MARICULTURE TECHNICAL CENTER
BUSINESS PLAN

PREPARED BY THE
MARICULTURE TECHNICAL CENTER
STEERING COMMITTEE

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Business Plan for the Mariculture Technical Center

The Business

The Mariculture Technical Center (MTC) is a non-profit marine research laboratory designed to support research in the field of shellfish aquaculture and studies that lead to a greater understanding of the effects of the marine environmental on shellfish biology, ecology, and commercial utilization. As a non-profit research and development facility, the NTC be operated by a board of directors charged with the mission to support aquaculture development.

Mission Statement

The mission of the Mariculture Technical Center Board of Directors is:

- To build long-term partnerships between the aquatic farming industry, researchers, and other Alaskans by fostering the exchange of information on mariculture.
- To promote and seek research and public education opportunities for individuals and organizations interested in shellfish culture in Alaska.
- To support the development of a healthy aquatic farming industry in Alaska and enhance the productivity of Alaska's marine environment.
- To consider the needs of the communities and those outside the shellfish industry in decisions pertaining to the operation of the Mariculture Technical Center.
- To manage projects efficiently and provide technical support for new studies.
- Seek research projects that will incorporate technology transfer to the Alaskan aquaculture industry as an end product of project.

Objectives

The goals of the Mariculture Technical Center operations are:

1. Develop the technology for in-state hatchery production of indigenous species of shellfish and aquatic plants for aquatic farmers and the enhancement or rehabilitation of wild populations.
2. Improve the productivity and efficiency of shellfish hatchery and nursery, and growout operations in Alaska.
3. Increase knowledge of the effects of marine environmental conditions on shellfish biology and ecology.
4. Support the availability of oyster seed at production levels and seasons meeting the needs of Alaska's aquatic farmers.
5. Support the development of an Alaskan strain of Pacific oysters specially suited for culture in northern latitudes.
6. Increase the knowledge of the effects of marine biotoxins on shellfish.

Priorities for Spending Unspent Appropriation Funds

After construction of the MTC, remaining funds left over from construction must be used to enhance the capabilities of the MTC. According to the Department of Transportation and Public Facilities $43,698 remains left from the cost of construction, but the 1% ($17,000) must be allocated to the art program top purchase art works for the facility. Another $85,000 is in an Alaska Department of Fish and Game account. After payment of the utility bills and additional travel expenses are deducted, approximately $100,000 will be available for operation of the MTC.

Following is the list developed by the MTC steering committee prioritizing use of the remaining funds.

1. Purchase basic equipment necessary in MTC research bays to facilitate projects, such as cabinetry, plumbing, sinks, fume hoods, etc.
2. Basic operational costs of the MTC.
3. Matching funds for grants for MTC programs or projects.

Species needing research and development

Littleneck clam Protothaca staminea

A native clam found in intertidal zones from Baja California to the Aleutian Islands, this species is very popular as a steamer clam. The market for steamer clams is enormous. Growers in the state of Washington, where they grow the Manila clam (*Venerupis japonica*), are expanding production to meet a demand that exceeded their current production level. The Alaska native littleneck clam, bringing a market price of $2.25 per pound, provides Alaska farmers an opportunity to enter this lucrative market.

Commercial market size for the littleneck clam is over 38 mm in shell length, which can be achieved in 5-7 years of growout time. Nursery culture may decrease the growout time. Hatchery and growout technology for the littleneck clam is in the development phase.

Pacific oyster *Crassostrea gigas*

Not native to Alaska, the Pacific oyster was first imported into Alaska in the nearly 1900s and grown on beaches. The initial industry faltered in 1968, but restarted in 1978 when oysters were cultured for the halfshell market. Pacific oysters are the most popular species being cultured in Alaska primarily because oyster seed can be purchased and imported into Alaska from hatcheries outside the state. Now grown in suspended culture rather than on beaches, farmers receive between $3.50 to $6.00 per dozen for live oysters.

The Pacific oyster matures sexually in its second year of life when eggs and sperm develop during the summer months. At the time when eggs and sperm are nearly developed, the quality of the oyster reduces significantly and it not marketable. These oysters are termed spawny. A large amount of Alaskan produced oysters do not reach sexual maturation due to the cold water temperatures. Reduced development of the eggs and sperm then enables these oysters to be marketed during the summer months. However, some farms do experience the spawny condition that can only be prevented if the farm converts production over to sterile, triploid seed. Shellfish hatcheries can produce sterile seed and

many are actively pursuing the conversion to production of sterile seed.

The current interest of Alaskan aquatic farmers is in the area of broodstock development. The best prospects for Alaska to develop an appropriate broodstock for culture in our northern latitude is to use the resources available through the U.S. Department of Agriculture Molluscan Broodstock Development Program (MBDP) in Newport, Oregon. Association of the MTC with the MBDP, as largest molluscan broodstock development program every attempted, Alaska may have access to a locally adapted oyster broodstock much sooner than if we attempted such an effort in isolation.

Cockles Clinocardium nuttallii

The cockle is a small hard shell bivalve, similar in size and slightly different habitat than the native littleneck clam. Cockles grow in wild populations throughout Alaska. The cockle is a hermaphroditic species that is unique among bivalve molluscs. This is a very popular species among the Alaska Natives. In several locations, local stocks of cockles are depleted and need enhancement in order for harvest to continue. The majority of cockle production is initially targeted for subsistence use by Alaska Native coastal villages in Prince William Sound. Technology for production of cockles needs development.

Purple Hinge Rock Scallop *Crassodoma gigantea*

The purple hinge rock scallop is a large scallop native to the state of Alaska and found attached to rocky substrate in the subtidal areas from southeastern Alaska to the Aleutian Islands. Although large natural populations of rock scallop exist in British Columbia and Alaska, a commercial fisheries to harvest wild populations in not feasible since SCUBA divers cannot easily remove the scallop from their rocky substrate.

This species is attracting a great deal of interest in recent years because it produces a large muscle meat and attempts to culture other large species of Pacific sea scallop (e.g. the giant Pacific scallop, *Patinopecten caurinus*) have failed. Commercial fishing for the larger species of sea scallop is on the eastern coast of the United States is also declining. Selling for as much as $2.50 for each scallop, Alaska and other West Coast farmers are very interested in farming rock scallop as an alternate species to sea scallop.

Geoduck clam Panopea abrupta

The geoduck clam is the largest of the clams found in the North Pacific ocean reaching over 10 inches in shell length and weighing up to 5 pounds. The average Alaska geoduck clam captured in commercial harvest is 2.4 pounds and worth, when sold live, $17.00. Alaska stocks of geoduck clams are found in southeastern Alaska to as far north as Sitka, Alaska. Alaska has a small commercial fishery for geoduck clam that harvested 319,000 pounds in 1996. The fishery is tightly controlled and not expected to expand significantly.

A popular clam for the Asian market, the geoduck clam is not currently being cultured or researched in Alaska. Bringing a market price of-$3.50 -$7.00per pound, the geoduck clam has great potential for becoming a high valued shellfish product. Hatchery and growout technology has been developed in the state of Washington. The hatchery culture technology needs to be brought to Alaska to produce geoduck seed, primarily for delivery

to farms in southeastern Alaska.

Other Species of Potential

Several other species attracted the attention of aquatic farmers or potential farmers through the years. Active development of these species for aquaculture has not been pursued, but the potential of these species for aquaculture will continue. Since Alaskan aquaculture must rely on indigenous species, developing these species for aquaculture will require, in some cases, considerable research and development.

The pinto abalone, *Haliotis kamtsckatkana*, receives substantial attention, particularly from inquiring aquaculture farmers applying for their first permits. Ranging from California to the Aleutians Islands, the pinot abalone grows in the intertidal zone to about 10 cm in shell length. The pinto abalone is a slower growing species than to red abalone, *Haliotus refescens*, that is culture extensively in California, Mexico, and recently in Chile. The slow growth, lighter meat weight, and the feed requirements make pinto abalone culture difficult in the northern latitudes. Attempts at developing pinto abalone culture in British Columbia have been mixed and considerable time and expense has be directed at technology development for hatchery seed production. A renewed effort, on a smaller scale, is being initiated in British Columbia.

