An Aquaculture Development Strategy for the State of Maine

Executive Summary
March 1990

MAINE • COASTAL ZONE MANAGEMENT PROGRAM

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Foreword

The Maine State Planning Office and the Department of Marine Resources commissioned this report to assess the economic potential of aquaculture in Maine and to devise a public policy strategy that will support the aquaculture industry in meeting its research, marketing, environmental, and technological challenges.

The timing of this study could not be more appropriate.

Highly competitive aquacultural markets are developing worldwide, influenced by the following factors:

1. Demand for wild seafood is strong and growing, yet supplies are constant or declining;
2. Many new, viable aquaculture technologies are being implemented; and
3. Canada, the world's largest exporter of seafood (especially to U.S. markets), is investing heavily in aquaculture.

Maine, located near major East Coast markets and having a natural environment well-suited to aquaculture, is preparing to enter a worldwide market. A competitive and well-structured industry in Maine, however, needs a supportive public policy. This need was documented in *Establishing the Maine Advantage: An Economic Development Strategy for the State of Maine*, a report commissioned in 1987 by Governor John R. McKernan, Jr. The report stated that aquaculture has strong economic potential if a series of obstacles can be overcome. These obstacles include "...the lack of a coordinated research and development program that can support the aquaculture industry, a questionable investment climate, and an inadequate marketing and distribution system."

In October 1988, the State Planning Office and the Department of Marine Resources, with funding from the U.S. Economic Development Administration, convened an Aquaculture Development Committee that included state agency, university, and industry representatives (see list of members on inside back cover). The Committee's mandate was two-fold: (1) to identify critical production issues that constrain the growth of Maine's shellfish and finfish aquaculture industry; and (2) to devise a strategy for overcoming production impediments. This document summarizes the Committee's findings.

Feeding time at a small salmon farm.

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Impediments to Aquaculture Development in Maine

Inaccessibility of information essential to aquaculture development (e.g., production technology). Such information is often not publicly available or is costly and time-consuming to obtain.

Lack of a lead state agency to coordinate effective action in supporting the industry.

Insufficient state services to the industry, such as programs for training, inspection, and grading.

Lack of coordinated aquaculture research and development among federal, state, and university research organizations.

Lack of public understanding that the aquaculture industry, as well as the traditional fishery, depends on good environmental quality in Maine's coastal waters.

Lack of adequate organized market institutions for sale of cultured seafood.

A dragger unloading cultured mussels.

Young salmon transferred from fresh to salt water.

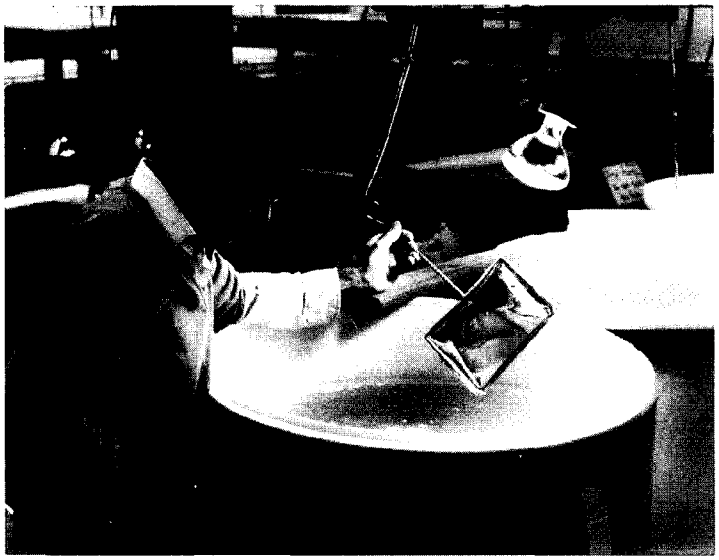
Seven Elements of an Aquaculture Strategy for Maine

1 Develop and disseminate information about aquaculture.

2 Cultivate a positive investment climate for small entrepreneurs.

3 Designate a lead state agency to support development of aquaculture.

4 Ensure consistency and predictability in the regulatory process.



Research with hatchery lobsters.

5 Pursue a coordinated development strategy encompassing aquaculture and traditional fisheries.

6 Protect, preserve, and enhance coastal water quality.

7 Develop a comprehensive plan for use of coastal waters.

Introduction

Maine's fishing industry is undergoing dramatic change. Pressures on traditional fisheries are mounting. Concerns about overharvesting rise, at the same time that demand for seafood increases. Can aquaculture help fishermen meet this demand? Can the State help sustain small-scale fishing operations by making it easier for them to supplement traditional harvesting with aquaculture?

Cleaning oyster aquaculture equipment.

