Small-Scale Oyster Farming
for Pleasure and Profit

AQUACULTURE SERIES

Terry Nosho

In recent years, Washington Sea Grant Marine Advisory Services (MAS) has received numerous inquiries regarding oyster farming. These have come from waterfront property owners, from entrepreneurs, and from owners of small oyster farms. It thus appears that up-to-date information on oyster farming would be useful to those interested in starting a small oyster farm, or in improving their existing operations either for their own pleasure or for commercial purposes.

This report provides basic information on species biology, state agency requirements for growing oysters, and commercial applications that can be adapted to small farm situations. There are other devices and techniques used in oyster farming that are not included in this report, but the material presented does describe proven commercial applications and should serve as a good starting point. Although most people are concerned primarily with siting, methodology, and economics, it is important to be aware that these are intertwined with biology. Successful farming will depend on balancing these aspects, being observant, using imagination, and following just plain common sense.

Oyster Species and Varieties

Oysters are widely distributed, inhabiting coastal waters everywhere except in the two polar regions. Worldwide, there are more than one hundred oyster species, three of which are cultured in Washington State. Two belong to the genus *Ostrea* and include the native or Olympia oyster *(O. lurida)*, and the Belon or European flat oyster *(O. edulis)* introduced from Europe. The third species, introduced from Japan, is commonly known as the Pacific oyster *(Crassostrea gigas)*. This species and its varieties form the most commercially important oyster group along the Pacific Coast of North America. The 1986 oyster production statistics for Washington show that nearly nine million pounds of Pacific oysters were marketed, compared to about 13 thousand pounds of

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all other oysters combined (Dale Ward, Washington Department of Fisheries, personal communication.)

Natural History

Members of the genus *Ostrea* are hermaphroditic—that is, they have both male and female reproductive organs. They first mature into males (in about one year). and then change to the female state after spawning. A regular alternation of sexes apparently continues throughout life. An animal with both sexual attributes developing simultaneously would be an extremely rare occurrence; however, the first stages of egg or sperm development may occur jointly with final development of mature stages. Olympia and Belon oysters are probably similar to other hermaphrodites in that they are incapable of self-fertilization. In *Crassostrea*, the oysters also develop first as males. After the first year, the population divides into males and females, usually with no further sex reversal occurring. However, an occasional hermaphrodite has been found.

Crassostrea oysters shed sperm or eggs into the water, where fertilization, hatching, and larval development take place. In Washington, this process occurs in mid-summer, when water temperatures reach about 70°F. However, with *Ostrea* type oysters, the males release sperm into the water, but the eggs are fertilized within the branchial chamber (space between the gills) of the female. The brood continues to develop for about ten days before being discharged into the water. During the brood stage, the larval mass becomes whitish, and this stage is referred to as the "white-sick" stage. As development continues, the larvae gradually darken, becoming first "grey-sick," and finally "black-sick." At this last stage larvae are extruded into the water in the late spring when high-tide water temperatures reach about 55° for Olympia oysters and about 65° for Belon oysters.

Once in the water, larvae become part of the plankton community and gradually undergo several changes. After three to four weeks, the larvae metamorphose to the juvenile form and are ready to settle on and attach to suitable substrates. At this time, oystermen place various kinds of material into the water to "catch" the larvae, in essence providing the young oysters with a home. This process is called "cultching." The catching materials are referred to as "cultch" and the recently settled oysters are known as "spat." Old shells from previously harvested oysters are commonly used as cultch.

Natural spawning and setting occur together periodically in Washington State waters. The best areas for collecting oyster spat are in Dabob and Quilcene bays, in Hood Canal, and in Willapa Bay. The yearly setting frequency, however, has always been unpredictable. In some years catches of oyster spat exceed 50 per shell, but in other years no spat is caught. Recently, oystermen have overcome this unreliability, to a large extent, by the use of setting tanks . These tanks of seawater are aerated, heated to favorable levels, and filled with bags of clean shell to catch the seed. Juvenile oysters at the eyed-larvae stage are purchased from a shellfish hatchery and added to the tanks. After a few days, the oysterman will have seed for the next crop of oysters.

Olympia Oysters

These are small delicate oysters that inhabit firm ground below the low tide line. They occur along the Pacific Coast of North America between 33 and 50 degrees north latitude. Olympia oyster shells are elliptical or oval in shape, and are generally a blackish shade on the outside and grey to pale blue on the inside.

Olympia oysters reach a maximum length of approximately 5 cm (2 inches) in about four years, and it takes about 300 oyster meats to make a pint. The Olympia is the original cocktail oyster, and its flavor has been described as peculiarly sweet.