The green sea urchin, *Stongylocentrotus drobachiensis*, is harvested commercially on the West Coast of the United States for its gonads that are sold to Asian countries, particularly Japan. High quality urchin roe commands a high price, reaching over 7,000 ¥/Kilo/Kilo. The commercial fishery, however, has difficulty reaching the quality standards demanded by the market since the row quality of commercially harvested urchin is quite variable ranging from 7,300-400 ¥/Kilo. Attempts have been made to enhance roe quality by feeding commercially caught urchins prior to marketing. The feeding enhancement technique does provide some improvement in quality, but the general impression in the aquaculture industry, is that combination of hatchery produced single age class urchins and supplemental feeding will greatly improve roe quality.

Aquaculture of the red king crab, *Paralithodes camtschaticus*, has generated some interest. In the International Symposium on Crab Rehabilitation and Enhancement held in Kodiak in 1992, hatchery techniques being developed in Japan to culture crabs were discussed. Initial results showed hatchery production of juveniles to be expensive and survival in wild stock enhancement efforts was very poor (0-0.8% survival). At the hatchery level, cannibalism, and expense of feeding were the most difficult problems to overcome.

Culture of seaweeds has been actively pursued in Alaska with research and development activities being conducted in Southeastern Alaska for culture of giant kelp, *Macrocystis integrifolia* and selected species of nori, *Porphyra sp.* Laboratory production of growout sporophyte stages has been completed for both giant kelp and nori. Growout trials for giant kelp, conducted at Whiting Harbor in Sitka, were inconclusive, caused mainly by unanticipated nutrient depletions and excessive freshwater runoff. Nori culture research is continuing with growout trials now underway.

The products of giant kelp and nori culture are quite different. Blades of giant kelp were destined for use as substrate for the Prince William Sound herring roe on kelp fishery.

With the current depression of herring populations in Prince William Sound, demand for giant kelp blades has not developed. Nori production is directed toward the Native American, domestic, and potentially Asian markets. Establishing a market in Asia will be difficult since product quality is a major are of concern.

History of Shellfish Hatchery Development

The modern era of shellfish farming began in the late 1970s with a handful of small farms near Wrangell, Alaska, cultivating Pacific oysters for the live market. These farms rely on oyster seed purchased from shellfish hatcheries in the Pacific Northwest to stock their farms. The idea of constructing a shellfish hatchery began in the fall of 1980 at an Alaskan Oyster Growers Association meeting in Wrangell, Alaska. At that meeting, Dr. Ken Chew, eminent shellfish researcher from the University of Washington, proposed the construction of a shellfish hatchery to support the growing oyster culture industry. Dr. Chew is director of the School Fisheries at the University of Washington School. As a matter of interest, Dr. Chew was the 1996 recipient of the lifetime achievement award for the World Aquaculture Association. Dr. Chew is one of our strongest supporters for construction of an Alaska shellfish hatchery and research center and was very involved in the design of the current proposed facility.

Poor capitalization and restrictive regulations constrained the shellfish farming industry in the 1980s to a cluster of farms located in southeastern Alaska. Because of the small demand for shellfish seed required by the farms, financing a shellfish hatchery was not consider feasible. In 1988, the shellfish farming industry transformed with passage of the Aquatic Farm Act. Simplification of regulations and permitting triggered rapid growth in permit applications and 71 farms were permitted by 1991 to culture shellfish on 256 acres of state tidelands. The need for an in-state shellfish hatchery now became evident.

With the increase in the number of shellfish farms came regional expansion with farm permits being issued outside of southeastern Alaska for Kodiak Island, Kachemak Bay, and Prince William Sound. The Kodiak Island farms, primarily because of chronic problems with paralytic shellfish poison contamination of shellfish, folded. Kachamak Bay farming grew to its present 22 farms; and, particularly with the efforts of a few dedicated farmers and the Chugach Regional Resources Commission (CRRC) initiating development of Native owned farms, the shellfish culture has been successfully developed in Prince William Sound.

In 1991, the Alaska Department of Fish and Game (ADF&G) included in its annual appropriations budget a MTC to enable ADF&G to conduct research in support of the expanding shellfish aquaculture industry. Receiving a low priority and receiving restricted allocation, the MTC project was not initiated. In 1992, a more direct approach was initiated with an appeal for direct funding for a MTC and Shellfish Hatchery (SH). The MTC and SH began as two separate projects requested by two separate entities, the ADF&G and the CRRC, respectively. The objectives of the two projects, though related, were quite different with the MTC conducting state funded research while the SH was proposed to be a production sized facility operated as a private corporation. The two were combined into one project during the legislative appropriation process.

Appropriation funding came from Exxon settlement money (Section 5 of the HCS CSSB 183[FIN]) to the ADF&G to construct a Mariculture Technical Center, Shellfish Hatchery, and Marine Nursery Facility on the lower Kenai Peninsula within the ADF&G Lower Cook Inlet Fisheries Management District. Also associated with the funding for construction was a site selection study, awarded by a bidding process to Dames and Moore, which included a feasibility study of sites for locating, building, and operation of the MTC/SH.

Beginning as a two-story design with the MTC housed on the second floor, the MTC/SG complex was consolidated into a pre-engineered single story metal building constructed on a 6-inch concrete slab foundation with a grow area of 10,920 ft^2. The SH occupies 7,660 ft^2, the MTC 1,550 ft^2, and the remaining 1,710 ft^2 is shared space composed of mechanical facilities, laboratory, and shop. Since the SH is intended to be operated by a private contractor, it will be a production facility with its function, administration, and business operations being separate from the MTC. Negotiations for a shellfish hatchery contractor are now underway.

The operational plan for the MTC has changed since its inception with the original plan to have the Alaska Department of Fish and Game operate the MTC for a period of three years. The MTC was to be staffed by four ADF&G employees - three full-time professionals and a part-time maintenance person. Later, the ADF&G funding contribution was reduced to an annual appropriation of $150,000 to $200,000 (2 full-time staff). While providing for staffing of the MTC, the plan called for generating revenues through grants and direct appropriations which would cover the cost of operation and overhead.

The operational commitment changed dramatically with the state election overturning the administration supporting funding of the MTC. With a change of state government leadership, and subsequent changes in ADF&G administrative personnel, the department revoked all operational funding support of the MTC operation.

Under agreement with ADF&G, Alaskan Shellfish Growers Association, and the University of Alaska; a committee has been formed to operate as a private non-profit group to develop policies and regulations for operation of the MTC. The advisory committee will operate with oversight from the Kenai Peninsula Borough Economic Development District which is contracted through ADF&G to oversee operation of the shellfish hatchery. The advisory committee composition is list in Table 1.

Table 1. Members of the Mariculture Technical Center advisory committee.

Members	Number	Suggested representatives
Industry	3	(2) Alaskan Shellfish Growers Assoc.(S.E. & PWS) (1) Kachemak Shellfish Mariculture Association
Local Government	1	City of Seward
ADF&G	1	Mariculture Coordinator
University of Alaska	1	Marine Advisory Program aquaculture specialist
Shellfish Hatchery	1	Designated by the shellfish hatchery contractor

History of Aquaculture in Alaska

The history of MTC development cannot be divorced in context from the history of shellfish aquaculture in Alaska and shellfish nursery culture development. The MTC, as a resource, is integrated into the larger shellfish aquaculture industry with direct two-way linkages to the shellfish hatchery, shellfish nursery culture, and growout on the farm sites (Figure 1). An obvious assumption is that the financial feasibility of the MTC operation requires that the shellfish aquaculture industry be an economically viable enterprise, and that nursery culture contributes to substantially improve the prospects of aquatic farmers to turn a profit.

It is appropriate that the aquaculture industry, and nursery culture be included into the business planning of the MTC. Without their contribution to the total economic viability of shellfish aquaculture in Alaska, further discussion about the business prospects of the MTC is unnecessary.

