These maps are available for about \$3.50 each from the authorized U.S. Geological Survey distributor in Rhode Island:

The Map Center
671 N. Main St.
Providence, RI 02906
(401) 421-2184

ADDITIONAL MANAGEMENT CONTACTS

After state and federal permit applications are filed, a number of agencies will review your plan to determine its environmental, economic, social, and resource use impacts. From time to time, various agency representatives may contact you with questions about certain aspects of the application. These agencies may also be important to contact prior to the permit application. Making early contacts will save time and trouble later in the application process. In the many agencies that follow, there is no single person who specializes in aquaculture issues. Initial contact persons are listed for some.

U.S. Environmental Protection Agency
Region 1, JFK Federal Building
1 Congress St.
Boston, MA 02203
(617) 565-3420

EPA staff are part of the sequential review process for COE permits.

Eric Nelson
National Marine Fisheries Service
Habitat and Protected Resources Branch
1 Blackburn Drive
Gloucester, MA 01930-2298
(508) 218-9118 Fax (508) 281-9301

Responsible for habitat impacts on federal lands or waters and COE permits review.

Greg Mannesto
U.S. Fish and Wildlife Service
Rhode Island Field Office
P.O. Box 307
Charlestown, RI 02813
(401) 364-9124 Fax (401) 364-0170

Responsible for reviewing projects that may affect Federal Trust Species (fish, wildlife, plants, and their habitats), as well as impacts on federal lands.

Joseph Migliore
Senior Water Quality Specialist
Department of Environmental Management
Division of Water Resources
29¹ Promenade St.
Providence, RI 02908-5767
(401) 277-3961 Fax (401) 521-4230

Responsible for the certification of shellfish-growing waters in Rhode Island under the provisions of the National Shellfish Sanitation Program (NSSP). Also responsible for water sampling to support the R.I. Department of Health (RIDOH) monitoring of PSP and related algal toxins.

Kenneth Kovach
Principal Sanitarian
R.I. Department of Health
3 Capitol Hill
Providence, RI 02908
(401) 277-2749 Fax (401) 277-6953

Responsible for shellfish sanitation in harvest, shipping, and sale under the provisions of the NSSP. The RIDOH monitors shellfish meats for PSP and other biotoxins, and is responsible for all health-related shellfish closures.

John Karlsson
Acting Supervising Marine Biologist
Department of Environmental Management
Division of Fish, Wildlife, and Estuarine Resources
Coastal Fisheries Laboratory
1231 Succotash Road
Wakefield, RI 02879
(401) 783-2304 Fax (401) 783-2760

Responsible for enforcement of rules and regulations regarding the importation of exotic or genetically altered organisms into Rhode Island and the oversight of imported seed stock and brood-stock disease-free certifications.

R.I. Marine Fisheries Council
c/o Richard Sisson, *Deputy Chief*
Department of Environmental Management
Division of Fish, Wildlife, and Estuarine Resources
Oliver Stedman Government Center
Tower Hill Road
Wakefield, RI 02879
(401) 789-3094 Fax (401) 783-4460
The R.I. Marine Fisheries Council (RIMFC) checks permit applications for possible conflicts with capture fisheries.

R.I. Department of Economic Development
7 Jackson Walkway
Providence, RI 02908
(401) 277-2601
Helpful in developing innovative business proposals with possible economic impact in Rhode Island.

U.S. Coast Guard
Office of Marine Safety
John O. Pastore Federal Building
Providence, RI 02908
(401) 528-5335
Responsible for monitoring structures placed in coastal areas, including navigation, placement and marking, and safety concerns.

William D. Watkins
Northeast Technical Services Unit
U.S. Food and Drug Administration
Building S-26, Quonset Point
North Kingstown, RI 02852
(401) 294-2561 Fax (401) 528-5278
Responsible for the oversight of all state shellfish sanitation programs, including Rhode Island, under the auspices of the NSSP of the Interstate Shellfish Sanitation Conference (ISSC). The ISSC documents contain chapters outlining shellfish sanitation procedures for aquaculture.

BUSINESS PLANNING

The site selection and permit application processes are among the first steps required for developing an aquatic farm. Business planning is another important initial step. Many aquatic farmers begin by developing a feasibility study; and from that study, they draft a preliminary business plan. A feasibility study is a scaled-down version of the intended operation. It serves as a test of the biological and economic feasibility of the site for aquatic farming without requiring a large initial investment. Every farm operation will be a little different, and these minor differences can make or break the operation. There is nothing like working from actual data from the farm to determine its economic viability. It is important to remember that, for adequate completion of a feasibility study, the costs of various stages of the operation must be determined, particularly the

expense of labor needed to operate the facility. To design a feasibility study, use the business plan outline and remember to keep thorough and accurate records.

