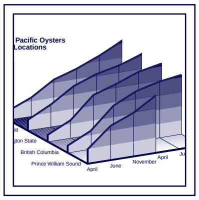
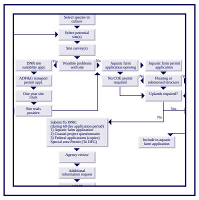
ALASKA'S MARINE RESOURCES

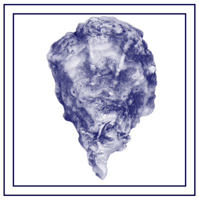
MARINE ADVISORY PROGRAM
UNIVERSITY OF ALASKA

Vol. VII No. 4 December 1992

In This Issue: Growing Shellfish in Alaska







MARINE ADVISORY PROGRAM, ALASKA SEA GRANT COLLEGE PROGRAM, SCHOOL OF FISHERIES AND OCEAN SCIENCES

UNIVERSITY OF ALASKA FAIRBANKS

Shellfish Aquaculture in Alaska
Its promise and constraints

by Raymond RaLonde

Alaska's shellfish aquaculture industry has a relatively long history beginning in 1910 with the introduction of the Pacific oyster. Although distributed on intertidal beaches from Ketchikan to Kachemak Bay, the oysters grew best in southeastern Alaska. The industry continued until 1961, but production remained small peaking in 1943 with the sale of 550 gallons of oyster meat.

Shellfish culture started again in the late 1970s with reintroduction of Pacific oyster spat (juvenile bivalve shellfish) into southeast Alaska. This time the renewed industry cultured oysters for raw consumption in the half shell market. Restrained primarily by lack of capital and restrictive tidelands permit regulations, the industry was confined to a few farms near Wrangell, Alaska.

In 1989, implementation and funding of Alaska Senate Bill 514 revitalized the shellfish culture industry. New regulations streamlined permit processing, agency coordination vastly improved, and changes in tidelands permit regulations added more stability to the industry. The improvements in the permitting process induced a surge in permit applications. By the end of 1992, 72 aquatic farms will be permitted to culture seaweed, clam, scallop, blue mussel, abalone, and sea urchin.

The new Alaskan shellfish farmers have many challenges. To begin with, the state of Alaska does not allow importation of any fish or shellfish into the state other than Pacific oyster spat that are less then 20 mm in length. In addition, oyster spat must be purchased from shellfish hatcheries approved by the Alaska Department of Fish and Game. These importation restrictions require shellfish farms, culturing species other than Pacific oysters, use only species native to Alaska.

High operation cost is a major problem faced by the Alaska shellfish farmer. High transportation cost to ship equipment to the farms and product to market is a major reason for the problem. As an example, increased production costs require Alaskan oyster farmers to ask for $3-$4 compared to $2-$3 for a dozen oysters cultured in the state of Washington. Tough competition from Pacific northwest oyster farms compels the Alaska farmer to increase efficiency and cut production cost to succeed.

Presence of paralytic shellfish poison toxin (PSP) affects all bivalve shellfish cultured in Alaska. PSP is a naturally occurring toxin found in several species of microscopic dinoflagellate algae. Shellfish consume the toxic algae and accumulate the toxin in their intestinal tracts and tissues. The potential to concentrate PSP toxin requires shellfish cultured in Alaska to meet a safety standard of less than 80 mg of PSP toxin per 100 grams of tissue. To comply with these standards, the Department of Environmental Conservation (DEC) requires PSP screening of culture bivalves before marketing. The screening process requires that a farmer harvest shellfish, place them in cold storage, and send a tissue sample to the DEC laboratory in Palmer, Alaska for testing. The samples must pass the test before shellfish can be shipped to market. Because of its extreme toxicity, PSP is a major concern to the industry, but the perception that it hinders shellfish aquaculture is inaccurate. Over 10 years of extensive PSP monitoring of shellfish farms have resulted in very few failed tests.

The constraints to aquaculture may seem overwhelming, but Alaska holds a major advantage not found in other states, superior water quality. While shellfish harvest areas around the United States are seeing more restrictions and closures, Alaskan aquaculture is expanding. Superior water quality and strict sanitation standards now place Alaskan aquaculture products in a very competitive position.

In Alaska, each species with aquaculture potential has special promises and constraints. Finding ways of dealing with the constraints and taking advantage of the promises are what will ultimately determine the success or failure of each shellfish aquaculture venture.

Pacific oyster

Pacific oysters do not reproduce in the cold waters of Alaska. As a result, Alaskan oyster farmers must buy oyster spat from a shellfish hatchery. Unfortunately, Alaska does not have a shellfish hatchery so farmers are compelled to buy spat from an out of state hatchery. Reliance on outside sources of oyster spat places farmers in a precarious position because oyster hatcheries are often reluctant to sell spat to Alaska. Unwillingness to sell spat is caused primarily by low demand for spat, and the time and expense required by the hatchery to receive a disease free certification from the state of Alaska. Shellfish hatchery managers are quick to point out that their facilities produce millions of spat that sell with little trouble to non-Alaskan farms. Despite these problems and because of expected increasing demand for spat, a few shellfish hatcheries have received certification and shipped spat into Alaska. However, this coming spring only one shellfish hatchery will be certified to ship oyster spat to Alaska.

Complicating the problem of spat acquisition is the timing of when spat arrive at the farm. Ideally, oyster spat should start arriving in early spring to take advantage of the dense plankton blooms. During these bloom periods, oyster spat can double their shell size in a few weeks, but delayed arrival of spat, caused by reliance on outside spat sources, may result in missing the first spring growing season. This happened in 1992 when spat shipments to many farms arrived in mid-summer.