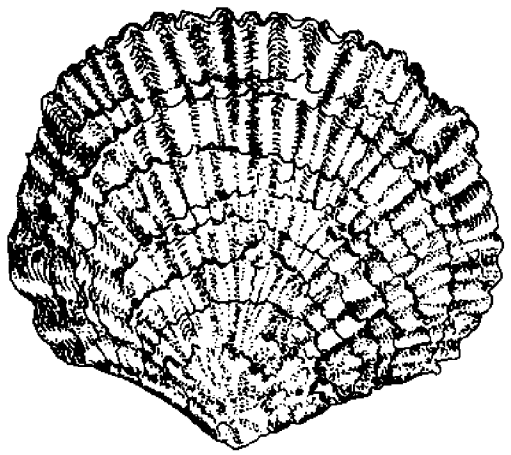
Oyster farming along the Pacific Coast began in southern Puget Sound at the turn of the century with the development of diking systems to cultivate Olympia oysters. The dikes were built with wooden floors, were filled with gravel, and were designed to retain a few inches of water to cover the oysters at low tide. These features were necessary to minimize siltation and to moderate temperature extremes. The dikes still exist, although many have been neglected and are used for other purposes, such as growing Pacific oysters or clams.

Olympia oyster

Belon Oysters

Belon oysters are native to Europe, occurring between 40 to 60 degrees north latitude. They inhabit grounds below the low tide line in places with cold

water of relatively high salinity. The shells are circular and the left valve is almost flat. In most areas, the oysters can grow to lengths of 10 cm (4 inches) in three to four years. However, a commercial grower in Wescott Bay, Washington, has observed oysters of harvestable size in two years. The meat of Belon oysters is a pale yellowish and/or greenish color, and some consider these oysters to be the most delicious of all oysters.



Belon (European flat) oyster

Pacific Oysters

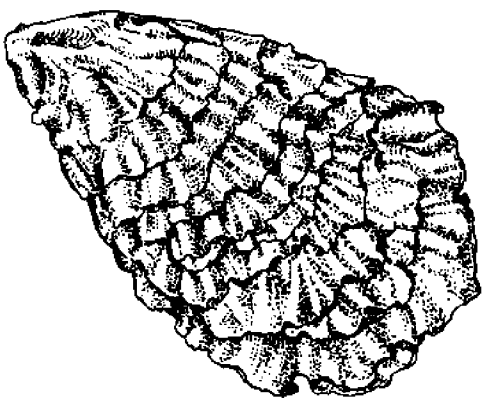
Currently, four types of Pacific oysters are commercially cultivated in Washington: Miyagi, Kumamoto (both originating in Japan); a hybrid Miyagi-Kumamoto that is referred to as a Gigamoto; and a neutered Miyagi oyster. A fifth type, Hiroshima variety, has been introduced into Washington, but it is not commercially farmed to any extent. Although all varieties grow and survive well in Washington, the Miyagi oyster, commonly known as the Pacific oyster, is by far the most intensively farmed, and it contributes to at least 99 percent of total production annually.

Pacific oysters are extremely hardy compared to *Ostrea*-type oysters. They grow rapidly, reaching lengths of about 4-6 inches in two to four years in most marine areas in Washington. If left to grow beyond that time, they will attain a considerably larger size. Because seed is generally available from a number of commercial sources, beginning growers should first try the Pacific oyster (see the Shellfish Suppliers List in the Appendix).

On the downside, prospective growers should also be aware that these oysters can periodically experience mass mortalities. Oyster growers refer to this as summer or heat kill, and stock losses of 70 percent or greater in a given year have been reported. Most scientists agree that the mortality stems from a combination of stress at or near spawning time, and high summer temperatures, followed by bacterial invasion. However, oyster farmers have learned to farm around this phenomenon by noting the following:

1. Mortalities occur predominantly on fat oysters.
2. Oysters two years and older are prone to mortalities.
3. Mortalities are heaviest in or near heads of bays.

Reducing air exposure time by transferring or growing oysters on lower ground, harvesting oysters at a smaller size, and/or avoiding heads of bays where water temperatures increase to higher levels will help to reduce or eliminate significant losses.



Pacific oyster

Beach Considerations

A tideland owner may wonder if oysters can be grown on his or her particular beach. Beaches vary considerably, of course, but some general observations may prove useful.

Ownership

First, owners should have legal assurance of tideland rights. They should check their deed, and if there is a question, they should contact either the Department of Natural Resources (DNR) in Olympia, or the County Assessor's Office. The Department of Natural Resources also leases state-owned tidelands for aquaculture activities, including subtidal grounds over which floating or hanging methods may be used.