Even though a complete business plan is not required in the permit application, potential aquatic farmers should seriously consider developing one. The permit application does require that you draw up a project development outline. This part of the application should not be interpreted as being an adequate business plan. The sobering reality is that you are starting an aquatically oriented business where profit margins and market opportunities are quite constrained or subject to considerable volatility. The novice farmer must be well instructed and financed. In other words, the job of planning an aquaculture business must be done properly the first time. There will be little opportunity for mid-course corrections to save a failing business.

Various instructional manuals can help you work through the business planning steps. The actual time expenditure required for the completion of an aquaculture business plan need not be extensive. Once committed to the task of writing a planning document, most prospective farmers find themselves able to produce an adequate document within five days. The effort is not just an enjoyable mental exercise, but is also essential for the success of your project. The omission of this planning step is one of the greatest causes of business failure. The business plan is fairly simple in structure and usually contains the following components:

CONTENTS OF A BUSINESS PLAN:

- Title
- Statement of Purpose
- Executive Summary
- The Business
 - History
 - Business Description
 - Species
 - Product form (live, shucked, value-added)
 - Culture technology
- Market
 - Market description
 - Marketing strategy
- Competition
- Operations
 - Start-up
 - Development schedule
 - Production tasks
- Facility Management
- Research and Development
- Personnel
 - List of team members and their experience
- Risk Factors
 - Production-related
 - Marketing-related
 - Risk reduction methods

Financial Information

- Facility and equipment costs
- Operating costs
- Liability considerations
- Method of financing
 - Source(s)
 - Amount

Financial Analysis

- Break-even analysis
- *Pro forma* balance sheet
- *Pro forma* income statement
- *Pro forma* cash flow
- Historical financial statements
- Equity capitalization
- Debt capitalization

Supporting Documents

For many aquatic farmers, this type of plan may seem overwhelming. The most difficult and least understood part may be the financial analysis section. You may need the assistance of an accountant to complete this section. You probably have the remaining information needed, or have it readily available.

BUSINESS PUBLICATIONS

The following list of introductory business planning materials can provide basic information needed for the construction of a business plan. Most of these references are specific to aquaculture business planning, but your local library will also have a selection of generic business development and business planning literature. Small business planning centers, the Cooperative Extension Service, and the Sea Grant Marine Advisory Service offices are also good sources of assistance.

- "Is Aquatic Farming for You?" (NRAC Fact Sheet 101) 1991.
- "Business Planning for Aquaculture: Is It Feasible?" (NRAC Fact Sheet 150) 1992.

Copies of these fact sheets are available from the office of the University of Rhode Island (URI) aquaculture extension specialist. Alternatively, copies may be obtained from the Northeast Regional Aquaculture Center:

Northeast Regional Aquaculture Center
University of Massachusetts, Dartmouth
North Dartmouth, MA 02747
(508) 999-8157 Fax (508) 999-8590

- "Economic Evaluation of Investment Decisions for Aquaculture Enterprises"
- "Developing an Aquaculture Business Proposal"
- "Aquaculture Record Keeping"
- "Marketing Management in Aquaculture"
- "Financial Management"

Robert S. Pomeroy and coworkers at Clemson University have developed a number of these helpful fact sheets to aid in aquaculture business plan development.

Department of Agricultural and Applied Economics
Barre Hall
Clemson University
Clemson, SC 29634-0355
(803) 656-5789 Fax (803) 656-5746

- *Northeast Region Aquaculture Industry Situation and Outlook Report* by M.J. Bush and J.L. Anderson. 1993. \$8.
- *Pen-Reared Salmonid Industry in the United States* by S.U. Bettencourt and J.L. Anderson. 1990. \$25.