Alaska is an outstanding place for Pacific oyster culture. Although native to warmer waters, it is an attractive species for aquaculture in Alaska because it grows very well in cold water providing there is abundant, high quality plankton. Many estuaries in Alaska produce so much high quality plankton during bloom periods that they can match the growth achieved in warmer waters of the Pacific northwest. Cold, clean water also reduces bacteria contamination extending shelf-life and assuring safety of Alaska cultured oysters, especially oysters eaten raw.

Pacific oysters, grown in warmer waters, reach sexual maturation during their second summer of life, causing them to become soft and milky colored. These characteristics make oysters unmarketable. In Alaska, because cold water temperature retards maturation, high quality oysters are available during the summer. High quality, summer oysters allow farmers to market their product when there is less competition which can result in a higher price.

Blue mussel

Native populations of blue mussels live on many beaches in Alaska. Being so abundant, you may ask, "Why culture mussels if they are everywhere?" This is a good question. Mussels are everywhere, but they are not always edible because beach grown mussels tend to accumulate sand stirred up from the bottom and small pearls may develop. These mussels are not marketable, but mussels cultured off the bottom eliminates the grit problem. The mussels also grow faster.

Mussel farmers cannot buy spat from a shellfish hatchery. To start the mussel farm, the farmer must capture spat from the wild population. Successful capture of mussel spat requires an understanding of the bivalve life history, and using a proper collection technique.

Bivalves reproduce mainly by releasing eggs and sperm into the water. After fertilization, a sequence of free floating larval stages develop. Near completion of the last larval stage, the larvae seek a preferred substance to attach to and go through metamorphous into their adult form. Theoretically, a mussel farmer can collect spat by simply deploying, at the proper location and time, a material that larva prefer to set on. Hemp or coconut ropes are good materials. After the metamorphosis occurs, the spat are transplanted to the farm where they grow to market size. The process may seem easy, but the farmer may need to modify the technique to get a good set of mussel spat.

Mussel larva generally set during the summer. Spat are ready for transfer to culture gear during the fall or spring following the set. The farmer removes spat from the gear and packs them into a net mesh tube, called a mussel sock. The spat filled mussel sock is hung from a raft or buoy until the mussels reach market size. In Alaska, blue mussels grow from spat to a market size of two to three inches in about one year.

A major constraint for culturing blue mussels is the labor required to fill the mussel socks, and to harvest and process mussels for market. Mechanical aids are available that can help to reduce labor, but the equipment is expensive. Marketing is important for mussel culture to succeed because the west coast populations of the United States are not traditional mussel consumers. Mussels tend to accumulate PSP toxin faster and to higher levels than other shellfish. This increases the chances of high PSP test results that will deny or postpone sales. The risk is greater during the summer and is site dependent. Some farms have also experienced high summer moralities at harvest time. These high moralities can cut deeply into profits, and require further investigation.

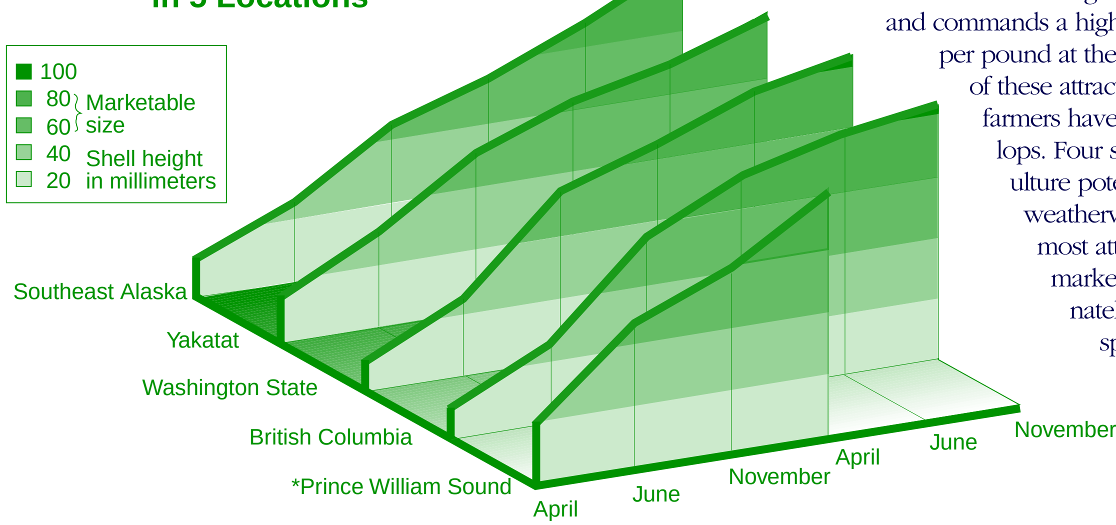
Despite these obstacles, mussel culture has promise because cultured mussels are high quality and fast growing. Attaining an adequate production level to allow mechanization of some of the laborious tasks, providing a stable flow of product to the market, and marketing are some of the challenges facing the mussel farmer.

Scallop

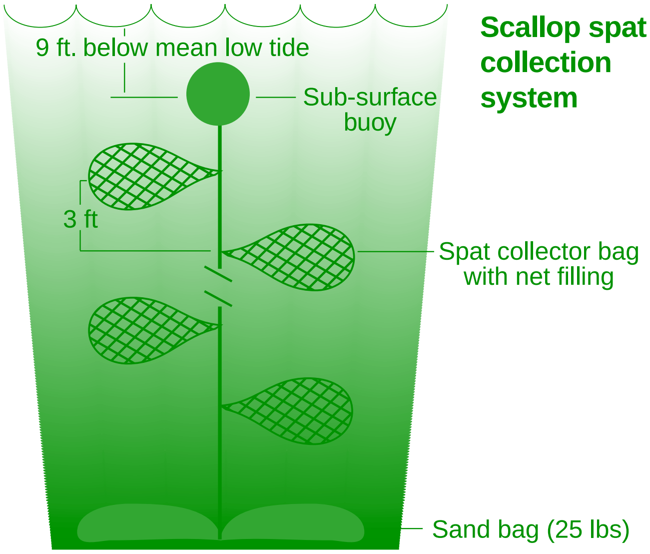
The muscle from the large scallop is in great demand and commands a high price, selling for over $2 per pound at the wholesale level. Because of these attractive features, several farmers have permits to culture scallops. Four scallop species have aquaculture potential. Of these species, the weathervane scallop attracts the most attention since it grows to a marketable size muscle. Unfortunately, weathervane scallop spat are not available because shellfish hatchery technology has not been successful in producing spat.