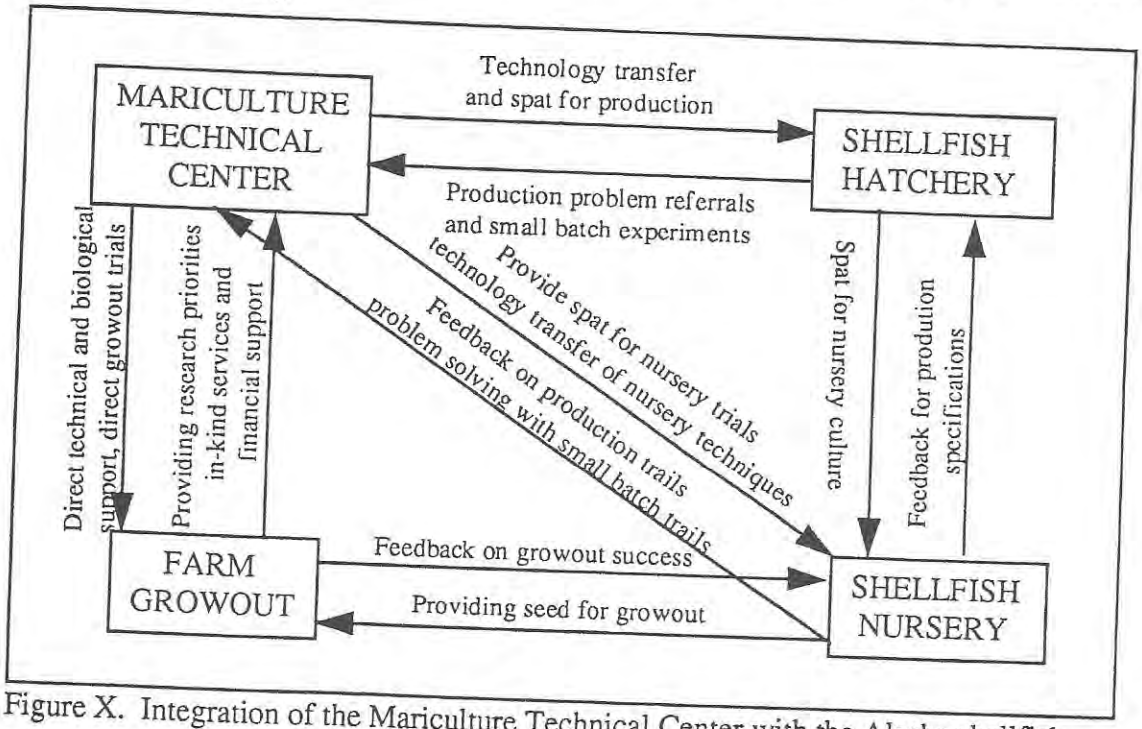


Figure X. Integration of the Mariculture Technical Center with the Alaska shellfish culture industry.

History of Shellfish Aquaculture in Alaska

Shellfish culture is not a new endeavor for Alaska. Pacific oysters, originally imported from Japan, was first introduced into Alaska in 1910. The industry started as intertidal culture with clutched oyster spat. Maximum production of shucked oyster meats reached 550 gallons by 1943 followed by declining production during the 1950s, and ended in 1961.

Oyster culture started again in the late 1970s when spat were imported to southeast Alaska and grown on floating trays constructed with logs and wire screen. These oysters

were cultured from cultchless spat specifically for the gourmet half-shell market. Several farms were in production during the next 10 years, but expansion of the industry was constrained by lack of capital and restrictive state regulations. The atmosphere for aquaculture development in the 1980s was clouded with a confusing permit acquisition program that restricted the farmer to one-year tideland use permits and did not allow for preference right for permit renewal.

Shellfish culture was revitalized in 1989 with passage of Senate Bill 514. The Department of Natural Resources was designated the lead agency for permit processing and coordination between agencies was vastly improved. Under the new regulations, permits are filed during a sixty-day opening period and permit applications are batch processed. Tidelands use permits are more secure and allow the farmer three years to meet the state production requirements. Permits are renewable and a tidelands lease is available to the farmer after a three year production goal is reached.

Since the new regulations were implemented in 1989 the industry has grown from a single farmer in 1989 to 56 farms now cultivating shellfish on 219 acres of state managed tidelands, a total of 209 applications were issues by the end of 1992 (Figure 2).

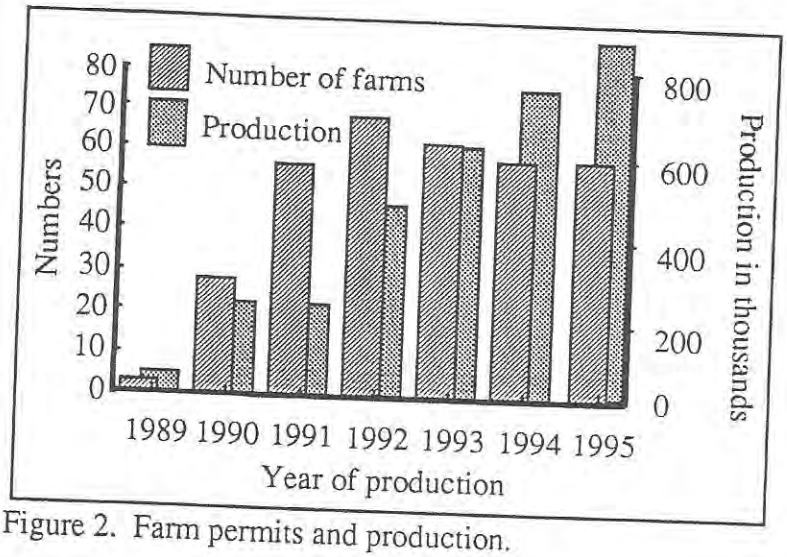


Figure 2. Farm permits and production.

Oyster culture is more expensive for the Alaskan shellfish farmer than in any other location in the Pacific Northwest. Much of the expense is a result of the remoteness of the farms, and the subsequent transportation costs to ship equipment to the farm and product to market. Consequently, the breakeven price of Alaska grown oysters ranges between $3.00-4.00 per dozen which is substantially more expensive than Pacific Northwest oysters than typically sell for $2.00-3.00 per dozen.

Oyster culture in Alaska does have one major advantage over aquaculture in other part of the nation and that is the quality of the oysters. While much of the United States is struggling to maintain or improve their water quality, often against tremendous social and technological obstacles, Alaska has some of the most pristine marine waters remaining in the Northern Hemisphere. Oysters cultured in Alaska have never been denied shipment to

market because of sanitation violations.

Nursery culture of shellfish

The most pressing needs of these farms are access to reliable, high-quality oyster seed and diversification of production. Currently, Alaskan aquatic farmers can purchase only Pacific oyster seed from shellfish hatcheries in Washington. Oyster seed purchased from out-of-state hatcheries are frequently unsuitable for Alaska culture because hatchery production schedules are not reliable, and seed often arrives late, disrupting the farm production schedule. Oyster seed quality is also variable, and farmers often experience poor growth and survival. Oyster farms risk disruptions in production if current oyster hatcheries supplying seed lose their permits to import into Alaska.

In 1992, through the efforts of aquatic farmers in Kachemak Bay and the Kenai Peninsula Borough Economic Development District, the Kenai Peninsula Shellfish Task Force was formed to identify and make recommendations to eliminate constraints limiting the viability of shellfish culture in the borough. The Task Force identified acquisition of high quality shellfish seed as a high priority need for the industry to continue to develop. Approaches to this problem were to construct a shellfish hatchery and develop nursery culture technology to grow small seed, purchased from shellfish hatcheries in the Pacific Northwest, to a larger size for farm growout. Construction of a shellfish hatchery was financially far beyond the capability of the Task Force to complete; as a first step, the Task Force Recommended a feasibility study to investigate application of nursery technology as a partial solution to the oyster seed quality problem. In 1993, the Kachamak Bay Shellfish Mariculture Association conducted a project titled Oyster Nursery Feasibility Study that was completed in January 1995. The results of the study clearly demonstrated the importance of nursery culture to grow oyster seed from hatchery size seed (5 mm shell length) to a larger size (30 mm shell length) for delivery to the farms. The significance of this study has been the driving force that lead to the construction of the production size nursery system in Kachemak Bay, that was completed in May 1997. A summary of the advantages of nursery culture prior to farm growout is listed in Table 2.

Table 2. Comparison of oyster farming from in-state and out-of-state seed sources

	Out-of-state seed	In-state seed
Seed size	Less than 20 mm	Greater than 30 mm
Seed cost	$15-18.00/1000 seed	$30.00/1000 seed
Expected slow growth	20%	<5%
Excepted survival	50-80%	85-90%
Gear requirements	• Trays for early culture	• Not required
	• Lantern nets for first year	• Not required
	• Lantern nets for growout	• Lantern nets for growout
Time to market size	• 18-36 months	• 12-18 months
Labor requirement	• Tray maintenance	• Not required
	• First year culture	• Not required
	• Growout for second year	• Growout for second year

With the help of a $64,000 grant from the Alaska Science and Technology Foundation, nursery culture research is continuing with the goal to refine and develop more efficient culture methods.