Water Quality

The Department of Social and Health Services (DSHS), Shellfish Sanitation Program, or the local Environmental Health Specialist should be contacted for information concerning water quality in a particular area. Waters in the state are classified as

either Approved, Conditionally Approved, Restricted, or Prohibited. Oysters may be directly harvested for commercial purposes only from Approved growing areas. However, permission may be granted by DSHS to relay oysters from non-Approved (except Prohibited) areas to Approved areas. In this case, oysters must be maintained in the Approved area for a minimum of two weeks to cleanse themselves. Then the oysters will be tested for safety. The Department of Social and Health Services requires licensing and certification for all commercial farms (see section on legal aspects).

Ground Elevation

A good level to begin farming is the tideland between +3 and 0 ft relative to mean lower low water because this zone will allow for inspection and work during most low tide series. Furthermore, this level is below the barnacle line, a help in producing clean shells. In general, lower tidal levels provide for a little better growth and reduced air exposure during the warm summer months. However, they may also provide for increased opportunities for predation by starfish and crabs, especially red rock crabs.

Ground Type

Firm mud-sand is ideal as this type of ground can provide for bed culture or some type of off-bottom culture. In general, this kind of ground is indicative of calm waters not subject to scouring currents. It is most apt to be found in coves, bays, and heads of inlets.

Sandy ground suggests that the soil is unstable and is easily moved by waves and currents. Nearby eroding bluffs are frequently sources of sandy, coarse materials. This type of ground will require some anchoring or possibly use of the rack or tray method. Areas exposed to winds are also quite sandy.

Gravel to cobble beaches are indicative of heavy storm or current movement. These areas can provide for excellent growth, but planted oysters will very likely roll and move, particularly during windy periods. This movement may cause breakage of the outer edges of the shell known as the "bill," which is the new growth area of the shell. Also, oysters moved by waves and currents will tend to pile up somewhere downwind, and they must be moved back and respread. Generally, these kinds of beaches require some sort of anchoring, fencing, or bag method to contain the oysters on the property.

Growing Methods

Growers have the choice of producing single oysters or what is referred to as *shellstock*. Single oysters can be sold by the dozen in uniform sizes for the halfshell trade, whereas shellstock is sold to processors for opening and packing. Shellstock producers are usually paid according to the yield of meat obtained from one bushel of oysters, and the price will reflect the size and condition of oysters brought to the plant. One gallon of meat per bushel of shellstock is the industry yardstick. The number of oysters in a one gallon container is standardized for the entire industry (Table 1).

TABLE 1. FDA specifications for the number of shucked oysters per one gallon container.
***Indicates industry standards.**

SIZE	MORE THAN but	NOT MORE THAN
Large	0	64
Medium	64	96
Small	96	144
X-small	144	-
*Yearling	240	300
*Petite	300	400
*Cocktail	400	600

Source: Fishery Market News, National Marine Fisheries Service, Statistics and Market News, Seattle, WA

Bed Culture

This method of growing oysters involves little preparation or maintenance. It is done by placing cultched seed onto beds, then harvesting when the oysters reach appropriate size (most likely medium size). The best areas for this technique are protected bays or inlets with firm mud bottoms where currents and waves are not excessive.

As a rule-of-thumb, the cultched shell should be spread about every one to two feet to allow for adequate growth. The seed should be allowed to grow until oysters are about two inches long. This will result in clumping on the cultch. If there are too many oysters on the cultch, the oysters must be separated to reduce crowding and poor growth. This is accomplished by simply striking the base of the oyster clump with a metal object such as a railroad spike or hammer. Although many oysters will be lost in this process, it must be done. The end result will be an increase in yield because breaking reduces stunting and promotes individual oyster growth and fatness.

Each grower must learn how his ground will produce. In general, yields ranging from 800 to 1,000 gallons per acre can be anticipated. Certain grounds in Puget Sound have produced 3,000 gallons per acre. About 12,000 spat are needed to produce 20 gallons of medium-sized oyster meats. This means that 600,000 spat are required to produce at the rate of 1,000 gallons per acre. Seed are commonly sold by