While wild spat collection, has been

Growth of Pacific Oysters in 5 Locations



*The PWS data are not extended to November because oysters reach market size by April



Scallop spat collection system

successful in capturing the Japanese scallop spat, it has not proven successful for capturing weathervane scallop spat. The growth rate for wild weathervane scallop is slow. While the growth rate of farmed shellfish often exceeds that of their wild counterparts, the potential growth rate for cultured weathervane scallop is unknown.

Culture of purple hinge rock scallop has promise because this species grows to a marketable size muscle. Spat can be hatchery produced, but since Alaska has no shellfish hatchery, this species is not currently feasible to culture. Collecting wild spat has been unsuccessful. Traditional shellfish culture gear cannot be employed to culture purple hinge rock scallops since one inch size scallops have the uncontrollable habit of cementing to a hard surface. The only way to remove scallops from the culture gear at harvest time is to cut them out, which distroys the gear.

Wild scallop spat collection has not been a total failure because of large incidental captures of pink and spiny scallop spat. Unfortunately, pink and spiny scallops do not grow large enough to produce a marketable size muscle. Farms currently culturing these species hope to develop a whole scallop market. Although very good quality, and easy to culture, whole scallops can retain more PSP toxin than is accumulated in the scallop muscle alone. Because of high PSP levels, there have been no sales of whole scallop. High PSP is most likely a site or season associated problem and not a measure of the tendency of whole scallop to retain the toxin. Whole scallops are sold alive and because of their short shelf-life, require prompt sale to the consumer or holding in live tanks for extended storage.

Littleneck clam

Littleneck clams, also called steamer clams, are a very popular seafood that sells for a good price, ranging between $1.95-$2.75 per pound at the wholesale level. Littleneck clam culture differs from other bivalve species because they grow on the bottom mixed with the existing wild population of clams. Clam farming begins with a survey of the beach to determine the current population size of resident clams. If a beach is found to be underutilized, clam spat are planted on the beach to bring the population size to the optimum level. The plot is then covered with net to prevent predation. Growth rates for littleneck clams are slow in the northern latitudes requiring up to 6 years for a crop to reach market size of 1-1/2 to 2 inches in length. Littleneck clam culture also requires a shellfish hatchery to produce the spat.

Seaweed

Seaweeds have several useful purposes: human consumption, food for other cultured marine animals (abalone and sea urchins), and for the herring spawn on kelp industry. In recent years, studies in Alaska have concentrated on techniques to culture the giant kelp *Macrocystis* for the herring spawn on kelp fishery in Prince William Sound.

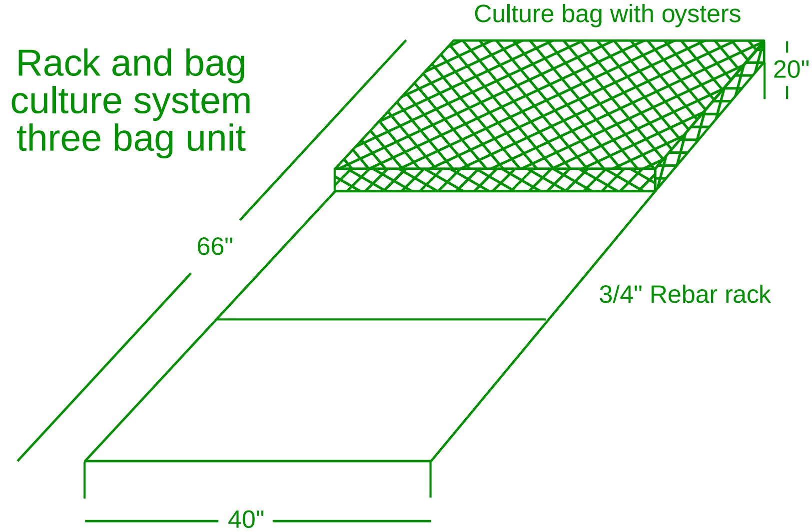
Kelp culture involves four phases, collecting pore producing blades (sporophylls) from the wild, artificial reproduction in the laboratory, culture of the young plants (sporophytes), and culturing the plants to marketable size at the farm site. A pilot research project sponsored by the University of Alaska, the state of Alaska, and Japan was successfull in collecting, reproducing, and planting young giant kelp sporophytes at a farm site near Sitka, Alaska. Although experimental results showed promise, no commercial kelp culture facility is currently available to produce kelp sporophytes for aquatic farming.

Other species

Abalone commands a very high price with wholesale prices reaching $9.50 per pound, but culture of the Alaska pinto abalone is not currently feasible because no spat are available

History *continued on page 5*

Rack and bag culture system three bag unit



Glossary of Shellfish Aquaculture Terms

Spat - A juvenile bivalve immediately following the free living larval stage. At this stage the larva attach to a preferred substrate and then metamorphose into their adult form. Bivalve spat are often refered to as seed when they reach 3-20 mm in length. At this stage the spat are cultured on the farm.

Suspended Culture - A shellfish culture technique where the shellfish are suspended individually or in cages attached to a floating structure such as a raft or buoy. An example is long line, lantern net culture.

Shellfish Transport Permit - A permit required by the Alaska Department of Fish and Game for a person to move or possess live shellfish for purposes other than harvesting for consumption.

Off Bottom Culture - A shellfish culture techniques where the shellfish are supported individually or in cages from a structure anchored to the bottom. An example is rack and bag culture.