Oyster broodstock development

The Molluscan Broodstock Program (MBP), located in Newport, Oregon, houses the largest and most aggressive oyster broodstock development program in the world. Through their effort and the Western Regional Aquaculture Consortium, forty oyster brood line have been development. Alaska, as a participant in the MBP, received the seed from these brood lines to conduct growth performance studies. Located at Pristine Products Oyster Farm in Prince William Sound, the oyster have gone through their first summer of growth. By the end of 1998, we anticipate a differentiation of growth to occur and the high performance lines will be transported to the shellfish hatchery to be used as the Alaskan source of oyster broodstock. This is an important development since farmers will know the genetic makeup of their oysters and be able to better forecast growth and survival of seed produced from these known brood lines.

The Hatchery/Nursery Impact on Growout

The combined impact of the shellfish hatchery and broodstock development will enable production of our own Alaskan strain of Pacific oyster seed, and nursery culture will deliver a larger, faster growing shellfish to the farms. The net result will be a reduction in oyster growout time from 18-36 months to 12-18 months. In addition, farmers will experience an estimated 40% savings in farm construction and operation costs. By farming seed grown through nursery culture, the lower mortality and predictable growth will enable farmers to attract larger markets since farmers can accurately estimate their shellfish inventory and guarantee delivery to the buyer. Reliable and consistent delivery is particularly important for supplying the lucrative Asian markets that have expressed interest in Alaskan shellfish.

Location of the Mariculture Technical Center

Land Location

The MTC is located on the campus of the University of Alaska, Institute of Marine Sciences (IMS) in Seward just north of the present maintenance/library facility. Immediately east of the MTC/SH complex is a mariculture pond that will be used as a pre-nursery pond for the SH (Appendix Attachment 1).

Resurrection Bay

The MTC is located on the north shore of Resurrection Bay. A significant amount of data on the oceanography of Resurrection Bay was collected in the mid 1970's by the University of Alaska Sea Grant Program and NOAA and the National Science Foundation. Salinity and temperature profiles taken over several seasons indicate that the water in

Resurrection Bay is stratified from approximately April to November. Salinities at the surface during this period vary between 23 ppt and 29 ppt due to increased runoff in the summer. Temperatures at the surface range as high as 14 °C during mid summer. In late winter, the surface salinities are approximately 31 ppt and temperature averages just above 3 °C. In deep water, the maximum salinities (approximately 33 ppt) are found during the fall and winter, with temperatures around 4-5 °C. Nutrients in the upper levels of the water column are depleted during the summer from biological activity. Nutrients are replenished during the winter when there is less uptake from living organisms and vertical mixing brings the deep, nutrient rich waters close to the surface. Nutrients at the mid and deeper levels slowly decrease in the winter from this mixing and is then replenished by deep water from the Gulf of Alaska.

Primary productivity was also measured during this series of studies and was similar to other fjords in Alaska, with most of the production occurring in the early summer due to the long day length and available nutrients. Productivity rate ranged from 1776 mg C/m^2 per day in the summer to 8 mg C/m^2 per day during the winter.

Water chemistry samples were analyzed from the deep water intake at the Institute of Marine Science Lab and from a shallow location in the fall of 1993. These data show that water quality in the immediate area of the proposed facility is generally good and indicate no unusual levels of the primary constituents of typical seawater or serious problems with trace heavy metals.

Utilization of the deeper nutrient waters for culture of mariculture species is beneficial in that it reduces the amount that needs to be added to the algal food cultures. Additional information on the water quality of Resurrection Bay are found in Appendix Attachment 2.

Ownership of the MTC/SH and Land

The Alaska Department of Fish and Game owns the MTC/SH building. The lot is owned by the City of Seward (Tract 1), and is under lease to the University of Alaska, Fairbanks (Appendix Attachment 3). Other existing IMS facilities are located north of Railway Avenue on a separate parcel owned by UAF. The City of Seward owns the tidelands adjacent to the MTC/SH. Zoning on the IMS site (on both sides of the Railway Avenue) is currently IMS - or institutional, public, and quasi-public.

Operation Contracts

The SH portion of the facility will be operated by a private party under a contract negotiated with ADF&G. Contract negotiations are now underway. A plan of operation for the MTC portion of the facility is now being developed by a Mariculture Technical Center Steering Committee. To facilitate the steering committee operation, ADF&G developed a covenant agreement and provided funding of not more that $25,000 for the Kenai Peninsula Borough Economic Development District to contract with the Alaskan Shellfish Growers Association for the steering committee to perform the following tasks:

1. Develop a business plan for operation of the research component of the Mariculture Technical Center including but not limited to the following:

a. Overview

1. Profile the objectives of the MTC.
2. Provide a mission statement.
3. Describe a successful outcome.

b. Organizational Structure

1. Explain in detail the intended structure of the management and oversight team of the MTC. Develop an organizational chart.
2. Explain the make-up and function of any special committees that will provide guidance or oversight to the operator of the MTC research component. Explain how committee members will be chosen, what their terms will be, and how they will be replaced.
3. Explain the separation, and or sharing of responsibilities between the SH operator and the MTC operator.
4. Explain in detail the personnel needs (time and season) of the MTC.

c. Operation and Project Administration

1. Provide a plan to develop research priorities and to advertise the availability of the MTC for research projects.
2. Explain in detail the process of project selection.
3. Explain how available space will be scheduled for use by research projects.
4. Provide a plan for management, oversight, and review of the research projects.

d. Capital Requirements/Funding

1. Provide cost estimates for supplying the MTC with basic equipment.
2. Determine cost to be shared by the operator of the MTC.
3. Develop a detailed operating budget.
4. Determine how much working capital will be required for purchasing project specific research equipment.
5. Provide a plan for using department contingency and/or construction over-run funds for the MTC if they are available.
6. Identify potential sources for start-up funds: Actively pursue all options.
7. Provide a plan and a time schedule for the MTC to generate enough funds to become self-sufficient.

Upon completion of the project the Mariculture Technical Center Steering Committee will submit a summary report to the Alaska Department of Fish and Game and begin the process of operation.

Physical Characteristics

Floor plan description of the Mariculture Technical Center

For a detailed floor plan of the MTC/SH complex, refer to the building plans available through the Alaska Department of Fish and Game. The descriptions that follow summarize the content of the facility design documents.

Both MTC and SH functions are housed in a single a pre-engineered single story metal building of rectangular shape on a 6-inch concrete slab foundation with a gross square footage of 10,920. A sloped roof (18 feet to peak) is used to drain snow and rain away from building entrances. Ceiling height is 12 feet (Figure 3). The site is adjacent to Resurrection Bay so the building is designed to withstand wind driven salt spray. Framing members are hot-dipped galvanized to resist the humid air created by heated hatchery saltwater. High quality finishes are required on both the exterior and interior surfaces. Space utilization in the MTC will be as follows (Table 3).

Table 3. Specifications of the Mariculture Technical Center

Mariculture Technical Center (Use and Area-square feet)	
Wet Labs (2)	860
Office and Restrooms	520
Hall	170
TOTAL	1550