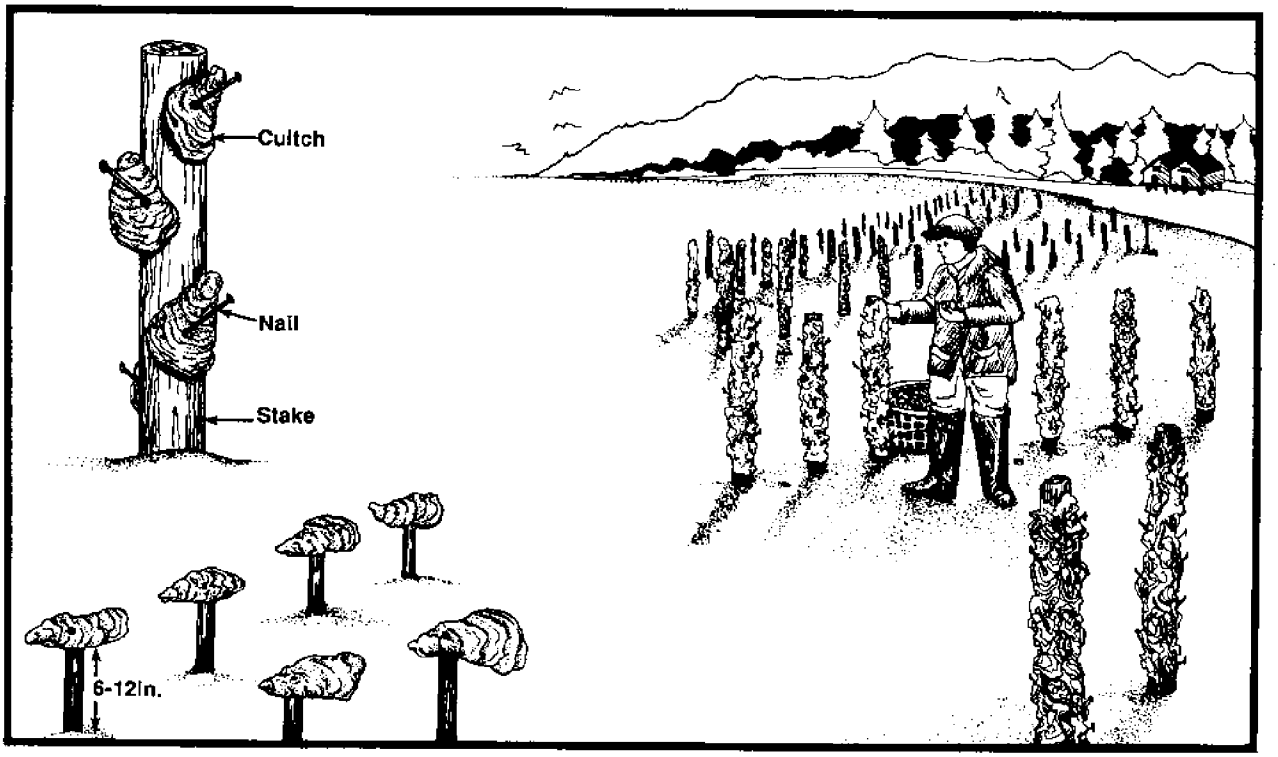


Figure 1. Stake culture of Pacific oysters

the shell-bag, and such bags are available in several sizes. Assuming that a bag contains 150 shells and each shell has 20 spat, the bag would contain 3,000 spat. In our example, we would need to purchase 200 bags per acre to attain the given planting rate. If yields begin to diminish, overplanting is probably the cause.

The price received for shellstock will be determined by the yield of meat at processing. For example, if the processor gets one gallon of meat for every bushel delivered, the grower will probably receive maximum price. In general, good plump oysters of medium size will receive the best prices. In recent years this has ranged from $9 to $12 per bushel FOB processing plant. With a delivery of 100 bushels which yields 100 gallons of meat, the grower may receive up to $1,200. However, if the yield from 100 bushels is only 50 gallons of meat, payment may be only $450-$600.

Stake Culture

This is a simple attachment method that can be readily adapted to most beaches (Figure 1). It is particularly useful in bay areas with extremely muddy bottoms or hard grounds unsuitable for bed culture. Basically, the procedure involves hanging oysters on precut stakes that are driven into the bottom. Stakes should be from 30-36 inches in length and should be driven to a depth of 15-18 inches to keep them in place. The top of the stakes should be at about the 3.0-ft tide level relative to mean lower low water. It is advisable to apply an acceptable wood preservative to the stakes. Cultch are hung on galvanized nails that have been driven in at an angle of about 45° before installation.

Smaller stakes extending 6-12 inches out of the bottom may also be used. In this case, one piece of cultch is attached to the top of the stake. Stakes should be installed about 2 ft apart in rows spaced to allow free movement during maintenance or harvesting.

Longline Culture

This technique involves spacing cultch equal distances apart on a premeasured length of rope or wire. Once strung, the line can be submerged off a dock, anchored on hard bottoms, hung on a rack, or elevated on stakes (Figure 2).

Wire lines should be used for the first three examples because wave action will severely chafe rope. The lines can be made using the following materials: 14-gauge galvanized wire, spacers made of PVC pipe or garden hose, and punched cultch. If the cultch is not punched, a hole can easily be made by a punch or drill bit. Cultch should be spaced 8-10 inches apart (Figure 3).