Shell-stock - The entire bivalve including the shell and internal tissues.

Shell-stock shipper - Shell-stock shippers grow, harvest, buy or sell shell-stock. They are not authorized to shuck shellfish or to repack shellfish once received from shellfish farmers.

Bivalves - A group of animals characterized by having two shells. Examples are: clams, oysters, mussels, and scallop.

Bivalve larva - An early live stage immediately following egg fertilization where the bivalve is in a microscopic larva form.

Eyed larva - A later part of the larva stage where the shellfish develops a light sensitive organ, referred to as the eye, then begins the process of crawling on the bottom in search for a place to set.

Setting - The process where a bivalve larva ends its larval life by attaching to a substrate to begin its adult life form.

Remote setting - The process a shellfish farmer can use to produce spat using eyed larva purchased from a shellfish hatchery. It involves providing a saltwater tank with ideal conditions for setting,adding the larva to the tank and rearing the new spat in the tank until large enought to stock the farm.

Hardening - A process used by shellfish farmers tostrength the adductor muscle of oysters, the muscle used to keep the shell closed. Oysters grown in suspended culture have a weak adductor muscle. Planting oysters in the intertidal zone, permits them to be out of water for a period of time each day causing the adductor muscle to strengthen. A strong adductor muscle helps to keep the shell closed during transportation and storage.

Dry Storage - A refrigerated, shellfish holding facility that is required to store shellfish after harvest and during the time period when tissue samples from the harvested shellfish are being tested by the Department of Environmental Conservation for paralytic shellfish poison toxin.

History *continued from page 4*

Abalone grow slowly and are expensive to feed. An abalone farmer should consider including seaweed culture as part of the farm operation to assure a constant food supply.

Sea urchin culture has generated some interest in recent years because the inconsistency of gonad quality obtained from harvested wild populations severely hampers development of a stable market price. Culturing urchins may help to eliminate this problem, but has not been explored in Alaska to date.

The future

Although growing at an unprecedented rate, modern shellfish culture in Alaska is in its infancy. The industry is so new that many farms have not yet produced their first crop of shellfish. At this stage of growth, the industry desperately needs a shellfish hatchery to supply a secure source of oyster spat, and develop additional species to diversify farm production. Several shellfish hatchery proposals are currently being investigated by the state of Alaska and private industry; hopefully, a hatchery will be in production soon.

With the increased number of farmers, several signs of positive change are evident in the shellfish culture industry. Alaska farmers are working more cooperatively. Research and development in Alaska aquaculture are increasing. Marketing efforts to sell Alaska culture products are beginning to show results. Hatchery proposals are being pursued. A number of coastal communities are now funding aquaculture ventures or seriously looking at shellfish aquaculture to add economic diversity. Within a few years, millions of oysters and thousands of pounds of other Alaskan cultured shellfish should be ready for market.

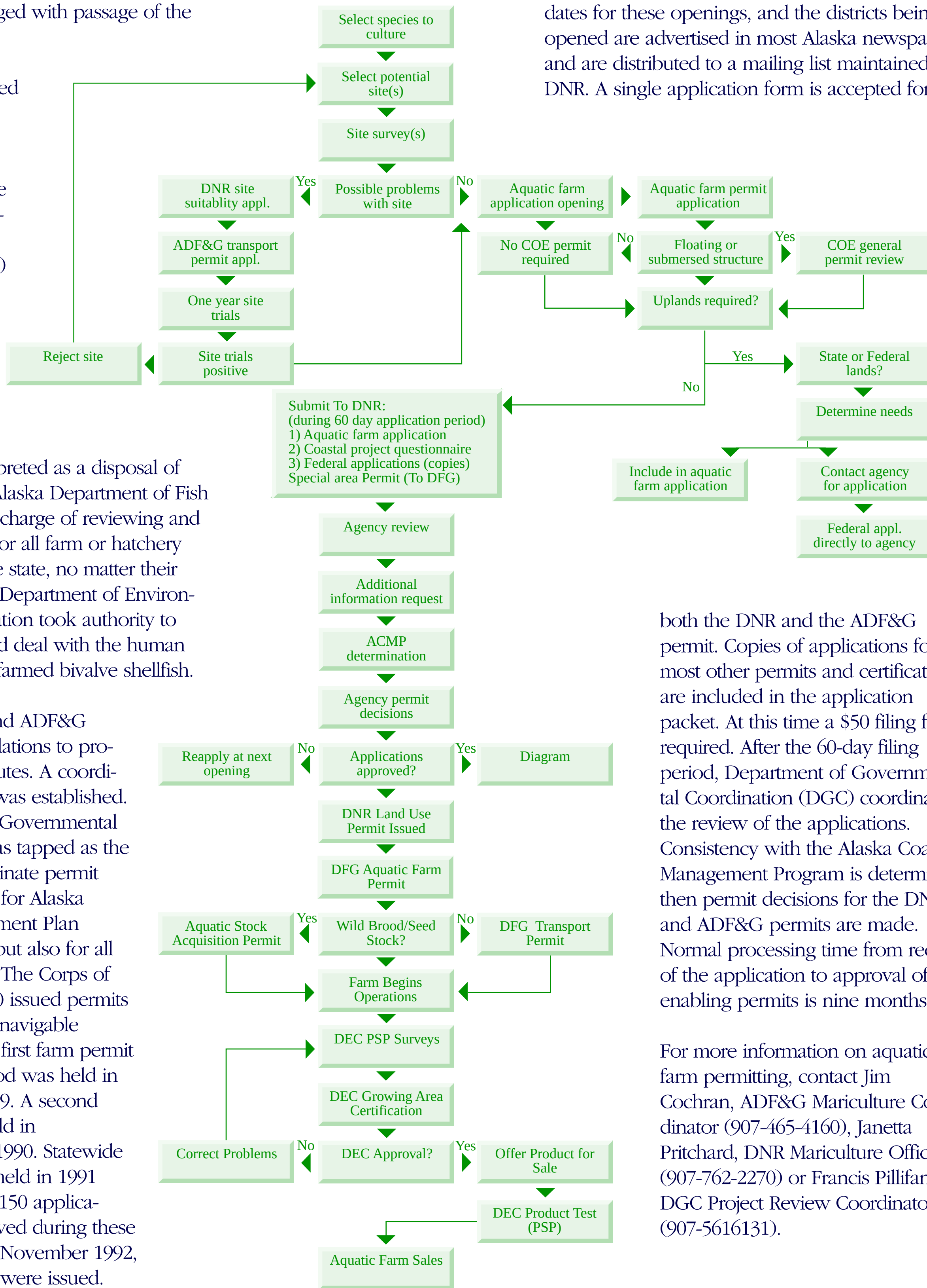
National concern about seafood quality only helps fuel interest in Alaskan aquaculture. We have an opportunity to learn from the mistakes made by other aquaculture ventures, maintain the purity of our coastal waters, apply existing information to solve problems constraining the industry, and employ the energy from participants to produce the finest quality shellfish available for the seafood market.