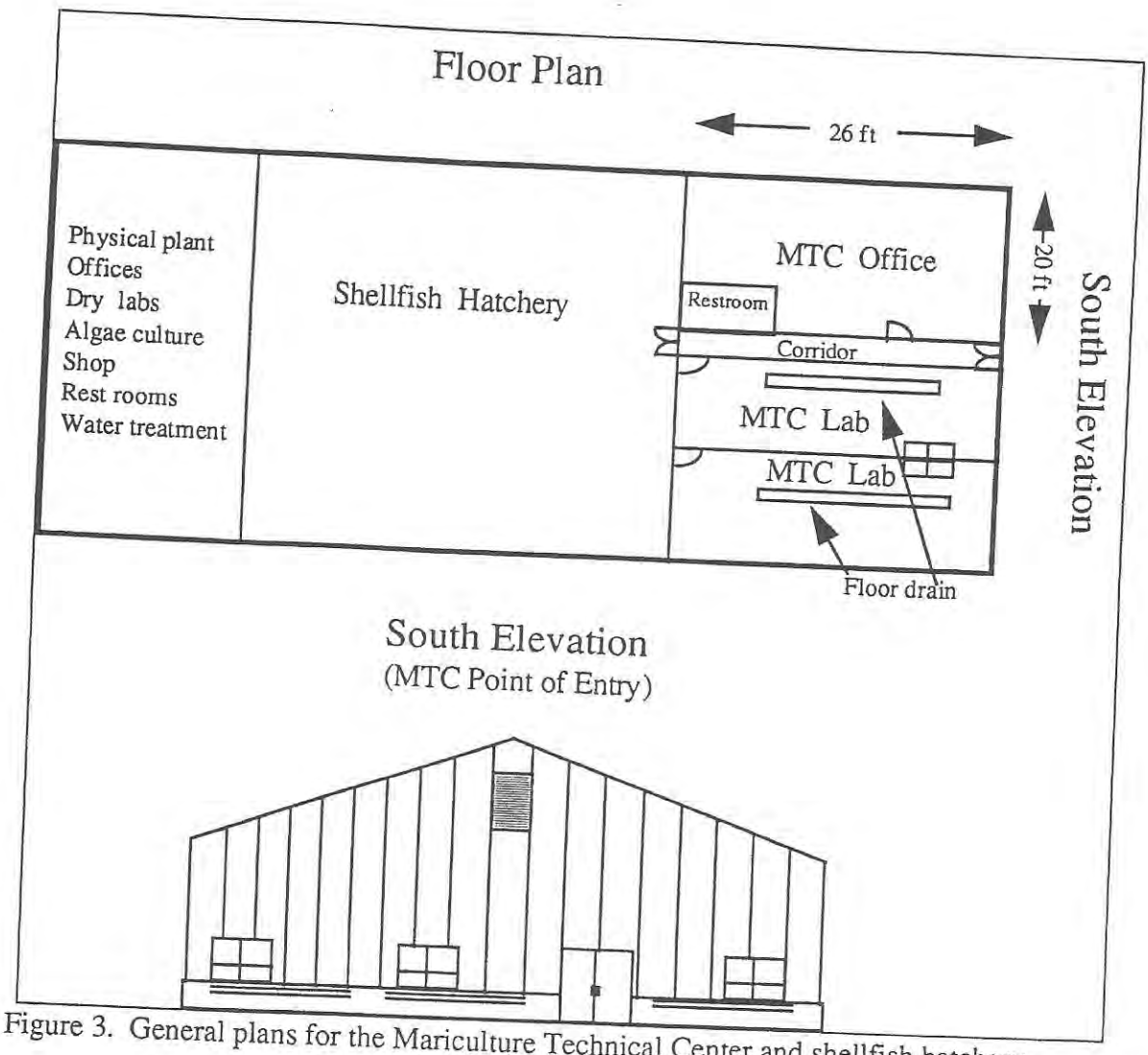


Figure 3. General plans for the Mariculture Technical Center and shellfish hatchery.

Each MTC lab has complete infrastructure facilities (heated and ambient seawater, heated and ambient freshwater, drains, etc.) to perform pilot scale research on a variety of shellfish species. Lab space is sufficient to produce food for shellfish independently for each lab. The result is two MTC modules that can conduct research on different species simultaneously and be provided with water quality of very different composition.

Adjacent to the MTC will be a production size shellfish hatchery (SH) (Table 4). The SH is designed for producing 20 million oyster seed each year to a size of 2 to 4 mm. In addition, the hatchery will have multi-species rearing capabilities and the design allows for genetic isolation between species in distinct modules.

Overall, the facility provides a sound, reliable water supply and drain systems for the anticipated activities of both the MTC and SH. The seawater supply system consists of an eight-inch HDPE underwater pipeline extended to a depth of minus 250 feet, primary pumps, sand filters, and oil fired boilers will be used to meet heated water demands. The ambient and heated seawater distribution piping is looped through high use areas with

oversized header pipes. Processed water drains from the shellfish culture tanks are collected to floor trenches and routed to a buried precast concrete energy recovery sump.

Table 4. Specifications of the shellfish hatchery.

Shellfish Hatchery (use and area in square feet)	
Hatchery Tank Room	6330
Mechanical Room	840 (common to SH and MTC)
Office, Restrooms, Hall	810
Shop	520 (shared with MTC)
Algae Culture Lab	520
Dry Lab	200 (shared with MTC)
Electrical Room	150 (common to SH and MTC)
TOTAL	9370

The building provides flexible space that can be converted to a variety of configurations without major modifications. Many of the functions provided will be shared by the MTC and SH (such as main water supply and main drain systems, mechanical/shop space, and dry lab). The facility is designed so that operations of neither the MTC nor SH will adversely affect the other.

In summary, the MTC and SH are unique facilities for Alaska because it is the only facility available for culture of early life stages of marine invertebrates.

Equipment for the MTC

The MTC is not currently equipped with laboratory furniture. Each MTC module has a sink, floor drains, and a water delivery pipe entering the room. Each module will need to be equipped with laboratory furniture and basic water distribution plumbing to enable their use by research personnel. A draft design of furniture layout (Appendix attachment 4) and cost estimate are found in Appendix Attachment 5).

Equipment other than the basic laboratory furniture will be provided by the researchers.

Housing for Research Staff

The IMS has apartment housing available for rent if rooms are available. Housing rentals are available in Seward the range from $410 to $650 per month. The vacancy rate for rental units in the Kenai Borough is 2.8%, one of the lowest in the state.

Permits and licenses

The SH must obtain and renew a number of permits regularly. The MTC will not be required to obtain separate permits for those issues to the SH. Permits required by the SH are:

Federal Environmental Protection Agency

- National pollutant discharge elimination system permit or general permit for stormwater discharge.

- Spill prevention control and countermeasure permit for the hatchery for storage in excess of 660 gallons of oil above ground.

State Department of Environmental Conservation

- Waste water disposal permit.
- Water supply and waste water treatment system.

Alaska Department of Fish and Game

- Shellfish hatchery permit
- Shellfish transport permits

The MTC will be included into the permits of the SH, but additional permits may be required for individual research projects to include shellfish and seaweed transport permits, permits necessary to use experimental animals, and storage and use of potential toxic materials. With respect to toxic chemical use, the MTC management board has the authority to deny a research project if it deems the chemicals used in the projects are not in compatible to the use of the MTC laboratory modules.

Transportation

A number of transportation options are available to the MTC site in Seward. These are:

- Highway, open year-around to Anchorage, Kenai, and Homer.
- Air transport by small plan. Seward has a small plane airport.
- Seward is a main port for barge service
- The Alaska Railroad stops regularly at Seward.

Infrastructure support

The IMS facility provide excellent support for the MTC via its physical plant staff and equipment, scientists on site, and laboratory facilities and equipment. In addition the Alaska Sealife Center, located adjacent to the MTC will also have extensive support services that the MTC can call upon in time of need. In the planning phase is a proposal to establish a marine scientist committee of all research entities in Seward to provide a scientific and physical support network between the Institute of Marine Science, Alaska Sealife Center, Shellfish Hatchery, and the Mariculture Technical Center.

The need for the Mariculture Technical Center

Research Needs

Alaska has tremendous marine aquaculture resources; which include an expansive coastline, pristine water quality, and biologically productive estuaries. These combined assets are found nowhere else in the United States. With increased exposure to the marketplace, Alaskan shellfish have now gained a reputation as being a product of exceptional quality and safety. In order to have the capability to meet the increasing demand for Alaskan shellfish, research is a necessary component. Specifically, research is

needed to two primary areas.

Northern latitude aquaculture

Alaska is the northern extreme for shellfish farming. Therefore, much of the research results obtained from shellfish cultured in lower latitudes do not apply directly to Alaska. For example, Pacific oysters are not native to Alaska and do not reproduce in these cold waters. Their inability to reproduce results in significant differences in their physiology, growth, and product quality from that of oysters grown in the Pacific Northwest of the United States. Research is necessary to develop an Alaska specific oyster broodstock that most likely will be quite different from that used in lower latitudes. Quality characteristics that need selection in a broodstock program are growth, shell characteristics, glycogen content, over-winter survival, disease resistance, and control of gamete development. Once a broodstock is developed, research directed for its improvement will be a necessary component of future research.