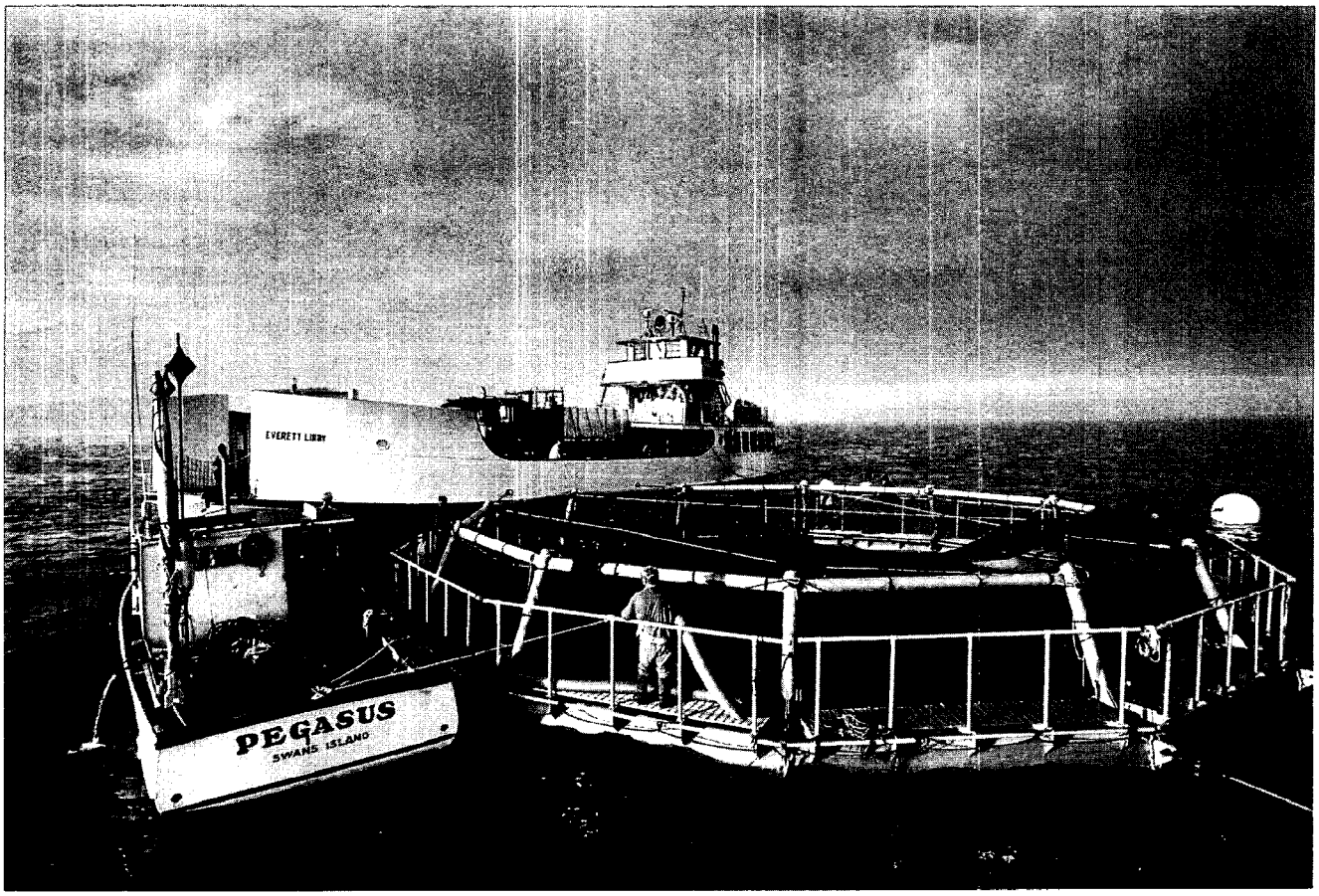
Why aquaculture?

Aquaculture has the potential to enhance Maine's fishing industry. Its economic potential far exceeds the current value of the state's traditional fisheries. Its biological potential is great: the industry so far is using only a few of the numerous possible sites and species. Even a small area can produce a highly valuable crop: for example, if 100 acres are seeded with oysters, approximately $3.5 million can be harvested each year.

By helping support the fishing industry, aquaculture can benefit coastal communities. Compared to traditional fisheries, aquaculture provides stable income and employment, yet is less physically taxing and dangerous. It can be pursued on a small scale to supplement other sources of income. It is easily and economically pursued in remote areas that offer few other opportunities. For example, it can substantially bolster the often fragile economic base of the state's island communities.

The benefits of aquaculture extend beyond the coast, as it enhances related industries, such as suppliers of feed, cages, and nets; seafood processors; fish markets; service providers; restaurants; and tourism industries. Seafood consumers also benefit, as aquaculture consistently provides high-quality seafood. Through the research needed to develop the industry, aquaculture also

Workers use a large hose to discharge the first 10,000 young salmon from a ferry into this floating pen near Swan's Island. In a cooperative venture, Mariculture Products leases the 18-acre site, and the local Fishermen's Coop provides support services such as fish handling, ice, and feed storage.

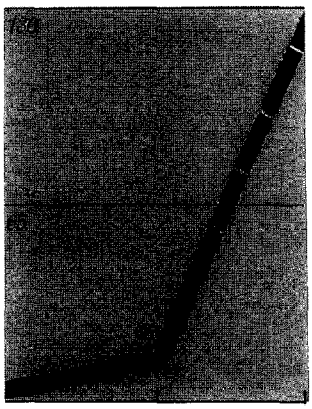


provides a greater understanding of the capacity and ecology of the sea, information we need to conserve our ocean resources. Encouraging aquaculture is an investment in Maine's future, as well as its present.

Given the spectrum of potential benefits that aquaculture offers for Maine, it is appropriate for the State to take a lead in facilitating its development. Aquaculture can be a strong component of a state economic development strategy that provides jobs and entrepreneurial opportunities to coastal areas often subject to high unemployment and low-paying, seasonal work.

Growth in Maine Aquaculture Production

value of aquacultural products (in million $)



1979 1989 1999 (projected)

Aquaculture Facts

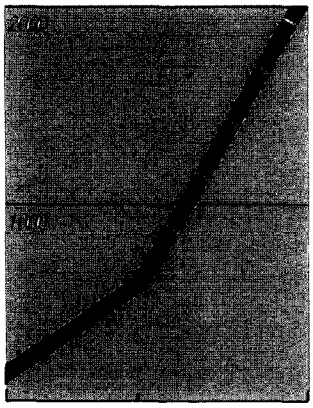
Aquaculture is the controlled cultivation and harvest of aquatic animals and plants. **Mariculture** is the raising of such crops in the sea.

U.S. aquaculture

- Per capita U.S. consumption of seafood increased nearly 25 percent between 1980 and 1987.
- Since 1980, over 16 states have begun developing their aquaculture industries. Their successes, and those of Canada, provide valuable experiences on which Maine's industry can draw.
- Major species currently raised in both inland and ocean sites include catfish, crawfish, salmon, trout, baitfish, and oysters.