Both publications discuss economic issues germane to the Rhode Island area and are available from Rhode Island Cooperative Extension. Send requests to:

Department of Resource Economics
Lippitt Hall
University of Rhode Island
Kingston, RI 02881
(401) 792-2472 Fax (401) 782-4766

- *Aquaculture Situation and Outlook Report*
A monthly periodical outlining prices and supplies of aquacultural commodities. Subscriptions are available for \$17 per year or less if you subscribe for more than one year. Obtain subscription information from:

U.S. Department of Agriculture, ERS-NASS
341 Victory Drive
Herndon, VA 22070
(800) 999-6779 Fax (703) 834-0110

FINANCES

An important part of the business planning process involves the capitalization of your aquaculture project. Where will the necessary funds come from? Will the project be sufficiently small to permit use of personal funds, or will borrowed money be required? Have you considered other funding options, such as securing a partner or forming a small corporation? Whatever your decision, conservative financial planning is encouraged. Have you considered liability and insurance? Be cautious about assuming any level of debt, particularly at the beginning of your project—a time when you are least able to support interest payments. Because you are venturing into a business in which income from sales may take two years or longer, you should be in a financial position where you can afford to wait.

The development of any aquaculture project should proceed in a stepwise manner and should include the completion of a pilot project before any attempt is made to move into full-scale production. This will help to establish the level and schedule of funding required. For advice on the proper scheduling of a mariculture project, contact the Sea Grant/Cooperative Extension Aquaculture Specialist at URI. The Ocean State Aquaculture Association—the Rhode Island aquaculture trade association—can be helpful in terms of business and financial advice. Contact:

Robert B. Rheault
President
Ocean State Aquaculture Association
East Farm
University of Rhode Island
Kingston, RI 02881
(401) 783-6007

For most independent farmers, once the pilot studies have been completed, the acquisition of investment capital becomes a major consideration. This is important. *The single most common reason for aquaculture project demise is the failure to devote enough time and effort to business and financial planning.*

Numerous small-business financial directories are available. The following volume reviews various sources of funding:

- *Aquaculture: A Guide to Federal Government Programs*

This book is available from:

Eileen McVey
Aquaculture Information Center
National Agricultural Library
U.S. Department of Agriculture
10301 Baltimore Blvd., Room 304
Beltsville, MD 20705-2351
(301) 504-5558 Fax (301) 504-5472

Financial publications are also available from the Small Business Development Center of the Rhode Island Department of Economic Development:

Small Business Development Center
Rhode Island Department of Economic Development
7 Jackson Walkway
Providence, RI 02908
(401) 277-2601

DISASTER RELIEF FOR AQUATIC FARMS

Prior to 1992, disaster relief was not available to aquaculture crops. However, in 1992, Congress passed supplemental legislation to include several crops, one of which was aquaculture. This was supplemental legislation for crop-year 1992 only. Currently, aquaculture is not covered under the Disaster Assistance Program, but producers should check with the Agricultural Stabilization and Conservation Service (ASCS) on an annual basis to inquire about the current status of aquaculture crops. This is not a windfall government profit program! Although there are many details that need to be worked out, the program does stipulate the following conditions for loan or grant assistance:

1. The expected production level must be known.
2. The production exceeds 40 percent of the crop loss (disaster level).

3. The damage to the crop is caused by a natural disaster, which can also include conditions that deteriorate the quality of the crop.
4. The aquaculturist's annual gross income must be less than \$2 million.
5. Annual payment must not exceed \$100,000.
6. Crop insurance is not required.

One very important feature of the law is that there must be documentation of the crop size and future projections. More information about the program is available through the state office of the ASCS. Contact:

Mark J. Ruwet
Program Specialist
Agricultural Stabilization and Conservation Service
U.S. Department of Agriculture
60 Quaker Lane, Suite 40
Warwick, RI 02886
(401) 828-8232

PART II: REFERENCES AND RESOURCES

SPECIALIZED LIBRARIES

There are a number of specialized library facilities that house materials of particular interest to the aquaculturist in Rhode Island. These specialized collections are a tremendous resource that should not be overlooked.

Claiborne Pell Marine Science Library
University of Rhode Island Bay Campus
South Ferry Road
Narragansett, RI 02882-1197
(401) 792-6161

The Pell Library houses a collection of books and journals dealing with marine science, fisheries, and aquaculture.

National Sea Grant Depository
Pell Library Building
University of Rhode Island Bay Campus
Narragansett, RI 02882-1197
(401) 792-6114

The National Sea Grant Depository houses copies of all publications funded by the Sea Grant College programs throughout the United States. Many of the publications are of direct interest to aquaculturists. You may request that your name be added to the depository mailing list to receive periodic updates of new publications.