Elevating longlines in rows above the bottom with PVC pipe stakes is a successful commercial method pioneered in Grays Harbor near Westport, WA. With this technique, lines are made by inserting

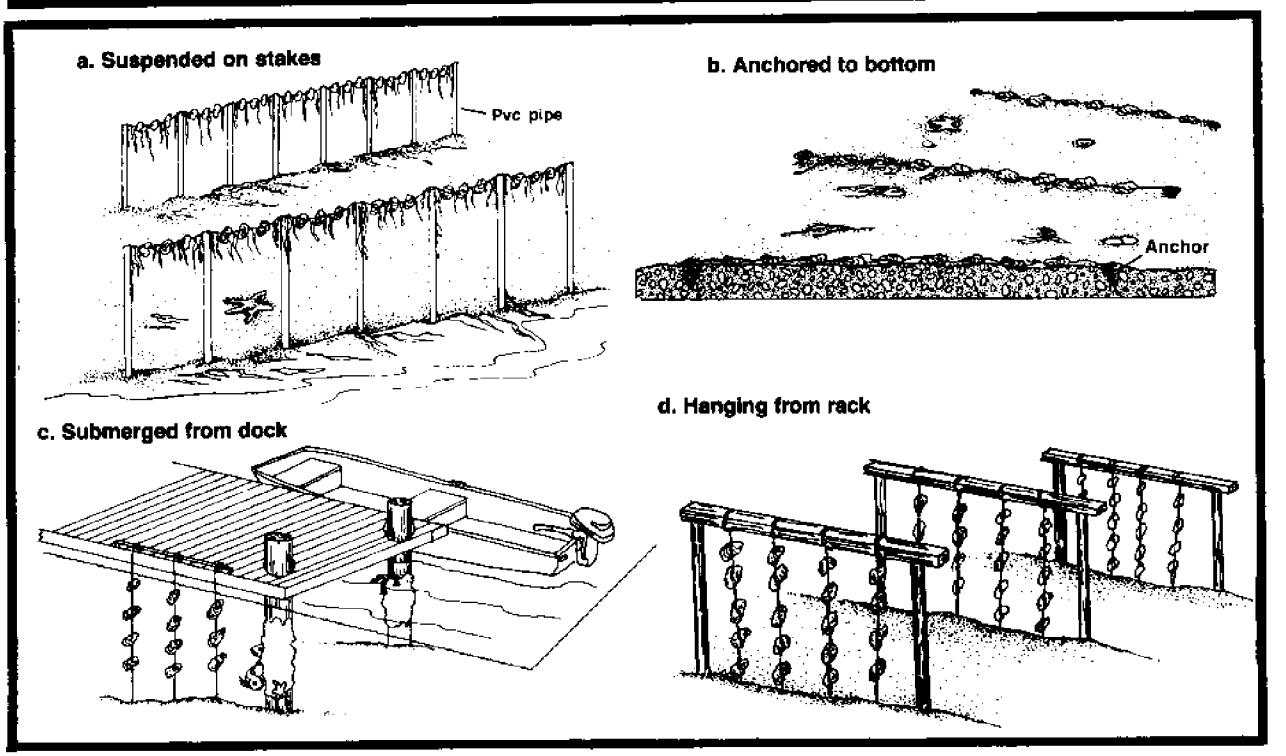


Figure 2 (a,b,c,d). Longline applications to grow Pacific oysters

cultch every 6-8 inches in 1/4-inch polypropylene laid rope. Stakes are cut in 30-inch lengths from 3/4- or 1- inch PVC pipe. The PVC pipe must be at least 200 psi or it will tend to shatter. The top of each stake is notched 1-1/4 inches with a power saw to insert and hold the line. Stakes are buried about halfway deep every 2 ft or so apart until the desired length of the row is attained. This spacing is required to allow for large weight increases from oyster growth. A bushel of oysters will weigh from 40 to 65 pounds, depending on size, when out of water. Rows are spaced 8 ft apart to allow for good growth. Ideally, the top of the stakes will be at the 1.0- to 3.0-ft tide level relative to mean lower low water.