Growth in U.S. Aquaculture Production

millions of pounds



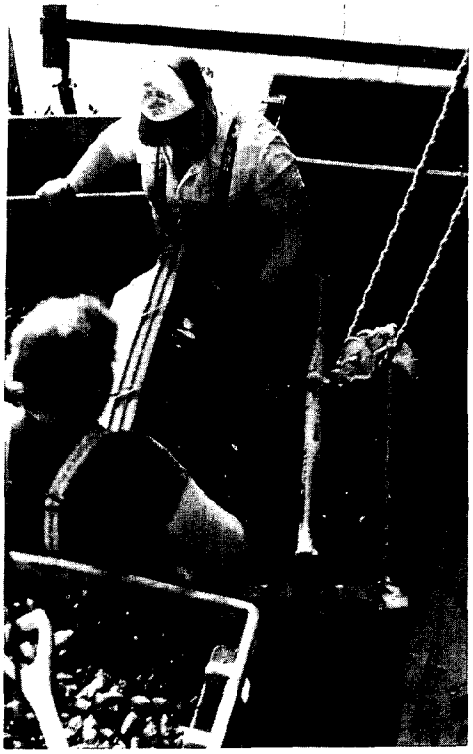
1975 1986 2000 (estimate)

Aquaculture in Maine

- Major species cultivated in Maine are Atlantic salmon, mussels, and oysters. Other species with aquaculture potential include trout, clams, scallops, and lobsters.
- The number of leased salmon-rearing sites in Maine has grown from zero to 36 in the last three years.
- There are currently 68 leases for all species located along Maine's coast, with nearly half east of Bar Harbor. Other clusters occur near Damariscotta, Bristol, the Blue Hill and Bar Harbor peninsulas, and from Freeport to Kittery.
- In 2,000 square miles of Maine's coastal waters, a total of only 2 square miles is currently leased or under application for aquaculture. The average salmon operation covers 2.5 acres.

Methods used in Maine for raising seafood depend on the species:

- Salmon and trout are grown in large, moored pens of netting and are fed daily.
- Mussels are raised in suspended mesh tubes, on suspended ropes, or on the ocean bottom.
- Oysters and clams are cultivated in floating trays of screen and on the sea bottom.

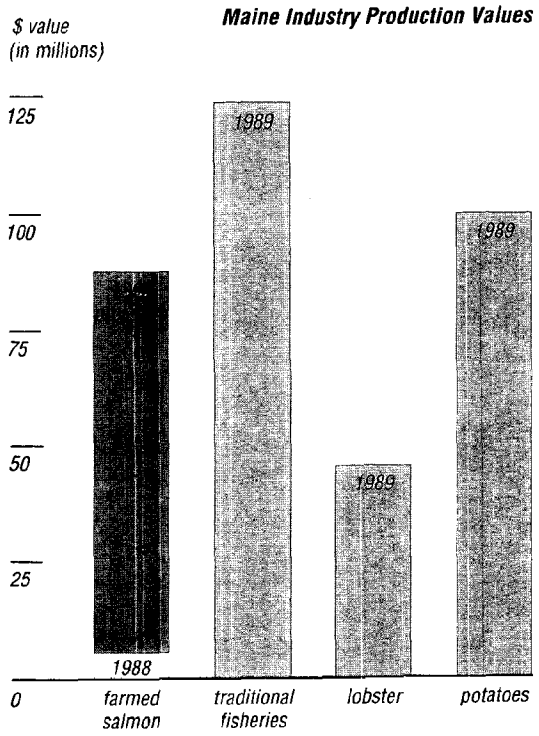


Mussels grown in bottom culture are off-loaded in bulk from a boat. Great Eastern Mussel Farms has been culturing mussels since 1978, and now has 30 employees. The company holds cooperative leases with traditional fishermen in Washington and Hancock Counties.

Aquaculture—a growing industry

Aquaculture in Maine has undergone rapid growth in the last decade. In 1979, cultured seafood products were valued at $450,000. The estimated value of current production is over $11 million—a 24-fold increase over 10 years. Projections for the next decade include a value equal to—or exceeding—current landings for the traditional fishery of $124 million. For example, the projected value in 1992 of farmed Atlantic salmon alone is $88 million. By comparison, lobster is currently valued at $46 million and the potato industry at about $100 million annually.

Maine's aquaculture industry currently employs approximately 55 managers, 300 full-time employees and approximately 80 part-time workers. Including spin-offs, the industry is responsible for 1,100 to 1,200 full-time equivalent jobs.



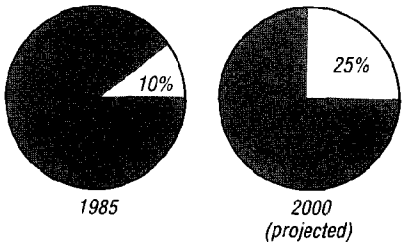
Strong relationship with traditional fisheries

Often aquaculture is mistakenly seen as separate from traditional fisheries or a threat to their existence. In fact, the two industries can have a strong and mutually beneficial relationship. Both traditional fisheries and aquaculture use the same human resources and shoreside infrastructure. Aquaculture companies need the water-related skills of traditional fishery workers, such as boat handling, net rigging, and product handling. In addition, Maine's aquaculture operations use existing traditional fishery services, such as wholesalers, processors, packagers, and transporters. In some cases, work in the wild fishery and in the cultured fishery are complementary. Lobstering in the wild and culturing of mussels form

a single employment opportunity, because they use similar equipment and fishing skills while peaking at different times of year.

Like traditional fisheries, aquaculture depends on clean water for survival, and is therefore compatible with environmental protection. Lastly, aquaculture jobs in Maine's rural coastal areas help communities maintain their quality of life and strengthen access to waterfront areas. The opportunity for Maine is not solely one of developing aquaculture, but of initiating a comprehensive program for conservation, development, and sound stewardship of all our ocean resources.

Aquaculture as Percent of Total World Seafood Landings



Economic/locational trends favoring Maine aquaculture

The capabilities of Maine's fishing industry, advantages in natural environment and proximity to markets, and economic trends combine to make aquaculture a potentially substantial contributor to Maine's economy. These trends include:

- Steadily growing domestic—and world—market demand for high-quality seafood;
- Growing requirements of the seafood market for predictable supplies and consistent product quality;
- Level or declining supplies of wild fisheries products;
- Growing consumer concern about the healthfulness of wild seafood products;
- Advances in biotechnology needed for aquaculture production (e.g., genetic engineering techniques for faster-growing fish and shellfish); and
- The natural environment of the Maine coast, which offers protected bays, high rates of tidal flushing, and good water quality.

These trends are important because, although Maine is well-situated near the large metropolitan markets of the East Coast, aquaculture is developing rapidly elsewhere, creating a highly competitive environment.