Aquatic Farm Permits

by Jim Cochran

In 1988, the Alaska legislature approved an act that formalized the farming of shellfish and aquatic plants in the state. Prior to 1988, farmers had existed in a tenuous world of make-do permits and, in some cases, no authorizations at all. That changed with passage of the aquatic farm act. This legislation specifically formed a program for shellfish and aquatic plant farming. On state land, the Department of Natural Resources (DNR) was identified as the lead agency because the aquatic farm permit could lead to a lease which was interpreted as a disposal of state land. The Alaska Department of Fish and Game took charge of reviewing and issuing permits for all farm or hatchery operations in the state, no matter their land status. The Department of Environmental Conservation took authority to issue permits and deal with the human health issues of farmed bivalve shellfish.

In 1989, DNR and ADF&G formulated regulations to promulgate the statutes. A coordinated program was established. The Division of Governmental Coordination was tapped as the agency to coordinate permit review not only for Alaska Coastal Management Plan (ACMP) issues, but also for all agency permits. The Corps of Engineers (COE) issued permits for structures in navigable waterways. The first farm permit application period was held in Southeast in 1989. A second opening was held in Southcentral in 1990. Statewide openings were held in 1991 and 1992. Over 150 applications were received during these openings. As of November 1992, 72 farm permits were issued.



Applications for aquatic farm permits on state land (for tide and submerged lands, this is the area between mean high water [MHW] and the 3-mile limit) must be received by DNR during an annual 60-day opening. Announcement of the dates for these openings, and the districts being opened are advertised in most Alaska newspapers and are distributed to a mailing list maintained by DNR. A single application form is accepted for both the DNR and the ADF&G permit. Copies of applications for most other permits and certifications are included in the application packet. At this time a $50 filing fee is required. After the 60-day filing period, Department of Governmental Coordination (DGC) coordinates the review of the applications. Consistency with the Alaska Coastal Management Program is determined, then permit decisions for the DNR and ADF&G permits are made. Normal processing time from receipt of the application to approval of the enabling permits is nine months.

For more information on aquatic farm permitting, contact Jim Cochran, ADF&G Mariculture Coordinator (907-465-4160), Janetta Pritchard, DNR Mariculture Officer (907-762-2270) or Francis Pillifant, DGC Project Review Coordinator (907-5616131).

Quality of Alaska Shellfish

by Raymond RaLonde

National concern about seafood quality is on every shellfish farmer's mind. An important part of this concern is the fact that the Alaska aquaculture industry is particularly sensitive to this concern since 85percent of all seafood illness is caused by eating raw seafood and the primary market for Alaska oysters is the half-shell oyster that is often eaten raw. In Alaska, assurance of seafood quality is the responsibility of the Alaska Department of Environmental Conservation (DEC). Bacteria counts found in raw shellfish tissue are indicators that DEC uses in its sampling program to check the quality of shellfish.

Two types of bacteria counts are monitored by DEC, fecal coliform and total bacteria. Fecal coliform bacteria are a part of the non-pathogenic natural flora found in the intestinal tracts of mammals. Fecal source pollution can be a serious problem since eating contaminated shellfish can cause some serious human illnesses. Total bacteria counts indicate the care given shellfish during processing, transporting, and storing. Generally, lower bacteria counts indicate better care and ensure a longer storage. Unfortunately, monitoring occurs at the wholesale level. Accompanied with a lengthy laboratory procedure, results of monitoring may not be available until after the shellfish are consumed. The past record of testing may be only sure to judge the quality of shellfish.

The Food and Drug Administration (FDA) sets the standards for bacterial contamination of seafood. For shellfish the standards are 230 fecal coliform bacteria per 100 grams of tissue and 500,000 total bacteria per gram of tissue. As you can see in the figure Alaska has consistently shown a superior record of compliance with FDA standards.