Aquaculture Information Center
National Agricultural Library
U.S. Department of Agriculture
10301 Baltimore Blvd., Room 304
Beltsville, MD 20705-2351
(301) 504-5558 Fax (301) 504-5472

The National Agricultural Library houses one of the best collections of aquaculture publications in the world.

PUBLICATIONS

A vast array of technical and biological information has been published about aquaculture species and methods. It is easy to become overwhelmed by this literature base. A number of introductory and review publications are listed on the following pages and can provide technical information on a variety of aquacultural topics.

Most of the listed volumes contain extensive bibliographies and lists of suggested reading. There are several strategies for obtaining copies of these references. The simplest method may be to request copies through your local library via interlibrary loan. Books printed in many parts of the world are available in this way. A more direct method may be to purchase your own copy from the publisher, or through your local bookstore. Most of these volumes are listed in ordering catalogs and in Books in Print, available at your local library. You will probably want to develop your own personal reference library of publications that you find most useful.

GENERAL AQUACULTURE AND WATER QUALITY:

Bardach, J.E., J.H. Ryther, and W.O. McLarney. 1972. Aquaculture: The Farming and Husbandry of Freshwater and Marine Organisms. Wiley-Interscience, New York. 868pp.

Although this book is over 20 years old, it is considered the classic aquaculture textbook. It gives a wealth of information about cultured species and methods from locations worldwide.

Boyd, C.E. 1990. Water Quality in Ponds for Aquaculture. Alabama Agricultural Experiment Station, Auburn University, Auburn, Ala. 482pp.

An excellent reference related to management of water quality in pond aquaculture systems.

Creswell, R.L. 1993. Aquaculture Desk Reference. AVI/Van Nostrand Reinhold, New York. 206pp.

A very handy book listing chemical formulae, conversion factors, specifications, and other useful information.

Huguenin, J.E. and J. Colt. 1989. Design and Operating Guide for Aquaculture Seawater Systems.

Elsevier Science Publishers, New York. 264pp.

A good aquaculture systems reference.

Lee, J.S. and M.E. Newman. 1992. Aquaculture—An Introduction. Interstate Publishers, Danville, Illinois. 449pp.

Although this textbook focuses on catfish, it covers many basic principles that are applicable to other forms of aquaculture.

Meade, J.W. 1989. Aquaculture Management. AVI/Van Nostrand Reinhold, New York. 175pp.

This is a treatment of aquaculture business economics useful for business planning.

Milne, P.H. 1979. Fish and Shellfish Farming in Coastal Waters. Fishing News Books, Farnham, Surrey, England. 208pp.

Pillay, T.V.R. 1992. Aquaculture and the Environment. Halsted Press/John Wiley, New York. 189pp.

This book discusses a number of aquaculture production systems and their potential impacts on the environment. This book is a "must read" for all those preparing environmental impact statements or designing environmentally sound systems.

Wheaton, F.W. 1977. Aquacultural Engineering. John Wiley & Sons, New York. 708pp.

Although this book is a little outdated, it is nonetheless a valuable reference about aquaculture system design.

FINFISH CULTURE:

Dore, I. 1990. Salmon: Illustrated Handbook for Commercial Users. Chapman-Hill Publishers, New York. 287pp.

Hodson, R.G. and J. Jarvis. 1990. Raising Hybrid Striped Bass in Ponds. North Carolina Sea Grant, North Carolina State University, Raleigh. NCU-T-90-0103. 41pp.

Lovell, T. 1989. Nutrition and Feeding of Fish. AVI/Van Nostrand Reinhold, New York. 260pp.

Piper, R.G., I.B. McElwain, L.E. Orme, J.P. McCraren, L.G. Fowler, and J.R. Leonard. 1982. Fish Hatchery Management. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C. 517pp.

This is an important reference with a great deal of valuable information about salmonids, bass, catfish, and other North American species.

Shepherd, J. and N. Bromage. 1988. Intensive Fish Farming. Blackwell Scientific Publications, Cambridge, Mass. 404pp.

Tucker, C.S. and E.H. Robinson. 1990. Channel Catfish Farming Handbook. AVI/Van Nostrand Reinhold, New York. 454pp.

SHELLFISH CULTURE:

Clime, R. and D. Hamill. 1981. Growing Oysters and Mussels in Maine. Coastal Enterprises, Bath, Maine. 46pp.

Available for \$5.75 from:

Coastal Enterprises, Inc.

141 Front St.

Bath, ME 04530

Hardy, D. 1991. Scallop Farming. Fishing News Books, Farnham, Surrey, England. 237pp.