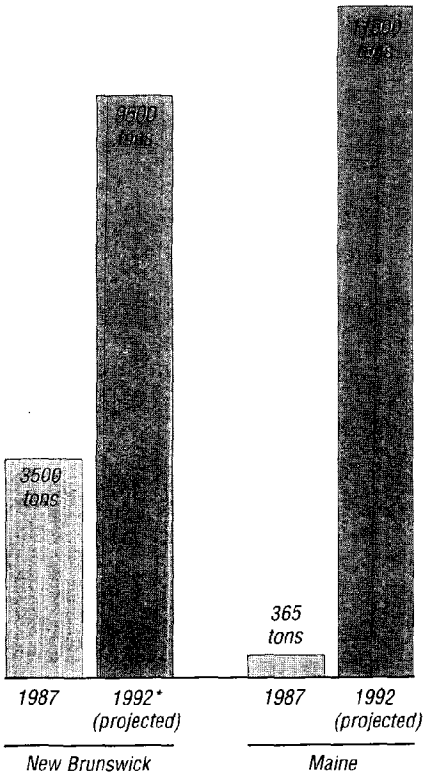
A dynamic world marketplace

The ability to capitalize on Maine's fishery assets will be the key to competing in a dynamic world marketplace. Worldwide aquaculture production reached nearly 24 billion pounds (over 10.6 million metric tons) in 1985, more than 10 percent of the world's total landings of fish and shellfish. By the year 2000, aquaculture will be responsible for 25 percent of total fisheries landings, according to predictions by the United Nations Food and Agricultural Organization (FAO).

The U.S. Department of Commerce estimates current total U.S. production from aquaculture to be 620 million pounds (281,160 metric tons). This figure accounts for only about 2.5 percent of total world aquaculture production, and about 11 percent of the total production of edible fish and shellfish in the U.S. The National Academy of Sciences projects that domestic production will reach 2 billion pounds by the year 2000, triple the level of current production.

Current total U.S. production from aquaculture is about 11 percent of the total production of edible U.S. fish and shellfish.

Farmed Atlantic Salmon



**Source: Economic Assessment of Salmonid Cage Culture Industry in Southwestern New Brunswick,Fiander-Good Assoc. Ltd., for Government of New Brunswick & Canada Dept. of Fisheries and Oceans. March 1988.*

Within the Gulf of Maine region, the province of New Brunswick produces 10 times more farmed Atlantic salmon than Maine, despite sharing similar growing conditions and starting in the industry at the same time. New Brunswick benefits from educational and training programs; coordinated research on the federal and provincial levels; and a planning and administrative capacity that includes a coordinated permitting system, lending predictability to public policy and industry development. Aquaculture development in Canada strengthens that country's already formidable fishing industry. Canada is the world's largest exporter of seafood, 80 percent of which goes to U.S. markets, mostly in the northeast.

State public policy needed to encourage diversity in industry

While Maine's industry appears to be doing well without specific public policy guidance, a broader issue is at stake as the industry grows: what type of industry will characterize aquaculture in the state? A consistent State response is necessary to ensure both good water quality and access to the industry for individuals and small businesses (e.g., traditional fishermen).

State policy must recognize that protecting and improving coastal water quality is extremely important to the economic success of aquaculture (as well as traditional fisheries). Even minor pollution incidents have dramatic negative impacts on consumer confidence and demand.

Furthermore, if the industry continues to develop in the current regulatory and economic climate, large firms can be expected to dominate the industry. As the State recently experienced with the poultry industry, this concentration of jobs and resources could render the industry vulnerable.

The number of aquatic and marine species that might be cultured in Maine waters is large and diverse. Adding in the varied talents and entrepreneurial skills of participants in traditional fisheries, this diversity can contribute to a broadly-based aquaculture economy that does not depend on any single narrow market or limited number of large firms.

Another industry access issue relates to regulation. Under the current regulatory procedures, a new firm entering the industry is faced with significant up-front costs. These costs create a strong, artificial bias against small firms, including members of the traditional industry who seek to diversify their operations. The State needs to develop a consistent and predictable regulatory policy, and coordinate activities with federal agencies that have overlapping jurisdictions.

New information: appropriate role for public policy

The State strategy to enhance diversity in the industry must include efforts to generate and publicize information about aquaculture production, marketing, and environmental criteria.

Aquaculture is an information-intensive industry. Acquisition and application of new knowledge specific to Maine aquacultural conditions is vital. Although aquaculture has been practiced around the world for centuries, the specific

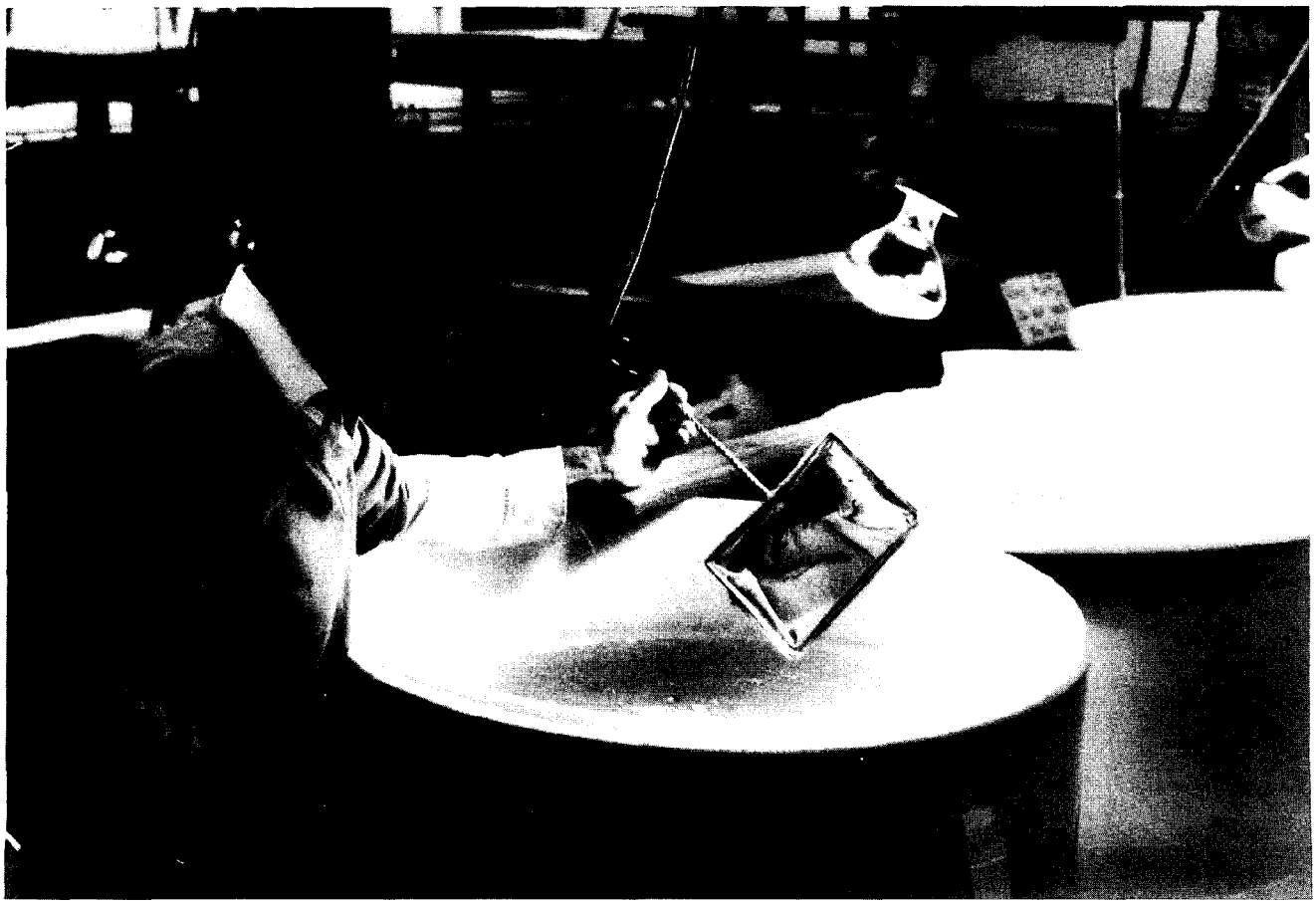
economic, biological, and environmental characteristics of the Maine coast require careful adaptation of species; experimentation with differences in water temperatures, currents, and other variables; and locating biologically viable sites. Appropriate gear and other mechanical devices need to be developed and/or adapted; market preferences and channels must be learned; and, of course, this information must be shared among potential users.