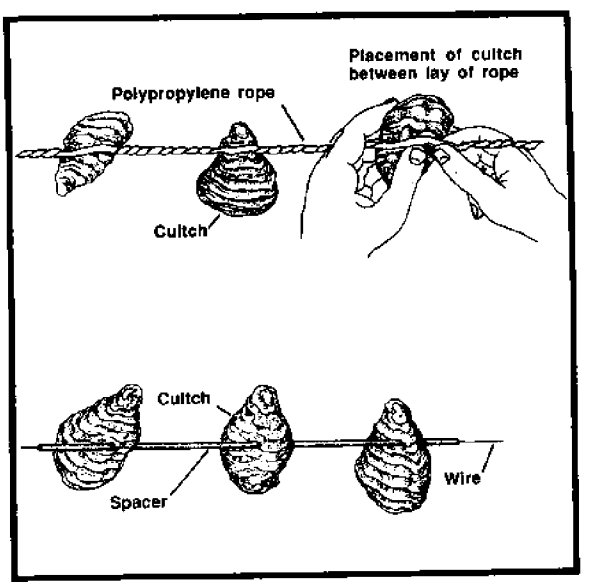


Figure 3. Basic construction of longlines

In general, off-bottom techniques such as the stake or longline methods described above offer several advantages over bed culture for the small farmer. First, grounds not suitable for bed culture can be put into production. Second, these methods provide for farms that can be maintained against starfish and red crab predation, thereby increasing overall survival. Third, the use of any one of these methods can result in substantially higher yields than bed culture on a per unit area basis; i.e., survival, growth, and fatness will be increased.

However, these methods do have some disadvantages. The most serious of these are potential damage from storms, fouling by assorted animal life and seaweeds, and greater potential for vandalism because of increased visibility. In addition, costs are higher than for bed culture because of the need to buy stakes, pipes, lines, etc.

Single Oyster Production

In producing single oysters, one may elect to use cultched seed or single seed. The former is readily available, whereas the latter can be secured only from certain shellfish hatcheries or nurseries. Cultched seed is usually available on whole oyster shell. In order to produce any amount of singles, the cultch must be broken after the oysters have grown about two inches. This procedure will result in the production of many singles, as well as doubles and triples. Advantages of the method are that costs are minimal compared to those of caring for single seed, a certain proportion of single oysters will be produced, and the clustered oysters can be sold as shellstock.

Specializing in producing single oysters requires purchasing single seed and growing them in trays, cages, or plastic mesh bags. Large losses occur if this type of seed is simply spread onto grounds. These devices, however, can be used in a variety of ways and on different ground types. They can be arranged on low-level racks, suspended from poles, hung from docks, used in floating culture, or simply tied down to the ground. Because the method chosen may depend on the particular county shorelines management plan, checking with the local jurisdiction (County Planning Office) is important in making the appropriate choice.

Seed is priced according to size, with the larger sizes being more expensive. Obviously, larger seed will result in faster crop turnover. A backyard farmer may wish to pay more so that the crop can be harvested within one year. Advantages of using single seed include: increased survival (80-90 percent can be expected); uniformity of size and shape; production of plump oysters of the highest quality; absence of processing; and rapid product turnover. Major disadvantages include a great deal more labor; added time expended in planning; extra costs associated with devices; and higher seed cost.

Rack and Bag Culture

This method was successfully introduced to Washington in Willapa Bay near Bay Center. Essentially it involves growing single oysters in polyethylene bags that are clipped to rebar racks (Figure 4), which are made to accommodate four grow-out bags laid side by side. The bags have 1/2-inch mesh openings and measure about 2 ft by 3 ft. They are kept closed by sliding a 1/2-inch PVC pipe, 300 psi, cut along its length, over the ends. Rubber straps or clips hold the bags to the racks.

Several steps are required in the growing procedure. First, small bags of 1/8-inch mesh should be used to nurse seed about 1/2 inch in size. Smaller mesh sizes will be required for smaller seed. These