Available for \$69 from:

Argent Chemical Laboratories

8702 152nd Ave. N.E.

Redmond, WA 98052

(800) 426-6258

Huner, J.V. and E.E. Brown. 1985. Crustacean and Mollusk Aquaculture in the United States. AVI/Van Nostrand Reinhold, New York. 476pp.

This highly recommended book provides an excellent overview of shellfish aquaculture as it is practiced in the United States.

Korringa, P. 1976. Farming the Flat Oysters of the Genus *Ostrea*. Elsevier Scientific Publishing Company, New York. 238pp.

Korringa, P. 1976. Farming the Cupped Oysters of the Genus *Crassostrea*. Elsevier Scientific Publishing Company, New York. 224pp.

Lutz, R.A. 1980. Mussel Culture and Harvest: A North American Perspective. Elsevier Scientific Publishing Company, New York. 350pp.

Malinowski, S. 1986. Small-scale Farming of the Hard Clam on Long Island, New York. New York State Urban Development Corporation. 60pp.

Available from:

New York State Urban Development Corp.

1515 Broadway

New York, NY 10036

Manzi, J.J. and M. Castagna. 1989. Clam Mariculture in North America. Elsevier Scientific Publishing Company, New York. 462pp.

Matthiessen, G.C. 1989. Small-scale Oyster Farming: A Manual. National Coastal Resources Research and Development Institute. 81pp.

Available for \$4 plus \$2.50 shipping and handling from:
National Coastal Resources Research and Development Institute
528 S.W. Mill St., Suite 220
P.O. Box 751
Portland, OR 97207
(503) 725-5725 Fax (503) 725-5709

Myers, E. 1981. The Husbandry of Mussels in a Maine Estuary: An Approach to a Commercial Enterprise. University of New Hampshire Sea Grant, Durham, N.H. UNH-SG-164. 45pp.

Nosho, T. 1989. Small-scale Oyster Farming for Pleasure and Profit. Washington Sea Grant, University of Washington. ESG-AS 89-1. 12pp.

Available for \$1.25 from:
Washington Sea Grant Program
3716 Brooklyn Ave. N.E.
Seattle, WA 98105
(206) 543-6600

Quayle, D.B. 1980. Tropical Oysters: Culture and Methods. International Research and Development Centre, Ottawa, Canada. IRDC-TS17e. 80pp.

Available from:
International Development Research Centre
P.O. Box 8500
Ottawa, Ont. K1G 3H9
CANADA

Rice, M.A. 1992. The Northern Quahog: The Biology of *Mercenaria mercenaria*. Rhode Island Sea Grant, University of Rhode Island. RIU-B-92-001. 60pp.

Available for \$7.95 from:
Publications
R.I. Sea Grant Communications Office
University of Rhode Island Bay Campus
Narragansett, RI 02882-1197
(401) 792-6842

Roland, W.G. and T.A. Broadley. 1990. A Manual for Producing Oyster Seed by Remote Setting. Canadian Ministry of Agriculture, Fisheries, and Food, Ottawa. 58pp.

Available from:
Ministry of Agriculture, Fisheries, and Food
808 Douglas St.
Victoria, B.C. V8W 2Z7
CANADA
(604) 387-5121 Fax (604) 356-7280

Shumway, S.E. 1991. Scallops: Biology, Ecology and Aquaculture. Elsevier Scientific Publishing Company, New York. 1,095pp.

Swann, C. 1989. An Introduction to Scallop Farming. Kevgor Aquasystems, Vancouver, Canada. 56pp.

Available from:

Kevgor Aquasystems
P.O. Box 48851
595 Burrard St.
Vancouver, B.C. V7X 1A8
CANADA
(604) 224-2485

Walne, P.R. 1974. Culture of Bivalve Molluscs: Fifty Years Experience at Conwy. Fishing News Books, Farnham, Surrey, England. 189pp.