A State public policy that nurtures the development and transfer of information is an appropriate public expenditure for several reasons.

First, the inability to put a proprietary stamp on much new information makes its development uneconomical for the individual. Knowledge about viable seafood species, kinds of locations, gear, and techniques, once employed, is difficult information to keep confidential. Public development of this information is, therefore, a necessity.

Second, creating new information may reduce other impediments to development, such as financing. In order to issue loans, for example, bankers require some sense of the technological and economic feasibility of proposed aquaculture ventures. Readily available information about technology, production costs, and market conditions significantly improves the lending climate. Numerous other examples with regard to regulation, pollution, entry of new ventures, management of firms and more can be alleviated by public availability of new information.

Dr. Herb Hidu researches ways to adapt shellfish hatchery techniques to culturing American lobsters. This tank at the University of Maine's Darling Marine Center aquaculture facility holds 10,000 larval lobsters.



Lines of buoys support oyster trays in the Damariscotta River at Dodge Cove Marine Farms. In June, floating trays of window screen are filled with hatchery-grown seed oysters. Feeding on plankton, the oysters grow from 3mm to 40mm in diameter. In late September, they are removed and planted on leased sea-bottom beds to grow to full size. This facility uses from 120 to 300 trays and extends over two to three acres.

Third, new information will be required to adequately protect the environment (which, as mentioned earlier, is the cornerstone of any fisheries policy). While aquaculture depends upon a clean environment, it is a potential source of pollution. The State's current attempt to assure that the marine environment is not unreasonably affected when granting aquaculture leases can be strengthened with an improved informational base.

In summary, it is essential that the State develop a consistent administrative response to the industry, create a thorough information base, and designate a lead agency for the purpose of supporting a coherent aquaculture policy.

Impediments to aquaculture development in Maine

For Maine to move forward with aquaculture development and implementation, the State will need to examine and alleviate specific problems hindering progress in the industry. The most significant issues that the State can address are as follows.

1. **Information essential to aquaculture development** (e.g., production technology) is often **not publicly available**, or is costly and time-consuming to obtain. This tends to:
   - create significant up-front costs for new entrepreneurs;
   - handicap small firms that cannot afford up-front learning costs;
   - limit opportunities for small-scale incremental investment traditionally pursued in the fishing industry;
   - increase costs of operation for existing firms; and
   - create uncertainty among banks and others in the investment community.
2. **Lack of a lead state agency** severely impairs aquaculture development in several respects. The absence of interagency coordination:
   - reduces predictability and raises the expense of permitting application procedures;
   - reduces the provision of technical and financial assistance;
   - retards the development of research; and
   - limits the ability to interrelate development of aquaculture and fisheries.
3. **The State does not provide crucial services** such as:
   - marine toxic monitoring programs (essential for public health and market confidence in seafood) that test for several plankton-based toxins, as well as red tide;
   - rapid and inexpensive services for disease diagnosis and control, and health certification for fish and shellfish;
   - inspection and grading of seafood products (essential for consumer confidence and broadening marketing capabilities);

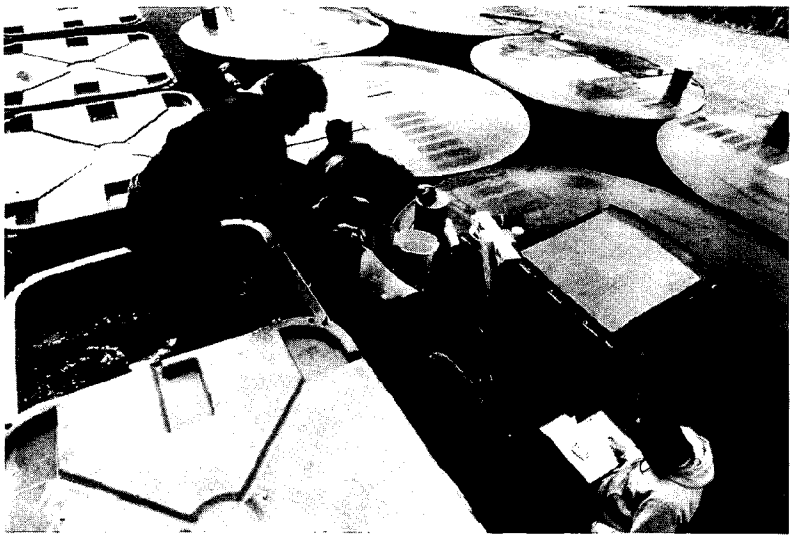
- effective policing of lease boundaries (an important incentive for investing in leases);
- maintenance of basic statistics on industry production, employment, and growth (important for making both private financial and public policy decisions); and
- training programs at the university and technical college levels (which can raise the quality of the labor force and the number of potential entrepreneurs).