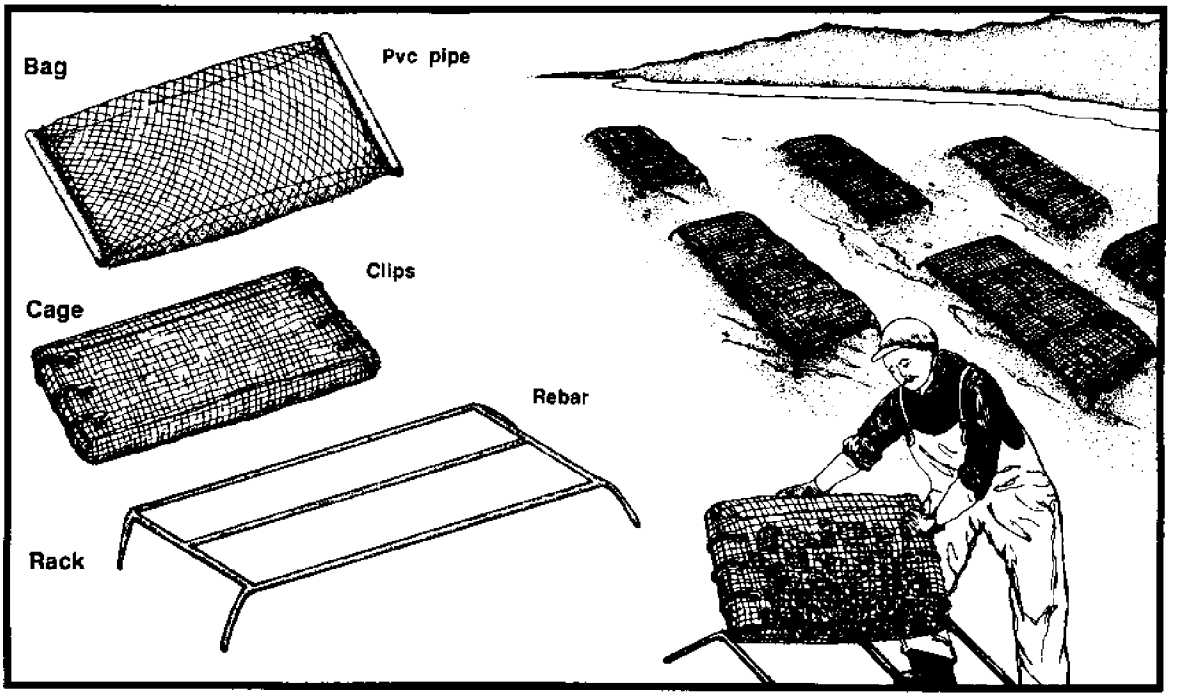


Figure 4. Rack and bag culture to produce single oysters

nursery bags can be inserted into the grow-out bags. The seed are allowed to grow until they can be transferred to a 1/4-inch mesh bag, which is then strapped to the racks. After a few months, the oysters will have grown enough to be placed in the final grow-out bags, at about 200 oysters per bag. The same method using polyethylene cages is also being employed. The main difference is that the ends are closed by clips rather than by PVC pipe. The oyster-filled bags or cages are turned over at about two-week intervals to reposition the oysters and to reduce fouling effects.

Floating Culture

In this method, oyster grow-out trays or polyethylene cages may simply be stacked on the floor of a sink float, or the stack may be suspended in the water column. Of course greater production levels per unit of surface area will result from suspension culture. If a float is used, one end should be tied to the anchor, and the other end left free. This will allow the float always to swing against the tide, providing for better circulation through the culture devices.

Floating culture requires considerable maintenance. During the summer months, oysters will be feeding at a maximum. This will result in a build-up of metabolites, which need to be removed on almost a weekly basis. When oysters are grown in dense concentrations, fouling is minimal. The oysters appear to be filtering everything out of the water. However, caution should be exercised as too dense a concentration of oysters will result in stunting and/or increased mortality.

In September, the oysters should be transferred to the beach. These oysters will have beautifully fluted shells that are extremely thin and brittle. The thin shells make the oyster susceptible to dehydration and temperature variations during transportation and in the marketplace, thereby reducing shelf-life. Because the adductor muscle is not as strong as that of oysters exposed to the daily tide changes, the muscle will weaken and cause the oyster to gape. Also, the brittleness of the shells makes opening difficult as they tend to shatter unless great care is exercised. Bedding the oysters will provide for hardening of the shell, strengthening of the adductor muscle, and additional growth.

Suspended Nets

Japanese lantern net culture has been adapted to growing single oysters in Wescott Bay, San Juan Island, WA. Essentially, the method involves suspending lantern nets (Figure 5) from an assembly of underwater longlines. This method involves a great deal of preparation and maintenance, but the backyard farmer who has access to a float or dock may find the technique very applicable to his needs. The desired number of lantern nets can simply be suspended from the dock or float with a rope bridle. If work is to be done by hand, each lantern net should consist of no more than five tiers because of weight considerations. This suspension method will produce oysters similar to those described in the previous section.

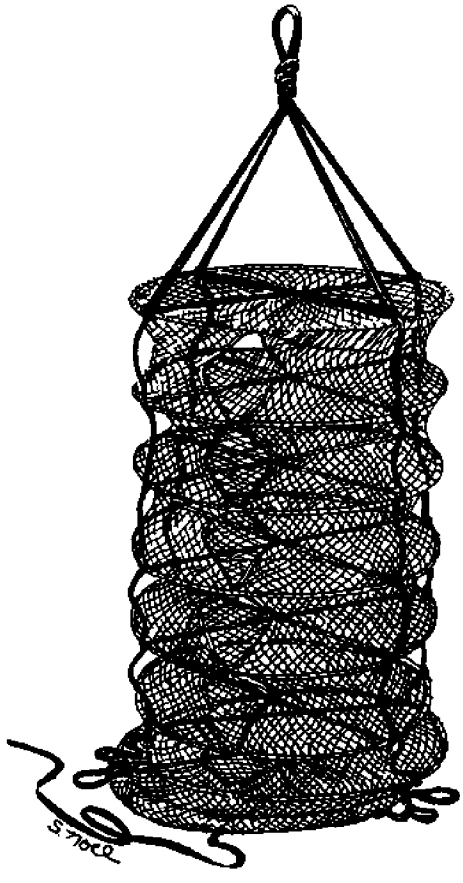


Figure 5. Lantern net for suspension culture

Legal Aspects

In April 1985, the Washington State Legislature declared aquaculture to be an agricultural endeavor, placing it under laws that apply to the advancement, benefit, or protection of the agriculture industry. The Legislature further declared the Department of Agriculture to be the lead agency. Currently, this agency provides a supportive framework and general marketing and promotional efforts for all aquaculture activities and products. Most licenses and permits, however, are the responsibility of other agencies. For convenience, the principal requirements

are itemized below, but prospective growers should contact each agency for further details to ensure compliance with current regulations. Not all of the listed licenses or permits may be applicable to a particular project.