BIBLIOGRAPHIES AND ON-LINE SEARCHES

There are a number of aquaculture bibliographies available. These publications cover a variety of practical topics and are frequently species-specific in content. Other volumes cover a particular technology issue—hatchery production, for example. Several readily available aquaculture bibliographies are listed below. Your local marine advisory agent or aquaculture specialist also maintains extensive files of reference information that is available to you for the asking or for a nominal charge to cover copying costs. Several useful bibliographies are:

- Aquaculture: Economics and Marketing (January 1979–February 1991)
- Mollusk Culture (January 1985–July 1990)
- Aquaculture (January 1992)
- Practical Aquaculture Literature II: A Bibliography (June 1989)
- The Potentials of Aquaculture: An Overview and Bibliography (October 1989)
- Interactions of Aquaculture, Marine Coastal Ecosystems and Near-Shore Waters: A Bibliography (May 1991)

These bibliographies are available from:

Aquaculture Information Center
National Agricultural Library
U.S. Department of Agriculture
10301 Baltimore Blvd., Room 304
Beltsville, MD 20705-2351
(301) 504-5558 Fax (301) 504-5472

Another method for locating specific technical information is through a computerized literature search. Your local librarian can be of assistance in completing this type of search. You also have access to the National Agricultural Library at the address and phone number listed above, which performs computer searches based on keywords you supply. Computer literature searches are particularly useful when attempting to locate information dealing with very specific topics. If you wish to use a computerized literature search service, be prepared with a list of specific keywords. An example of keywords would be "American oyster," "culture," and "larva," if you wanted information on the culture of American oyster larvae. Keep in mind that the service takes time and can be expensive. Be sure to ask if there is a fee charged for the service.

If you have a computer with a modem, you can access aquaculture information through the Aquaculture Network Information Center (AquaNIC). AquaNIC is a gateway to the world's electronic resources in aquaculture. AquaNIC is maintained at Purdue University in West Lafayette, Ind., and is supported jointly by Purdue University, the USDA Cooperative Extension Service, and the National Sea Grant College Program. A wide variety of information is available through AquaNIC. Most documents can be viewed on a computer monitor, downloaded via modem, or sent to your e-mail address. AquaNIC also contains an image directory that holds hundreds of pictures, short videos, and slides in a variety of common image formats. One of the unique features of AquaNIC is that it is also linked to other aquaculture databases and bulletin boards via the Internet. The main directory structure of AquaNIC is:

1. About AquaNIC
2. Search e-mail addresses
3. Search titles
4. Search text
5. Publications
 - a. USDA Regional Centers
 - 1) Extension Publications
 - 2) Technical Reports
 - 3) Annual Progress Reports
 - b. Federal Government Reports
 - c. State Extension or Sea Grant Publications
6. Newsletters
 - a. USDA Regional Aquaculture Centers
 - b. National Association of State Aquaculture Coordinators
 - c. State
7. Other Aquaculture Information ON the Internet
8. Other Aquaculture Information NOT ON Internet
9. E-mail Directory of US Aquaculture Contacts
10. E-Mail Directory of International Aquaculture Contacts
11. Calendar of Events
12. News Flashes
13. Images
14. Job Announcements

For more information about AquaNIC, contact:

Mark Einstein
Department of Animal Sciences
Purdue University
West Lafayette, IN 47907-1151
(317) 494-4862 Fax (317) 494-4862
Internet: meinstei@hub.anc.purdue.edu

AQUACULTURE PRODUCT CATALOGS AND DIRECTORIES

Supply catalogs and industry directories are extremely useful references and can be used to locate suppliers of a wide variety of products and services. Appendices contained within a number of these publications list additional information such as seed suppliers, agency contacts, aquaculture associations, marketing contacts, and related information. Another good source of equipment suppliers is advertisements in trade periodicals. When you obtain directories or catalogs, be sure to obtain the current or most up-to-date edition. The catalogs listed here can assist in the planning of your aquaculture business. The Rhode Island Sea Grant Marine Advisory Service, Rhode Island Cooperative Extension, or the R.I. DEM do not endorse any of the products or services listed within these publications.

SUPPLY CATALOGS/INDUSTRY DIRECTORIES:

- Aquaculture Magazine, Annual Buyer's Guide and Industry Directory \$15

Aquaculture Magazine
Subscription Department
P.O. Box 2329
Asheville, NC 28802
(704) 254-7334 Fax (704) 253-0677

- Northern Aquaculture: Annual Buyer's Guide \$7.50

Northern Aquaculture
4611 William Head Road
Victoria, B.C. V9B 5T7
CANADA
(604) 478-9209 Fax (604) 478-1184

- Asian Fisheries Directory \$14 via airmail

Asian Fisheries Society
c/o International Center for Living
Aquatic Resources Management
MC P.O. Box 2631
Makati, Metro Manila 0718
PHILIPPINES
63-2-818-0466 Fax 63-2-816-3183