4. There is a **lack of coordinated research and development** among federal, state, and university research organizations. This creates:
   - gaps in technical expertise in a variety of areas, such as physiology, genetics, microbiology, oceanography, and biotechnology;
   - a long-term climate in which Maine's producers are continually at a technological disadvantage relative to their competitors;
   - a high-risk investment climate, especially in the culture of new species and adaptation of new cultivation techniques; and
   - reduced production efficiency, especially in the early stages of the industry.
5. There is a **lack of public understanding that the aquaculture industry**, as well as the traditional fishery, **depends on good environmental quality** in Maine's coastal waters. The State must work to:
   - strengthen the ability of state agencies to sample and classify waters adequately, according to the National Shellfish Sanitation Program;
   - address threats from bacterial and toxic pollution, including non-point source pollution, cumulative effects of coastal development, and eutrophication of Maine's coastal bays; and
   - address the impact of aquaculture operations on the marine environment, including assessing site capacities for both cultured and wild fisheries.
6. Unlike in traditional fisheries, **few organized market institutions exist** for sale of cultured seafood. This tends to create:
   - very high marketing costs for all firms, regardless of size;
   - increased risk for all firms, especially at times when production constraints require the unexpected sale of product;
   - an often-disadvantageous selling position, even when market demand is strong; and
   - a strong bias against small firms, which are most affected by high fixed costs for marketing.

Atlantic salmon are processed at an Ocean Products facility in Washington County. At the large end of Maine's aquaculture spectrum, Ocean Products is the top salmon farm in the country, producing around two million pounds a year.

A Strategy for Developing Aquaculture in Maine

To generate economic opportunity, income, and employment, the State must adopt a strategy that emphasizes seven elements. State involvement will be essential in developing and disseminating aquaculture information; cultivating a positive investment climate; designating a lead state agency; ensuring consistent regulation; coordinating aquaculture and traditional fisheries; preserving coastal water quality; and planning use of coastal waters.



A researcher evaluates virus growth in fish cells in the Aquatic Animal Health Laboratory at the University of Maine, Orono.

1 Develop and disseminate information about aquaculture.

Aquaculture is a relatively new industry in Maine. To develop its potential and—once developed—to maintain a competitive position in domestic and international markets, the State must generate and disseminate sufficient information about the field. It should designate public and private institutions that can (1) adapt information acquired elsewhere about aquaculture, (2) develop new information, and (3) disseminate this material to potential users.

To fully pursue a new information strategy, the State must create and fund a set of institutions similar to those used successfully in American agriculture:

- **A strong university/ technical college/ industry/ government capability in basic research and applied development** should be supported, both for adopting new technology developed elsewhere, and developing and testing new technology within the state. The State and University must be committed to defining the forefront of biological sciences as they apply to aquaculture.
- **An active university/ technical college/ industry program for determining research requirements and disseminating new information** should be encouraged, as follows:
  - *Extension services* similar to those used in agriculture should be provided, but with an important modification. Instead of using extension agents as intermediaries between researchers and the industry, researchers (even basic researchers) and industry experts need to be brought into direct and frequent contact.

    As was done successfully in Canada, a *seminar series* should be initiated to bring world aquaculture experts to Maine to provide technology transfer in such areas as fish husbandry, disease control, environmental criteria for cultured species, seaweed culture, and animal nutrition.
  - The *University* should work to secure funding to fully implement its new undergraduate and graduate aquaculture curriculum. Earlier University programs in shellfish culturing created the first generation of aquaculture entrepreneurs in the State; expanding these programs to finfish and support services can be expected to further benefit the industry.
  - *Short courses*, tailored to the requirements of aquacultural entrepreneurs starting small-scale operations, should be developed and offered by the University and/or technical colleges. Currently such a program, which may serve as a model effort, has been initiated by the Marine Trades Center at the Washington County Technical College, in conjunction with Sea Grant, Cooperative Extension, the Job Opportunity Zone program, and the industry.
  - The *technical colleges* should implement a course of study for aquaculture workers and technicians. The program planned at Washington County Technical College should be supported.
- The **Maine Aquaculture Innovation Center** (MAIC), a joint research effort of the Maine Aquaculture Association and Maine Agricultural Experiment Station, should function as a coordinating forum for the research, teaching, and extension interests of the State, University, technical colleges, and industry.

Any research and development tasks should aim to fill information gaps about efficient production of aquacultured species through all life history stages and about effects of aquaculture on the environment. Important elements of the strategy should include:

- Integration of aquaculture training with industry **internships**.
- Development of **demonstration farms** in finfish and shellfish. Demonstration farms are an important and effective way to transmit new technology to small entrepreneurs. They are also a very economical way to provide training and test new strains of cultured species. The Darling Center and the Washington County Technical College are logical institutions at which to develop demonstration farms.
- **Coordination** among all state institutions, as well as private research and higher education institutions, that have expertise in aquaculture and supporting programs (e.g., business, engineering, oceanography, fisheries, genetics, and microbiology).

2 Cultivate a positive investment climate for small entrepreneurs.

Small individual entrepreneurs and family-owned firms, especially those in traditional fisheries, depend on an investment process that permits them to acquire new technology, experience, and capital in small increments. This allows the small entrepreneur to gain experience, reduce risk, prove new technology, and establish a track record without large up-front costs. For this kind of investment to succeed, information about technology and marketing must be readily accessible, and regulations must not require a large initial investment. The traditional fishing industry is a source of exceptional, proven entrepreneurial talent. This valuable resource can only be mobilized if the State creates a favorable investment and market climate for small aquaculture business by taking the following actions:

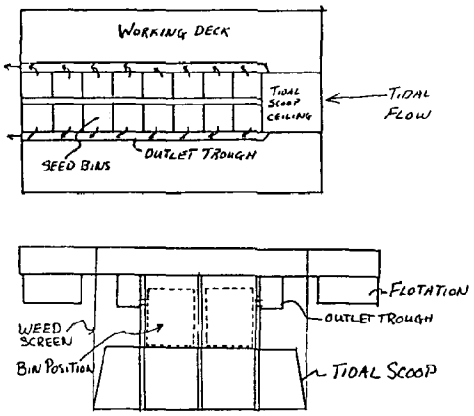
Three thousand salmon are raised in a floating pen at Allen's Island in Muscongus Bay. Local fishermen, a private landowner, and the Island Institute are cooperating in a research and experimental project to demonstrate a small aquaculture operation. The offshore site's waters are protected enough for fish to survive winter "superchill."