Species diversification

Alaska has one of the strictest exotic species import regulations in the World. As a result, shellfish farmers cannot import seed of highly prized shellfish species such as Manila clams and Japanese scallop. The primary effect of the import restriction requires that we develop our own shellfish broodstock from native species. To address the issue of species diversity, the industry has submitted two proposals to the Alaska Board of Fisheries to request export of shellfish broodstock from Alaska to ADF&G approved shellfish hatcheries in the state of Washington and Oregon. From these broodstock seed would be produced for import back into the state. These proposals were supported by ADF&G, the aquaculture industry, and commercial shellfish harvesters; and, even though broodstock export is allowed for Pacific oysters, the proposals were rejected both times. With our attempts to use shellfish hatcheries outside the state stifled, the obvious solution to the problem was to develop an in-state capability to develop our own broodstock and produce our own seed.

Currently littleneck clam, scallop, and the geoduck clam are the species attracting the most interest in the industry's efforts for species diversification. All three species demand excellent market prices (Table 5), and all are native to Alaska. We know from passed research that the technology for production is feasible, but research and development is needed for application to Alaska.

Table 5. Market prices for potential culture shellfish

Littleneck clam	$2.25-2.50/lb
Purple Hinge Rock Scallop	$2.50/scallop
Geoduck clam	$3.00-7.00/lb

Shellfish Hatchery Technology Development

Shellfish hatchery technology is constantly evolving as we learn more about the biology and physiology of shellfish, nutrition requirements, genetics, and environmental needs.

Production size shellfish hatcheries are not designed to conduct small-scale research, which can interfere with the existing hatchery operation. The MTC will be a resource to assist with new technology development by providing a laboratory facility separated from the hatchery to facilitate small-scale experimentation. The MTC is particularly useful since use of the same water as the SH, treated in the same manner as the SH, will enable immediate application of new technology to a larger scale of operation. Some areas of technology development that may involve use of the shellfish hatchery are:

1. Broodstock development.
2. Disease investigations.
3. Shellfish nutrition.
4. Algae physiology studies and culture methods development.
5. Nutritional studies of shellfish.
6. Water treatment methods.
7. Bioassay studies.
8. Trouble shooting of hatchery production problems.
9. Water chemistry.

Toxic Algae Research

Occurrences of toxic algae blooms in Alaska is a human health problem. Aquaculture is directly affected by toxic algae blooms, particularly those that cause incidences of paralytic shellfish poisoning (PSP). Shellfish produced on aquatic farms is certified prior to shipment and is safe for consumption. However, the process involved with testing and certifying shellfish free of PSP toxin is cumbersome and expensive.

The MTC is particularly suited for algae studies because of the quality of the treated water. Study of the PSP toxins and the algae that produce them can be an important function of the MTC. The number of studies that can be done on PSP is enormous. A comprehensive list of research opportunities is available in Ecohab: The ecology and oceanography of harmful algae blooms, A national research agenda, published by the Woods Hole Oceanographic Institute.

Environmental Studies

Environmental quality determines the success of any aquatic farm. The MTC will enable studies of environmental effect on shellfish because the water quality and temperature is highly controlled so the number of variables in the experimental design will be reduced.

Industry Research Priorities

The Alaska Mariculture Institute Board of Trustees will annually adopt a list of research and educational priorities for the Alaska Mariculture Technical Center. These goals will be used to help determine which projects should be housed at the facility.

The priorities should address the problems and opportunities faced by Alaska's aquatic farmers. Input from the industry will be solicited as the list is developed. The following prioritized list of projects was developed from a survey of aquatic farmers by the Alaskan

Shellfish Growers Association to serve as an initial list of research priorities:

1. Development of an Alaska strain of Pacific oyster broodstock specifically suited for culture in northern latitudes.
2. Development of littleneck clam seed for use by Alaska farmers.
3. Rock scallop broodstock development and hatchery techniques.
4. Development of sources of indigenous geoduck clam seed.
5. Weathervane scallop hatchery techniques.
6. Experiments with PSP and other toxic algaes.
7. Development of triploid (sterile) Pacific oyster seed.
8. Experiments with sterile Japanese scallops.
8. Development of razor clam hatchery techniques.
10. Sea cucumber broodstock development.
10. Hatchery techniques for pinto abalone.

Solicitation of Research Projects

The Alaska Mariculture Institute will publicize the availability of the MTC through a program focusing on direct outreach to the aquatic farm industry and scientific research community. This will be supported by public relations efforts.

Getting the word to Alaska's aquatic farmers will be accomplished through direct mailings and contacts with organized groups, i.e., the Alaskan Shellfish Growers Association and the Kachemak Shellfish Mariculture Association.

The scientific community will be reached through the University of Alaska's Marine Advisory Program and a compiled mailing list of researchers, organizations and agencies. Other key contacts would be the Alaska Department of Fish and Game, National Marine Fisheries Service, Alaska Science and Technology Foundation, and the University of Washington School of Fisheries.

The AMI also would get the word out through the media and a web site. Articles about the MTC would be distributed to the industry press, academic journals and Alaska media. A web site would be established for general information and periodic updates on projects in progress.

Project Selection

The AMI Board of Trustees will form a technical review panel composed of members of the scientific community and industry. The technical panel will develop a system for scoring project proposals. Proposals would be screened and scored through a peer review process, and recommendations made the AMI Board of Trustees. Evaluation criteria would consider, but are not limited to:

1. Priority of the proposed research for aquaculture.
2. Qualifications of the investigators.
3. Scientific merit of the proposed project.
4. Duration of facility use.
5. Direct and timely application for the aquaculture industry.

5 6. Strength of the technology transfers component of the project.
4 7. Safety considerations.
3 8 - Security of funding

Scheduling and Management of Research Projects

The AMI Executive Committee will oversee the scheduling of approved projects. This will be a relatively simple process because of the small number of research projects (2-3) which could be housed in the MTC at any given time.

Individual project manager would be required to provide periodic updates on the status of research projects the AMI President. Benchmarks would be established for easy review of project progress. To the greatest extent possible, projects would have to be held to established timelines because of the need to minimize facility "down time" between projects.

Each project in the MTC would be assigned a project reviewer from the Board of Trustees or Technical Review Panel. This reviewer would be responsible for keeping in touch with the project manager and, if possible, viewing the project on-site.

Industry Survey of Research Priorities

Industry interest in research conducted at the MTC is very strong. Grower interest in the MTC and potential research projects was assessed in a survey mailed to all active aquatic farm permit holders in April 1997. Sixteen growers (43 per cent of those mailed a survey form) responded to the survey, indicating a very high level of interest.

Growers were asked to rank projects on a scale of 1-5, with five being the highest. Following are survey results.

Project	Score	Ranking
Pacific oyster broodstock improvement	66	1
Littleneck clams	57	2
Purple-hinged rock scallops	43	3
Geoduck clams	42	4
Weathervane scallops	33	5
Toxic algae research	31	6
Triploid (sterile) Pacific oysters	28	7
Sterilization of Japanese scallops	20	8
Razor clams	20	8
Sea cucumbers	17	10
Pinto abalone	17	10

The most important research identified by growers was work associated with development

of what might be called an Alaska oyster, or a Pacific oyster stock bred to perform under Alaska conditions. Faster growth, better meat yields, improved shell shapes and suppressed gonadal development are the characteristics sought by growers in the broodstock development program.

Growers also were vitally interested in research projects leading to the introduction of new sources of shellfish to culture. The species of greatest interest to growers are, in order of importance: littleneck clams, purple-hinged rock scallops, geoduck clams and weathervane scallops. These indigenous shellfish have high commercial value and are thought to be the most adaptable as aquaculture species.

There also is much interest in research related the toxic alga related to paralytic shellfish poisoning (PSP). The MTC has the potential of attracting some of the country's top toxic algae researchers because of the chronic outbreaks of PSP in Alaska and the ability to obtain animals with high levels of the toxins. Depuration of the toxin from shellfish and toxin testing methods are of particular interest to growers.

MTC research which could improve performance at the adjoining shellfish hatchery were identified by potential hatchery operators as high priorities. These might include projects related to algal and larval biochemistry and nutrition, hatchery microbiology, and seawater chemistry.

Market Analysis

Definition of the Marketplace

The marketplace for research space in the MTC is unlikely to extend much beyond the state's borders. This is a function of the purpose of the MTC (to serve the Alaska aquatic farm industry), remote location, and the nature of mariculture research (which is very specific to the target region and species).