• Fisheries Product News
P.O. Box 37
Stonington, ME 04681
(207) 367-2396 Fax (207) 367-2490

• International Aquaculture Trade Directory
European Aquaculture Society
EAS Secretariat
Coupure Rechts 168
B-9000 Gent, BELGIUM
32-91-23-7722 Fax 32-91-23-7604

TRADE PERIODICALS:

• Aquaculture Europe
European Aquaculture Society
EAS Secretariat
Coupure Rechts 168
B-9000 Gent, BELGIUM
32-91-23-7722 Fax 32-91-23-7604

• Aquaculture Magazine
Subscription Department
P.O. Box 2329
Asheville, NC 28802
(704) 254-7334 Fax (704) 253-0677

• Atlantic Fish Farming
Island Press Ltd.
P.O. Box 790
Montague, P.E.I. COA 1R0
CANADA
(902) 838-2515 Fax (902) 838-4392

• Bulletin of the Aquaculture Association of Canada
Aquaculture Association of Canada
P.O. Box 1987
St. Andrews, N.B. E0G 2X0
CANADA
(506) 529-4766 Fax (506) 529-4274

• The Aquaculture News
P.O. Box 416
Jonesville, LA 71343
(318) 339-4660 Fax (318) 339-4664

• Fish Farm News

R.R. #4, Site 465, C-37
Courtenay, B.C. V9N 7J3
CANADA
(604) 338-2455 Fax (604) 338-2466

• Fish Farming International

21 John St.
London WC1N 2BP
ENGLAND

• Fish Farming News

P.O. Box 37
Stonington, ME 04681
(207) 367-2396 Fax (207) 367-2490

• Mid-Atlantic Aquafarmer

American Farm Publications, Inc.
P.O. Box 2026
Easton, MD 21601
(800) 634-5021

• Northern Aquaculture

4611 William Head Road
Victoria, B.C. V9B 5T7
CANADA
(604) 478-9209 Fax (604) 478-1184

• Out of the Shell

Mollusc Culture Network
Biology Department
Dalhousie University
Halifax, N.S. B3H 4J1
CANADA
(902) 494-3610 Fax (902) 494-3736

• Water Farming Journal

Carroll Truscclair and Associates, Inc.
3400 Neyrey Drive
Metairie, LA 70002
(504) 454-8934 Fax (504) 488-4135

• World Aquaculture

World Aquaculture Society
143 J.M. Parker Coliseum
Louisiana State University
Baton Rouge, LA 70803
(504) 388-3137 Fax (504) 388-3493

DIRECTORY OF AGENCIES AND ASSOCIATIONS

AGENCIES INVOLVED IN AQUACULTURE:

The organizations that follow can provide a wide range of valuable information and services, from addressing specific topic areas to accessing general information. These organizations are actively involved in aquaculture endeavors. It is strongly recommended that you maintain regular contact and request to be added to their mailing lists.

Robert H. Miller
Director
Rhode Island Cooperative Extension
Woodward Hall
University of Rhode Island
Kingston, RI 02881
(401) 792-2474 Fax (401) 792-4017

Scott W. Nixon
Director
Rhode Island Sea Grant
University of Rhode Island Bay Campus
Narragansett, RI 02882-1197
(401) 792-6800 Fax (401) 789-8340

Ralph Boragine
Director
Rhode Island Seafood Council
212 Main St.
Wakefield, RI 02879
(401) 783-4200 Fax (401) 789-9727
The Rhode Island Seafood Council does not directly market aquaculture products, but can be helpful to you in developing a marketing strategy.

Interstate Shellfish Sanitation Conference
Water Quality Program
2500 Broening Highway
Baltimore, MD 21224
(410) 631-3902 Fax (410) 633-0456
The ISSC publishes information on sanitation regulations for culture and handling of seafood products. Their annual meetings are the basis for recommended shellfish sanitation procedures adopted by the NSSP program of the U.S. Food and Drug Administration.

Shellfish Sanitation Branch
Center for Food Safety and Applied Nutrition
Food and Drug Administration
200 C St. S.W. (HFF-513)
Washington, D.C. 20204
(202) 254-3971 Fax (202) 254-3982

Gary Jensen

National Program Leader-Aquaculture

USDA Extension Service-Aquaculture

U.S. Department of Agriculture

Room 3863 South Building

Washington, D.C. 20250

(202) 447-5468 Fax (202) 475-5289

This office is in regular contact with the Rhode Island aquaculture extension specialist.