Results of wholesale level bacteria counts of shellfish since 1989

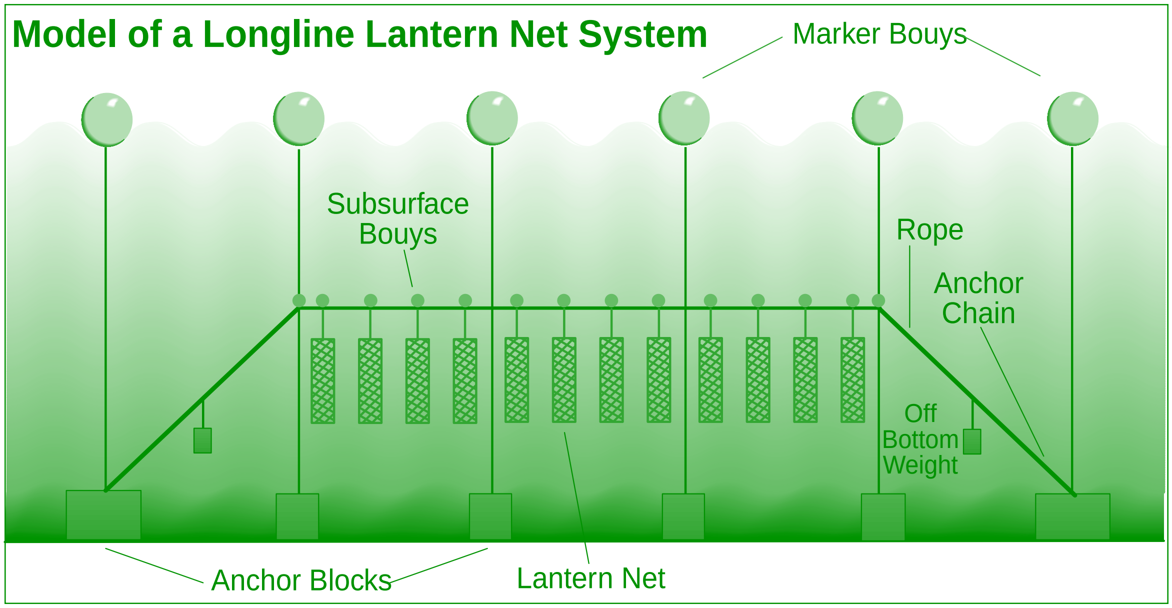
Year	Alaska		Imports into Alaska	
	Compliance	Violations	Compliance	Violations
1989	1	0	54	24
1990	12	0	55	8
1991	12	0	54	7
1992	12	0	20	2

NOTE: Products sampled were clams (other than razor clams or geoducks), oysters, and mussels. Data provided by the Alaska Department of Environmental Conservation.

You are probably wondering "How can I tell if the seafood I buy at the retail market is high quality and safe?" Actually, there is no sure way to determine if seafood is safe to eat, but for bivalve shellfish, there are some characteristics that will help you determine quality.

Shellfish should be stored in a moist environment at a temperature of less the 40ºF. Cold temperature slows bacteria growth and the metabolic rate of the animal. When live bivalve shellfish are purchased, the shells should be closed, or close when you snap the shell with your finger. If shells are gaped, the animal may be dead, and you have no way of knowing for how long. Also look at the entire batch of shellfish displayed. If several shellfish are gaped, this may indicated that even the closed shellfish may be in poor condition. The liquor, fluid that drains from the shell when opened, should be clear. Milky, soft tissue may be an indication of spawning condition or decomposition. An opened shellfish should smell clean and fresh, not like rotten eggs. Shellfish should be refrigerated as soon as possible after purchase, and do not eat shellfish that have gaped shells.

The Alaska shellfish culture industry is continuing to focus on safety and quality. As a consumer, you can assist the quality assurance issue by buying only high quality seafood from your retail outlet.



This is an example of one type of lantern net longline system used to culture oysters or scallops

Commercial Oyster Farm Part of Students' Aquaculture Training

by Jack Eddy, Instructor

After years of operating a successful pink salmon hatchery, the aquaculture students at Petersburg High School, located in South-east Alaska, became pioneers in a student operated commercial shellfish farm.

The purpose of the project is to provide "hands on" opportunities for aquaculture students in shellfish culturing, research and marketing techniques.

During the summer of 1989, the instructor conducted shellfish and plankton research in the Wrangell Narrows and ad-joining areas. The proposed school farm site was found to be quite productive in nutrients required for shellfish growth.

In the fall of 1989, the high school aquaculture program received approval from the school administration and the vocational advisory board to begin the permit application process.

The high school students were involved in the process from the beginning. They helped in the project planning, permit applications, and equipment ordering. In the fall of 1990, the high school received the appropriate permits.

The aquaculture class, in cooperation with the high school shop class, constructed rebar oyster racks and set them up on the school farm.

In May 1991, the class put 42,000 Pacific oysters, *Crassostrea gigas*, on their site.The school farm is an educational/experimental farm as well as a commercial farm. Half of the oysters were placed in lantern nets on a suspended line/buoy system. The remaining oysters were cultured in cages on beach racks. The students monitored the growth rates between the two methods, and they found initially the suspended culturing method provided slightly better growth opportunities.

The students put an additional 12,000 oysters on the site in the spring of 1992. They continue to try different culturing methods and monitor and record the results.

Marketable oysters are currently being harvested from the school farm site.

The shellfish farm project was initially funded by a state grant for vocational education. It is now in the process of becoming a self-sustaining business. Profits from the commercial venture are utilized to maintain the farm project and to hire students to work on the farm during the summer. Excess revenue will be used to establish a scholarship for students interested in aquaculture, biology or a related field. It is planned that the first scholarship will be given to a member of the 1993 graduating class.

Oyster Farm *continued on page 9*

Costs of Construction

Shellfish aquaculture can be expensive. Costs of construction and operation will vary for each farmer depending on the amount of resources the farmer has available. Each farm will require a boat, a place to live, transportation costs (which vary according to the remoteness of the site), and varying operation costs. There are, however, some costs that are relatively standard for each farm.

Permitting and tidelands use fees:
- Filing fee $50-$100
- Cleanup bond to be posted $1000-$1500 up to 5 acres
- Tidelands use fee $250 for first acre and $100 for each acre over 1 acre.
- Lease appraisal fee (only after 3rd year and required to meet production level $800 for 1-7 acres 1000 for 7-15 acres and an additional $85 for each acre over 5 acres).