While research at the MTC will be industry-driven, the real market for the MTC may be the research community. Until a major aquaculture company emerges in Alaska, most aquaculture laboratory research at the MTC will be conducted by biologists associated with university or government institutions or the adjoining shellfish hatchery.

Two of the growers surveyed indicated they were planning projects at the MTC and both were pursuing funding for the projects. If access to the MTC is restricted to projects directly related to aquatic farming, other likely sources of projects might be researchers connected to the Alaska Department of Fish and Game, University of Alaska or National Marine Fisheries Service.

The distance from major universities and government institutions makes it unlikely the MTC would be utilized for research of national or international scope. One potential major exception is research related to paralytic shellfish poisoning (PSP) because of the state's chronic problem with toxic algae and the availability of marine life with high levels of the toxin. The MTC has the potential of attracting multi-year funding for a PSP research project designed to address both Alaska and national biotoxin concerns.

Competition

Marine laboratory space in Alaska also might be secured at the University of Alaska's Institute of Marine Science in Seward, Fishery Industrial Technical Center in Kodiak, and the NMFS' Auke Bay Fisheries Laboratory in Juneau.

Research Facilities in Alaska

Seward Marine Center

Overview

The Seward Marine Center serves as the Institute of Marine Science's ocean-side station within the School of Fisheries and Ocean Sciences, which also serves as both a UAAAF and a University National Oceanographic Laboratory System (UNOLS) staging are for shipboard oceanographic studies. There are two full-time faculty and 3 full-time technicians involved directly in science studies. Five additional full time persons are in charge of managing the physical plant and service for the oceanography research vessel, the *Alpha Helix*, that utilized Seward as its home port.

Location

SMC is located at the head of Resurrection Bay in Seward. The center is located on approximately 13 acres of land, some of which has been purchased and some leased (through the year 2076) from the City of Seward. The shellfish hatchery and Mariculture Technical Center is located on SMC property that is under the lease agreement. The center is connected via 130 miles of road to Anchorage. This allows investigators, their equipment and freight, year round access to the SMC. Seward also has direct rail, sea and air transportation access.

Existing space and capabilities

Located adjacent to a deep fjord the SMC has a deep water seawater intake drawing water from 70 meters to support research into high latitude marine invertebrates and fish. The water is not treated extensively by filtration or temperature control, but mainly raw seawater used to supply tanks for holding experimental fish and shellfish. This water system allows researchers to hold and conduct experiments with live North Pacific, sub-arctic, and some arctic fauna. Research completed at SMC included most of the work on bioenergetics of Alaskan fishes, much of the life history of the Alaska King and Tanner crags plus pioneering exploration of neurochemical and neuroanatomical characteristics of salmonid brains.

The available space the SMC is divided into the following areas:

Space types	Net (sq ft)
Laboratory building	6,418
Laboratory wet lab (within laboratory building)	1,830
Warehouse and administrative office	17,526
Public education building (Rae Center)	5,947
Machine shop	2,193
Apartment building (4-plex)	4,536
Pier	180
Total space	38,630

Fisheries Industrial Technology Center

Overview

The Fisheries Industrial Technology Center was established in 1981 by AS 16:52 to provide research and development, technology transfer and training in fish harvesting and processing for the fishing industry and citizens of the State. In recent years the FITC has dedicated much of its effort into seafood process technology development. The facility has no saltwater delivery system.

Location

The FITC is located on a 244 acre tract on the northeastern side of Near Island in the City of Kodiak. It is with 0.5 miles of the Port of Kodiak facilities in St. Herman Harbor and within tow miles of nine processing plants which processed 374 million pounds (%4.6 of he total U.S. fish catch) landed in 1993.

Existing space and capabilities

The FITC is located in the Owen Building, which is a two-story 21,000 sq ft structure. The main building houses a 40 ft x 60 ft pilot plant for seafood processing, roll-in freezers for storage at 4°C, research laboratories for seafood engineering (600 sq ft), seafood chemistry (600 sq ft), seafood biochemistry (600 sq ft), seafood microbiology (700 sq ft), and sensory analysis (500 sq ft). Spaces are allocated as listed below.

Spaces types	Net (sq ft)
Faculty and administrative offices	1,920
Library	720
Student space	320
Classroom/conference room	910
Research labs (9 labs)	4060
Cold room	100
Pilot plant	2,240

Cold storage	780
Storage	400
Total space	11,450
Physical plant	1,400
Total space	

Kasitsna Bay Laboratory

Overview

The Kasitnsa Bay Laboratory is owned by NOAA and leased to the University of Alaska Fairbanks School of Fisheries and Ocean Sciences. The site is dedicated to support shore side and offshore marine science research of the Kachemak Bay ecosystem. The lab has a full-time site manager and a part-time technical assistant. As an educational facility the lab is visited and used by 40 research scientists and 105 graduate and undergraduate students

Location

Kasistna Bay is located on the south side of Kachemak Bay in Lower Cook Inlet.

Existing space and capabilities

The lab can support research on live fishes and invertebrates. The dry labs are well equiped but the saltwater delivery system needs expansion to enable substantial increase in research capabilities. Several small boats are available to support area research.

Saltwater delivery system supplies 200 gallons/min, drawing from 30 feet depth below low tide. Saltwater is not presently delivered into the labs.

Usable Space	Net (sq ft)
Laboratory building (2 labs)	800
Trailer labs (2 labs)	560
Housing dormitory (18 sleeping spaces)	1,608
Shop and storage building (heated)	512
Storage (unheated)	168
Shop and storage building (unheated)	386
Walk-in freezer	786
Total	4,820

Auke Bay Laboratory, National Marine Fisheries Service

Overview

The NMFS Laboratory at Auke Bay has conducted marine and fisheries research for several decades. At Auke Bay is a salmon hatchery and laboratory complex. The facility is inadequate to meet its current needs for NMFS operation and a new facility is proposed.

At the present time, the new NMFS facility is not scheduled to have a saltwater supply line.

Juneau Fisheries Center, University of Alaska Fairbanks

Overview

The Juneau Fisheries Center houses about 75% of the University of Alaska Fairbanks School of Fisheries and Ocean Sciences fisheries graduate program. Research conducted at the facilities includes laboratory and field work on early life history of marine fishes, marine benthic ecology, invertebrate fisheries biology, mariculture, animal behavior, molecular and population genetics, and computer intensive work related to biometrics and population dynamics for both marine and freshwater fish and shellfish.

Location

The facilities, located approximately 11 miles north of Juneau, are split between the Anderson Building (shared with the University of Alaska Southeast) and space leased in the Sherwood building approximately two miles away. The facility in Juneau, through various agreements, also conducts research at facilities (some remote) operated by other organizations [NMFS Auke Creek Hatchery, Little Port Walter and Laboratory; the Douglas Island Pink and Chum (DIPAC) Gastineau Hatchery and Kowee Creek Hatchery; and USFS Pack Creek Reserve]

Existing space and capabilities

The Juneau facility houses seven faculty, six science technical staff, and 30 graduate students as well as three administrative people.

Usable Space	Net (sq ft) Anderson Building	Net (sq ft) Sherwood Building
Faculty office space (12 offices)	850	510
Student rooms and library (2)	300	240
Computer labs (2)	225	600
Administrative areas (2)	600	260
Research wet lab with seawater	800	
Research labs (1)	2,125	
Instrument room	375	
Class and conference room	300	
	5,650	1,910

With construction of the new NMFS facility, the Juneau Fisheries Center anticipates move a substantial part of their program to the new facility. In that effort, the current JFC facility will be substantially converted to a marine lab and at least doubling their current available wet-lab space. The plan to develop this transition is in its very early preliminary phase of development and cannot be commented in detail at this time.

Near Island Facility, National Oceanographic and Atmospheric Administration

Now under construction, the Near Island facility will be equipt for fisheries research, gear technology development, marine mammal research and autopsy labs, and a modest saltwater system that delivers raw seawater in the flow-through system for holding of marine organism for research activities. The wet lab encompassed approximately 3,000 sq ft.

Potential for Expanding the Marketplace

The field of potential users of the MTC is increased if the criteria is broadened. For example, if projects related to the effects of oil pollution on marine life or salmon ranching were approved, the marketplace for the MTC would become significantly larger.

The marketplace for the MTC also will become larger as Alaska's aquatic farming industry grows. Of particular importance will be the emergence of a major company with sources of private funds to match grant dollars.