Victor Mancebo

Director

Northeastern Regional Aquaculture Center

University of Massachusetts, Dartmouth

North Dartmouth, MA 02747

(508) 999-8157 Fax (508) 999-8590

This organization is funded by the USDA. It provides grant money for aquaculture research projects, maintains a regional aquaculture extension network, and publishes a regional newsletter.

AQUACULTURE ASSOCIATIONS:

You are encouraged to become a member of your local aquaculture association. It is also a good idea to become a member of other regional and national aquaculture associations and trade groups. These organizations publish regular newsletters that are replete with information ranging from technical innovations to market trends. Aquaculture trade associations frequently serve as an industry voice in the often-turbulent political arena. The costs of association membership are often minimal.

American Tilapia Association

4943 Cosgrove Road, S.W.

Kalona, IA 52247

Aquaculture Council

National Fisheries Institute

2000 M St. N.W.

Washington, D.C. 20036

(202) 296-5090 Fax (202) 296-3663

National Aquaculture Association

P.O. Drawer 1569

Shepardstown, WV 25443

(304) 876-6666

National Shellfisheries Association

Natural Science Division

Southampton College

Southampton, NY 11968

(516) 287-8418 Fax (516) 287-8419

Ocean State Aquaculture Association
East Farm
University of Rhode Island
Kingston, RI 02881
(401) 783-6007

Shellfish Institute of North America
National Fisheries Institute
2000 M St. N.W.
Washington, D.C. 20036
(202) 296-5170

Striped Bass Growers Association
P.O. Box 5452
Raleigh, NC 27650-5452

United States Chapter
World Aquaculture Society
143 JM Parker Coliseum
Louisiana State University
Baton Rouge, LA 70803
(504) 388-3157 Fax (504) 388-3493

U.S. Trout Farmers Association
P.O. Box 220
Harpers Ferry, WV 25425

UNIVERSITY OF RHODE ISLAND FACULTY RESOURCES

A number of URI faculty researchers work with the aquaculture industry on specific problems. Below is a list of URI faculty, their telephone numbers, and their general area of expertise.

James Anderson	792-4568	Aquaculture economics
David Bengtson	792-2372	Flounder culture
Joel Bodammer	792-2114	Finfish diseases
Terence Bradley	792-2114	Salmonid culture
Victor Cabelli	792-5914	Water quality indicators
Robert Carlson	792-2334	Finfish diseases
Pei Wen Chang	792-2477	Shellfish diseases
Stanley Cobb	792-2683	Lobster culture
Joseph DeAlteris	792-5333	Oyster culture
John Gates	792-4584	Aquaculture economics
William Gordon	792-5108	Coastal zone issues
David Nelson	792-5902	Bacterial diseases
Dennis Nixon	792-2147	Coastal zone law
Lori Pivarnik	792-2972	Seafood sanitation
Richard Pollnac	792-4140	Fisheries anthropology

Michael Rice	792-2943	Shellfish culture
Yuzuru Shimizu	792-2751	Algal toxins
Kenneth Simpson	792-2977	Aquaculture feeds
Theodore Smayda	792-6171	Toxic algal blooms
Jennifer Specker	792-2658	Fish endocrinology
Cathy Wessels	792-4569	Seafood market economics
Richard Wolke	792-2334	Finfish diseases

AQUACULTURE TRAINING PROGRAMS

A wide variety of training programs is available to individuals entering the aquaculture industry. Courses range from short workshops to undergraduate and graduate degree programs.

For availability of short courses and specialized workshops contact the aquaculture extension specialist:

Michael A. Rice
 Department of Fisheries, Animal, and Veterinary Science
 Woodward Hall
 University of Rhode Island
 Kingston, RI 02881
 (401) 792-2943 Fax (401) 792-4017

For application materials and information about the undergraduate (B.S.) degree program in aquaculture at URI, contact the undergraduate enrollment coordinator at the College of Resource Development:

Deborah Carroll
 College of Resource Development
 Woodward Hall
 University of Rhode Island
 Kingston, RI 02881
 (401) 792-4507 Fax (401) 792-4017

For application materials for graduate (M.S. and Ph.D.) programs in aquaculture, contact the graduate enrollment coordinator:

Richard C. Rhodes III
 Department of Fisheries, Animal, and Veterinary Science
 Woodward Hall
 University of Rhode Island
 Kingston, RI 02881
 (401) 792-4184 Fax (401) 792-4017