Oyster spat (Oyster seed):
- Oyster spat $15- $20 for 1000 spat

Lantern net culture:
- Lantern nets $30-$40 (capacity of 500-700 marketable oysters)
- Buoys $6.50 for 15", $50 for anchor buoys
- Mexican trays for small spat (800 spat/tray) $9
- Pressure washer for removing fouling $350 to $400
- Working raft $3500 to $5000
- Anchors $200-$300 each
- Dark sea trays (substitute for lantern nets) $75
- Rope for longline (3/4 - 1" diameter at $.23-$.40 per foot)

Rack and Bag Culture (capacity of 400-450 marketable oysters)
- Rack to hold 3 bags made of 3/4" rebar $26-$30
- Three bags at $3-$4 each

Sea Farming Alaska Style

by Don Nickolson

In many ways farming oysters is no different than any other type of farming, whether it be raising chickens or growing tomatoes. To achieve a marketable crop involves orchestrating a diverse set of variables. Doing this in Alaska's coastal environment adds to the challenge.

Don Nickolson inspecting surface trays of oysters. Don started his farm with surface tray culture in 1978 and later changed to lantern nets.

Basically, the year is divided into two segments-one, when the oysters are growing full bore (the growing season), second, when the oyster growth slows down. All of our activities are scheduled around this annual cycle.

In early spring as the hours of daylight increase (but not necessarily the amount of sunshine) the major activities are preparing for the growing season. Flotation devices need repairing and culturing gear cleaned. This is also the time to plant the new crop—spat, as they are called—small oysters about 7-8mm in length, which will become increasingly demanding for attention and handling as the months go by. Also, repair of motors and boat maintenance are better taken care of now. I have duplicates of every motor and machine, including all three outboards, spare boats, and lots of replacement parts. There is no harsher environment on earth for machines than salt water. By May the fun really begins. Everything suddenly needs attention. Gear that has been beached needs to be refloated. This is midnight work as this is when the big tides occur in the Spring. Oysters in all stages of growth have literally exploded—doubling or tripling in size—squeezing into every available square inch of culturing gear. As I frantically run from one project to the next I don't really notice that I'm only getting 4 or 5 hours of sleep every night. Our work week involves about 2 days of harvesting market size oysters, 2 days of working on intermediate sizes, and 5 days of thinning babies, as the babies double in size every 3 weeks or so. Swatting no-see-ums is full time.

This is our summer program, oyster, oyster, oysters. Also, at this time all the cute little critters of the sea make a point of propagating themselves and establishing homesites on all of your submerged gear. Boat bottoms are a favorite with the barnacles, nets and plastic trays are perfect for sub-tidal tunicates, and those tiny black specks plastered everywhere will soon become inch long mussels. You think you've got weeds in your garden - you ought to give this a try.

Finally, its Fall and Sharon and I take a break. After ten minutes, we prepare to spend the next 4 months catching up. We give the babies (now a strapping 3 inches long) one last thinning and diaper change before settling in for the winter. Harvesting still continues, 2 days of every week, not only for cash flow, we need space for the next crop. You've heard the saying "Jack of all trades master of none" —in all my long years of Alaska style oyster farming I've mastered one—Perseverance.

Oyster Farm *continued from page 8*

Educational goals for the program are to provide opportunities for students to participate in gathering and recording scientific data, practice aquaculturing techniques, maintaining business records, developing markets, and in general obtaining skills and knowledge applicable to the seafood industry, other businesses and the biology field.

The students work quite hard and feel an ownership in the project.

Brian Paust, the Marine Advisory Agent in Petersburg, has been a valuable source of information and assistance for the high school venture.

Is Aquatic Farming in Alaska for You?

Shellfish aquaculture is a rapidly expanding industry in Alaska. Before 1988 there were a few shellfish farms located in southeastern Alaska, but since passage of the 1988 mariculture legislation by the Alaska legislature, applications for aquatic farms have mushroomed to a point that by the end of 1992 there will be 72 permitted aquatic farms.

Aquatic farming is, however, a risky profession. Like other forms of farming. aquaculture involves considerable investment of capital, labor, patience, and good business practice to succeed. If you are considering shellfish aquaculture, this checklist can help you determine whether aquatic farming is feasible for your particular situation.

This checklist does not consider all possible questions that you need to ask yourself, nor is answering "yes" to many of the questions a guarantee of success. The real intent of this checklist is to provide you a format to address the main problems you will be facing when entering an aquatic farming business: organizing and preparing a business plan. Even though a business plan is not required by the state of Alaska to obtain an aquatic farming permit, it is well understood by persons successful in aquaculture that one is necessary for success. This is a good place to start planning your business. If you have any questions that need addressing feel free to contact the University of Alaska Marine Advisory Program.

Yes No Marketing

☐ ☐ 1. Have you assessed the existing market for the species you have selected for market size, seasonal demand, customers, competition, and wholesale/retail price?

☐ ☐ 2. What is the product form you wish to market (live, shucked, value added)?

☐ ☐ 3. Do you have the equipment to harvest, process, store, and transport your product to market?

☐ ☐ 4. Are you familiar with the legal requirements to market your product?

☐ ☐ 5. Do you have a marketing strategy?

☐ ☐ 6. If your marketing strategy does not work, do you have a fall back strategy?

Economics

☐ ☐ 1. Have you developed a 3 to 5 year business plan?

☐ ☐ 2. Do you have monthly objectives, production schedule, and cash flow projections through the development stage and your first year in the market?

☐ ☐ 3. Have you determined the cost to construct your facility?

☐ ☐ 4. Have you estimated the yearly operational costs for your facility?

☐ ☐ 5. Do you have access to equipment or know suppliers for aquaculture equipment necessary to develop your site?

☐ ☐ 6. Do you have the necessary financial resources?

Yes No

☐ ☐ 7. Can you afford to wait 18-24 months for income until your first crop attains marketable size and can be sold?

☐ ☐ 8. Do you have adequate cash reserve for unanticipated costs (equipment failure, system modification, and crop loss?)

☐ ☐ 9. Have you inquired about insuring your facility?