- Minimize the *initial* (not final) regulatory requirements faced by small operations. The current permitting approach should be supplemented with an alternative small-scale, general **experimental permit**. The basic guidelines of this permit should include:
  - *minimal requirements* (e.g., siting should not interfere with navigation);
  - *small size* (1/10 acre for nets and pens; 1/2 acre for bottom culture);
  - *limited duration* (3-4 years);
  - a requirement that during the experimental period, the leaseholder gather and make public the site-specific *environmental data* necessary for meeting full regulatory requirements; and
  - the *short courses and other services* previously outlined should be tied in some explicit way to the experimental permitting process, to increase the likelihood of both regulatory and eventual economic viability.
- Use the experimental lease approach just described to improve the regulatory **assessment of environmental impact**. Under the State's current procedures,

an assessment of environmental impact must be made before any practical experience with a site is acquired. This is not optimal given that conditions from site to site may vary. Consequently, an experimental period during which site-specific data could be gathered would be beneficial from an environmental, as well as economic, perspective.

- Support the Finance Authority of Maine's efforts to encourage Legislative funding of the **Natural Resources Capital Investment Fund**, a revolving loan fund that would provide necessary financing for piers, pens, nets, work platforms, and related equipment.
- Take steps to **minimize the costs, time, and uncertainty** that Maine firms face in marketing aquaculture products. The State's policy should be to establish organized market mechanisms capable of providing Maine firms with flexibility in their marketing approach. Given the large number of species that may be cultured in the future, the highly varied nature of sales contracts and conditions, and the rapid change that characterizes the seafood market, Maine firms need to be in a position where they can readily locate new buyers and arrange (or rearrange) their contracts. The State can facilitate this flexible structure by pursuing the following.
  - Continue joint development by the industry and State of *grading and inspection standards*. Such standards assure public health and describe product quality for efficient and flexible marketing.
  - Establish an *electronic clearinghouse* or other appropriate public market mechanism. Any mechanism of this sort should be tied to the existing Portland Fish Exchange (currently used for wild seafood). Sellers of cultured (or, when appropriate, wild) seafood should be given access to what might be termed a "near futures market," in which they can arrange contracts to deliver a product at some specified future date. Such a market would provide greater certainty for sellers and buyers, create low-cost access to a national network of brokers and wholesalers, and generate better prices for sellers.

    However, it is important to note that the electronic trading of seafood (either cultured or wild) can only succeed if quality descriptors for the product are well-established and provide the basis for third-party arbitration of disagreements between buyers and sellers.
  - Assist the aquaculture industry and the Portland Fish Exchange in developing other specific *opportunities for marketing* cultured products.
  - Assist the industry in establishing a *marketing cooperative*.
  - Extend the *"Certified Maine Seafood" program* (the Department of Marine Resources' voluntary quality inspection) from wild seafood to cultured products (e.g., mussels and salmon) that meet the same standards.



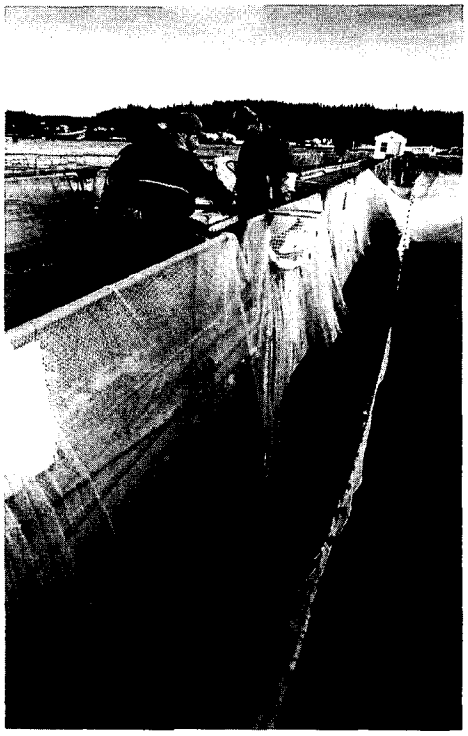
A locally-designed tidal-powered upwelling nursery for growing shellfish. Very small hatchery oysters, clams or scallops are placed in the floating, moored pen to grow to an intermediate stage. The pen requires a minimum one-knot current to function.

3 Designate a lead state agency to support development of aquaculture.

If Maine is to develop a progressive aquaculture policy, the State must designate a lead agency to be responsible for organizing and disseminating information about the industry.

The Department of Marine Resources (DMR) is the most appropriate state agency to assume lead status. The DMR is the only agency in the state with sufficient fisheries experience and understanding of the issues involved in aquaculture development. The agency is also experienced in balancing the competing demands of fostering industry development and enforcing regulations.

Key responsibilities for DMR would be to administer permits; collect statistics; disseminate information about the industry; and provide a state link with the United States Department of Agriculture (USDA), the lead federal agency for U.S. aquaculture development. In addition, DMR services should be expanded in pathology and health certification for imported and exported fish and shellfish.



Salmon are harvested when they reach three years old, at this pen complex off Eastport. Ocean Products began raising salmon in 1982, and now has over 125 employees.

4 Ensure consistency and predictability in the regulatory process.

Aquaculture is a business with many inherent risks. Variables affecting operations include weather conditions; diseases; changing markets; and, of course, the availability of financing. To meet the demands of aquaculture entrepreneurship, growers and lenders must have confidence in time-frames and costs for business development. Uncertainty impedes small and large firms alike, and limits their ability to finance aquaculture ventures.

In most cases, it is not regulation itself that hinders aquaculture. Rather, it is the time required to obtain permits; uncertainty about the roles of regulatory agencies; and inadequate information about which regulations apply in specific situations. Maine's aquaculture industry cannot effectively plan for the future if the current variations in permitting schedules and cost continues.