Marketing Plans

Marketing of the MTC

Use of the MTC for mariculture research should be marketed to the state's aquatic farmers and marine research community. A variety of methods, including direct mail to specialized lists of growers and researchers, establishment of a web page on the internet, articles in Marine Advisory Program publications and the Alaskan Shellfish Growers Association newsletters, and addresses to gatherings of growers and scientists can be employed as marketing techniques.

Solicitation of Projects

The target audience of the MTC is not readily reachable through advertising. When space in the MTC becomes available, potential tenants would be reached through mailings, faxes and e-mails to a targeted audiences, such as shellfish growers and researchers. The scope of these targeted solicitations can be widened as necessary to keep the MTC labs in use.

The Management Team

Organizational Structure

Operation of the MTC would be directed by the board of directors of a private nonprofit corporation formed specifically for the purpose. The Alaskan Shellfish Growers Association and the City of Seward would incorporate the private nonprofit corporation.

The board of directors would be composed of representatives of the following organizations:

- Alaskan Shellfish Growers Association (2)
- City of Seward
- Kachemak Shellfish Mariculture Association
- Qutekcak Native Association
- Alaska Department of Fish and Game
- University of Alaska

Duties and powers of the board of directors shall include:

1. Solicitation, review, and selection of research proposals for use of the MTC.
2. Power to enter contractual agreements with project managers.
3. Management of the projects to ensure proper use of the MTC, and that contractual obligations of tenants are met.
2. Ability to solicit grants, donations, and other funds to help offset operating costs of the MTC.

Operation of the MTC

General Operation

The Mariculture Technical Center is constructed to operate year around. Although aquaculture projects using the MTC will most likely involve use that is more intensive during the non-winter seasons, this may not always occur. Research projects using the MTC may range between very short projects that are a portion of a project being conducted elsewhere to those occupying the space for multiple years. Such has been the case for example in the Institute of Marine Science, located adjacent to the MTC.

Many of the research projects will be funded with grants that have limited duration and a required termination product to be developed by a predetermined date. These grant funded projects may support a private party, government researcher, or graduate student enrolled in University. Projects of this nature are available through organizations like the National Science Foundation, Saltonstall-Kennedy, and the Alaska Science and Technology Foundation. Projects of this nature are expected to supply a substantial amount of their own equipment and supplies.

The MTC board of directors may also solicit funding for research projects requested by the aquaculture industry. In this case the board will identify a problem, approach qualified researchers, develop the project, and submit it for funding. This type of grant funding, since the MTC is the overseer, may be able to use existing equipment, supplies, and a portion of the facility costs as matching as may be required by the granting agency.

The MTC board will also advertise available laboratory space is available to a broad array of agencies. Solicitations about the availability of the facility may generate interest by agencies to house particular research activities in the MTC.

The MTC board may also approach the local, state, or federal government for direct

appropriation of the MTC or a portion of the basic operational cost of the facility. With such funding the MTC may be able to offset some costs to attract research in specific areas where the funding base may not be substantial.

While not being occupied, the contractor will assume the responsibility to maintain the integrity of the MTC laboratories and office. By providing heating, security, general building, physical plant maintenance, and snow removal, damage to the MTC should be prevented.

Along with the laboratory modules, office space is available for research staff. The office is a large shared space that can house 3-4 personnel.

The MTC, although constructed as part of the shellfish hatchery, can be access through a separate external door and traffic need not interfere with the shellfish hatchery operation. There is, however, some shared space to be used by both hatchery and MTC personnel. This space includes some wet lab space in the hatchery, the hatchery laboratory, and the shop.

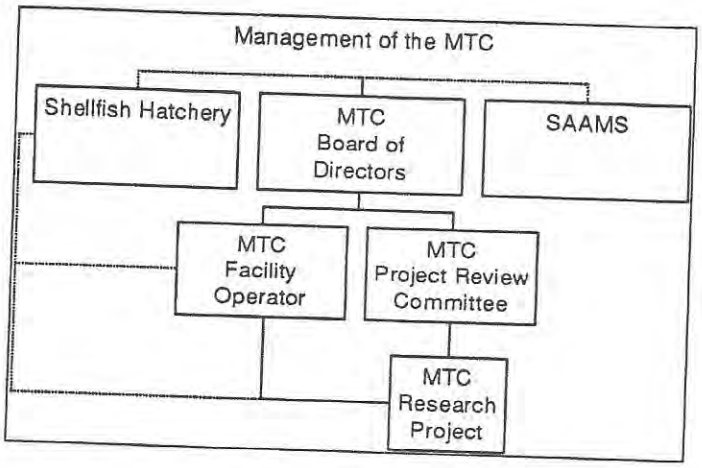
MTC-Shellfish Hatchery interaction

The MTC and the shellfish hatchery will have different operators, but will work closely together to enable efficient use of both operations. From the outset, it must be understood that the MTC will have a very difficult time operating if the hatchery is not operating. The primary reason is that the fiscal plant, water delivery system, and water treatment system are constructed for a large 10,000 square foot facility and the MTC draws a small portion of the total fiscal plant output. By itself, with funding primarily from specific research grants, the MTC cannot afford to operation such a large facility.

Personnel of the MTC and Shellfish Hatchery will interact at five different levels.

- In formal participation at the MTC board level where both facilities will have representation.
- At the MTC facilities operation level where the MTC operator will interact directly with the shellfish hatchery operator in planning facility use, payments to the shellfish hatchery by MTC for a portion of the facility operation costs, and use of shared space.
- At the project review, level where both will evaluate and make recommendations on projects allowed to use the MTC.
- As active members of the Seward Association for the Advancement of Marines Sciences (SAAMS).
- In daily activities at the MTC and Shellfish Hatchery where personnel will share information and plan facility use access and activities.

Management scheme for the MTC (a proposed flow chart)



Production expectations

The goal of the MTC board of directors is to use the MTC to its fullest capability by housing research projects of importance to aquaculture development in Alaska. As a practical matter, in order to pay expenses for the MTC, projects not having direct application to aquaculture may also be allowed use of the MTC. To keep the MTC fully utilized will be a primary role of Board of Directors and the MTC Operation Committee.

The MTC has several advantages that can be used to attract potential researchers. These are:

1. Since the facility is paid for, expenses to conduct a research project should be lower than comparable facilities.
2. Overhead cost should be lower than comparable facilities. (i.e. University of Alaska Fairbanks has an overhead cost of 47%).
3. The MTC has unique features that enable control of water quality.

Operational Cost of the Mariculture Technical Center

Providing a complete and accurate itemized budget is not possible since the Mariculture Technical Center is not in operation nor has a contract for the shellfish hatchery been issued. Cost estimates are based on proportion of the hatchery cost estimates scaled for the size of the MTC modules. Other assumptions for the estimates are:

- A lab module cost also assume office space in included
- Square footage of the hallway and restrooms are included in the laboratory module fee. The total cost is split between the two lab modules
- Maintenance and insurance are paid as a percentage of the total square footage as indicated for each line item.

Setting up the Mariculture Technical Center (MTC) as a Private Non-profit Corporation

Alaska Mariculture Institute

ARTICLES OF INCORPORATION

ARTICLE I

Name of the Corporation:
Alaska Mariculture Institute

ARTICLE II

Period of Duration:
Perpetual

ARTICLE III

Purposes for which this corporation is organized:

The purpose of the Alaska Mariculture Institute (AMI) is to manage the Alaska Mariculture Technical Center to meet the following goals:

1. Develop the technology for in-state hatchery production of indigenous species of shellfish and aquatic plants for aquatic farmers and the enhancement or rehabilitation of wild populations.
2. Improve the productivity and efficiency of shellfish hatchery and nursery operations in Alaska.
3 Increase knowledge of the effects of marine environmental conditions on shellfish biology and ecology.
4. Support the availability of oyster seed at production levels and seasons meeting the needs of Alaska's aquatic farmers.
5. Support the development of an Alaskan strain of Pacific oysters specially suited for culture in northern latitudes.
6. Increase the knowledge of the effects of marine biotoxins on shellfish.

ARTICLE IV

The internal affairs of the corporation shall be regulated by:

The internal affairs of the Alaska Mariculture Institute shall be managed by a seven-member Board of Trustees with duties and powers as set out in the attached by-laws. Distribution of assets on dissolution or final liquidation shall be determined by a two-thirds