Personal

☐ ☐ 1. Are you willing to work long, hard, and irregular hours (16 hours days, 7 days a week, at night)

☐ ☐ 2. Are you comfortable with mathematical problem solving, economic accounting, and marketing?

☐ ☐ 3. Are you willing to seek help when you need it?

☐ ☐ 4. Are you the type of person that works better independently than for someone else?

☐ ☐ 5. Do you have technical experience?

☐ ☐ 6. Are you mechanically skilled?

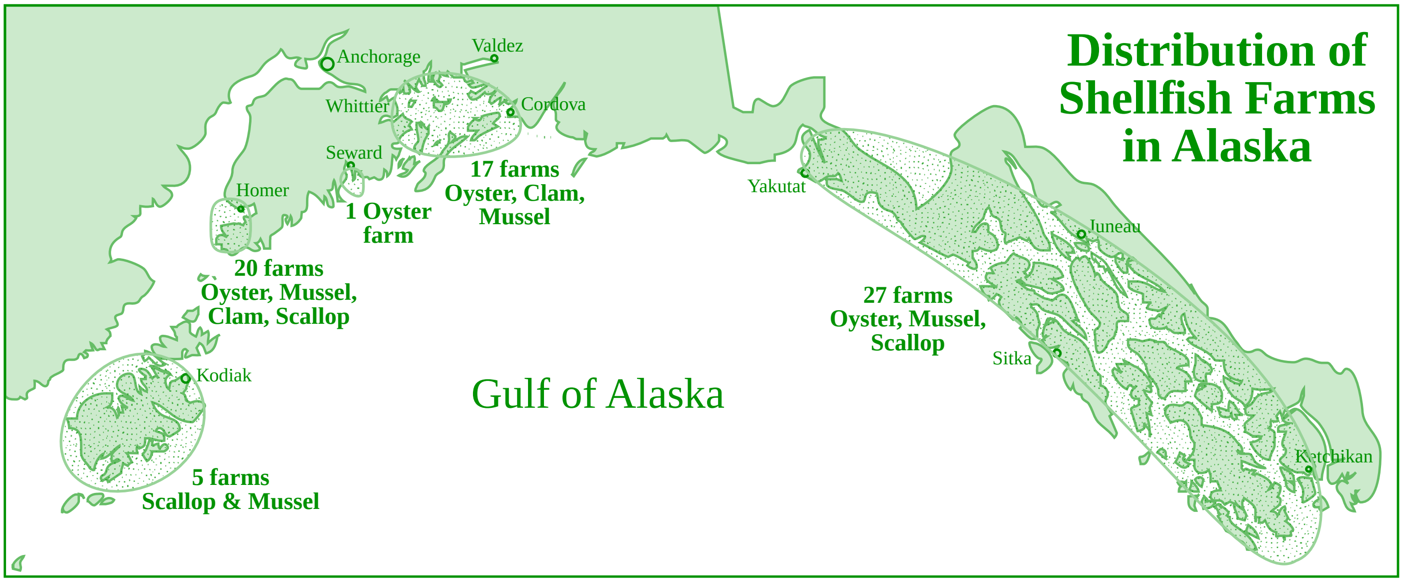
☐ ☐ 7. Do you know others in the business who will provide help and advice?

☐ ☐ 8. Are you a member of an aquaculture association?

☐ ☐ 9. Do you subscribe to and read aquaculture periodicals?

☐ ☐ 10. Are you willing to participate and pay the expenses to participate in workshops and short courses?

☐ ☐ 11. Does your family support your work?



Yes No Site and design

1. Does your site comply with the coastal zone management plan for your region?
2. Is it feasible to culture the organism you selected at the site?
3. Does the site have any potential sources of pollution in the area?
4. What form of transportation is available to your site.
5. What is the transportation expense for freight to and from your site?
6. Are utilities available to your site.
7. If no utilities are available, how are you going to provide them as needed?

Legal constraints

1. Do you know the regulations for tidelands use in Alaska?
2. Do you know the state and federal regulations for use of land if these agencies are the upland owner?
3. Will the upland owners, neighbors, or the nearest community object to your operation?

Yes No

4. Have you discussed your planning operation with local, state, and, if required, federal agencies that may be reviewing your permit application?
5. Have you requested an aquatic farm permit application from the Department of Natural Resources or the Department of Fish and Game?
6. Do you have the necessary data to complete the permit application, or a plan to obtain the data?
7. Have you estimated the expenses you may need to apply toward obtaining information to complete data collection for the permit application?

Production

1. Have you determined what species you want to culture and are there established culture techniques?
2. Do you have an idea of what culture technique you intend to use?
3. Do you have a dependable source for obtaining seed stock for your farm?
4. Are back up seed stock sources available?
5. Is there a trained experienced work force available in your area to assist with farm operation?

This fact sheet was adapted from *Is aquaculture for you?* by Frank R. Lichtkoppler and James M. Ebeling, Ohio Sea Grant

For a list of technical resources, organizations, and publications on aquaculture request *Bibliography of Mariculture Information Resources* from the Aquaculture Specialist at the Marine Advisory Program in Anchorage, Alaska.

*For current information, visit our website at www.uaf.edu/map/People.html

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Publication of Alaska Marine Resources is made possible through funding from the Alaska Sea Grant Program which is cooperatively supported by the U.S. Department of Commerce, NOAA Office of Sea Grant and Extramural Programs, under grant Number NA82AA-D-00044F, project number A/71-01; and by the University of Alaska with funds appropriated by the state.

Publisher: University of Alaska
Marine Advisory Program
Donald Kramer, Chairman
Donald E. Kramer

Managing Editor: Deborah Mercy
Technical Editor: Raymond RaLonde
Photography: Don Nickolson, Raymond RaLonde
Illustrations: Deborah Mercy

Subscription: To receive this publication send your name and address to the Anchorage office. There is no charge.

ALASKA'S MARINE RESOURCES

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