The present regulatory approach also creates uncertainty for the State regarding eventual environmental impacts of each aquaculture site. Current procedures require a forecast of environmental impacts, but do not provide the basis for collecting site-specific data necessary for a reliable forecast. Given that the marine environment is complex and subject to continual change, good environmental forecasts depend on a multi-year history of data from a particular site.

The State could help assemble better general and site-specific data by building upon interagency discussions currently underway (at both the state and federal level). The goals of the discussions should be to:

- Minimize state and federal agency **redundancy in water-quality requirements and permitting activities**.
- Review **current statutes** to identify and—where appropriate—eliminate provisions that either do not apply to the industry or deter its development.
- Establish a **"one-stop shopping" format** for lease applicants in which the lead agency would develop a single application and coordinate the involvement of other agencies. The lead agency would also offer technical assistance in

answering permitting questions; publish a guidebook on aquaculture regulation in Maine; and hold annual workshops in different locations to educate lease holders and lease applicants about technical information (e.g., changes in law, general permitting guidelines, and specific agency regulations).

- Increase **deterrents** to violating aquaculture leases. Currently, fines assessed by the court system are often $50 for a first offense, even if thousands of dollars of production are at risk. The penalty assessed should be increased, and should include loss of shellfish license and restitution for the dollar value of the stolen product. In addition, the DMR needs to take a more active role in marking lease boundaries (perhaps by flagging) to give the industry a greater presence on the water. A lack of lease protection, or even the perception that leases are inadequately protected, serves as a disincentive to aquaculture investment.
- Streamline **federal permitting procedures**, as this appears to be the most significant regulatory issue affecting the industry.

5 Pursue a coordinated development strategy encompassing aquaculture and traditional fisheries.

Aquaculture can become an important economic opportunity for Maine citizens currently engaged in traditional fisheries.

Aquaculture and traditional fisheries share many of the same markets, resources, suppliers, and labor skills. Most importantly, aquaculture can become an important economic opportunity for Maine citizens currently engaged in traditional fisheries. From the State's perspective, their entrepreneurial abilities and water-related skills should be viewed as valuable human resources that provide an important component in developing aquaculture. Consequently, the development of aquaculture and traditional fisheries should be closely coordinated.

- The DMR should continue to **extend its marketing programs to aquaculture products.**
- **The electronic exchange, grading, and inspection programs should be extended to cultured fisheries products**.
- **People currently engaged in traditional fisheries should be viewed as the principal audience for the University and technical college programs** previously mentioned. Those programs should be based on the premise that aquaculture and traditional fisheries are a single, integrated industry.

6 Protect, preserve, and enhance coastal water quality.

Clean water is essential for the health of the aquaculture industry. However, the state's marine and coastal waters are threatened by growing pollution from overboard discharges, industrial wastes, failing septic systems, inadequate municipal sewers, combined sewer overflows, and non-point sources. Pollution poses the greatest threat to shellfish, since filter feeders tend to accumulate bacteria, viruses, heavy metals, and hydrocarbons. The State must act to assess the status of our coastal waters and sediments, and to determine trends over time.

- Full support of the Department of Environmental Protection (DEP) and the DMR's **Marine Environmental Monitoring Program** is needed to assess the extent, effects, trends, and sources of pollution in Maine's coastal waters. The State should consider funding of $100,000 per year for DEP to monitor status and trends at 30 sites coast-wide.
- DMR's monitoring programs for **paralytic shellfish poisoning (red tide) and other toxins** needs to be expanded.
- For the DEP and DMR to determine environmental impacts and seafood-growing capacities for pen culture sites, $120,000 is needed for a **baseline study** involving bottom sampling of invertebrates; hydrographic studies; sediment studies; literature review; and field work/diving.
- Maine should cooperate with the Environmental Protection Agency to initiate **watershed management programs**.

7 Develop a comprehensive plan for use of coastal waters.

As aquaculture increases in Maine and becomes a more integral part of our food-producing industry, issues will intensify concerning:

- **Water quality** (the importance of clean water for the industry, as well as environmental impacts of the industry); and
- **Suitable sites** for growing operations in a coastal environment characterized by competing uses (such as marina development, traditional fishery areas, and views from private shorefront property).

If we are to sustain our coastal resources and develop them in a balanced, rational manner in the years ahead, the State needs to develop criteria for allocating scarce resources among competing uses. Aquaculture, previously an uncommon use of Maine's coastal areas, will need greater attention as it takes its place among many uses of our coastal resources.

A mussel-dragger brings in a harvest of bottom-cultured shellfish off Vinalhaven Island. Joe Upton is a good example of fishermen who have diversified by adding aquaculture to their operations.

Conclusion

Maine's aquaculture development strategy as proposed here will help further the goals of coastal legislation enacted in 1986 with overwhelming public support. That law (P.L. 794) established nine policies to guide future decisions affecting coastal resources.

The proposed aquaculture production strategy addresses several of these coastal policies:

- **Support for maritime uses**—The coastal policies recognize the economic and cultural importance of Maine's marine industries. The aquaculture development strategy reinforces these industries and demonstrates the symbiotic relationship between traditional fisheries and aquaculture. Although the two types of fisheries are often pursued separately, they are complementary (as demonstrated by the growing numbers of people involved in both wild and cultured fisheries).
- **Shore management and access**—Marine uses must be assured of adequate waterfront facilities in the face of competing residential and commercial development. While many municipalities support marine uses along waterfronts through zoning, the State needs to offer economic incentives for marine industries to expand. The aquaculture development strategy outlines specific activities that will ensure continued shoreline access for marine users.
- **Marine water quality**—Another policy supports sustained and improved marine water quality, in part because clean water is essential to Maine's fishing industry. The aquaculture strategy recommends increased monitoring of marine waters and recognizes that aquaculture can be pursued without jeopardizing water quality.
- **Coastal heritage and economy**—Both the coastal policies and this strategy call for economic development activities that are compatible with our coastal heritage. Unlike many of the large economic development projects that were proposed for coastal Maine in the early 1970s (e.g., oil refineries and aluminum smelters), aquaculture can build on the existing skills and traditions of coastal residents.

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Copies of the full Aquaculture Development Strategy report can be obtained from the Maine Coastal Program, State Planning Office, Station 38, Augusta, ME 04333. 207/289-3261.

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