State Agencies

Washington Department of Fisheries

1. Aquatic Farm Registration
   Contact: Licensing Division
   115 General Administration Building
   Olympia, WA 98504
   Cost: No fee

2. Shellfish Transfer Permit
   Required to move shellfish from beach to beach. Used to control the spread of disease, pests, or predators.
   Contact: Point Whitney Shellfish Lab.
   1000 Point Whitney Road
   Brinnon, WA. 98320
   Cost: No fee

3. Hydraulics Permit
   Required for floating structures such as rafts, or prior to any construction or modification work on or adjacent to a beach.
   Contact: Habitat Management Division
   115 General Administration Building
   Olympia, WA 98504
   Cost: No fee

4. Wholesale Dealers License
   Required only for companies handling products produced outside the state.
   Contact: Licensing Division
   115 General Administration Building
   Olympia, WA 98504
   Cost: $37.50 for license
   $2,000 performance bond

Department of Social and Health Services

1. Shellfish Operation License and Certification
   Required by all commercial shellfish operations: growers and harvesters; processors; wholesalers; repackers. Certification is required for growing area and product. The agency will inspect growing grounds and adjacent uplands, and will secure water and meat samples for coliform analysis
   Contact: Shellfish Sanitation Program LD
   Building 4, Airdustrial Complex
   Olympia, WA 98504
   Cost: Fees are prorated and vary according to acreage. (0-10 acres would be $110 annually.)

2. The agency further requires labeling and recordkeeping for all product units and shipments.

Department of Natural Resources

Aquatic Land Lease
Required for the use of state-owned tidelands.
Contact: Division of Marine Land Management
Public Lands Building
Olympia, WA 98504
Cost: Lease fees are established through competitive bidding or negotiation

Department of Agriculture

Identification of Aquaculture products
Required labeling and sale documentation to cover products produced by aquatic farmers.
Contact: Aquaculture Coordinator
406 General Administration Building
Olympia, WA 98504

Department of Ecology

One should check with this agency to determine whether it is necessary to apply for the following:
Statement of Consistency with Coastal Zone Management Act
Water Quality Certification
Water Quality Standards Modification
National Pollutant Discharge Elimination System Permit.
Contact: Aquaculture Coordinator
Shorelands and Coastal Zone Management
Lacey, WA 98504

County/Local Agencies

A check with the local shorelines permit administrator will determine exact requirements. A Substantial Development Permit may be needed if the project has a total cost or fair market value exceeding $2,500. The contact person is usually with the county planning department.

Federal Agencies

U. S. Army Corps of Engineers

Section 10 Permit—River and Harbors Act
Required for any structure that will be put over navigable waters, including piers, docks, piles,rafts, etc.
Contact: Regulatory Branch
P. O. Box C-3755
Seattle, WA 98124
Cost: $10 for private purpose structures
$100 for structures intended for commercial use. Fees are paid if the project is approved.

U.S. Coast Guard

Navigational Markings
Required for fixed or floating structures in or over water.

Appendix

Shellfish Suppliers

This list was compiled for the convenience of persons interested in growing shellfish on a small scale. Additional seed sources may be found by checking with other local clam and oyster farms. Also, needed materials may be handled by various marine hardware companies. Washington Sea Grant does not endorse any of the companies or products listed.

Seed

Coast Oyster Co. 1437 Elliott West Seattle, WA 98119 Attn: Bridget Cook tel: (206)281-4010	Pacific oyster seed- bagged shells, singles and eyed-larvae. Minimum order $100
Kuiper Mariculture, Inc. 3025 Plunkett Road Bayside, CA 95524 Attn: Ted Kuiper tel: (707) 822-9057	Pacific oyster seed - singles. Manila clam seed. Bay mussel seed.
Lummi Shellfish Hatchery 2616 Kwina Rd. Bellingham, WA 98226 Attn: LeRoy Deardorff tel:(206)647-6261	Pacific oyster seed - bagged shells, singles and eyed larvae. Manila clam seed. Minimum order-none.
Olympia Clams, Inc. 6331 Murray Court NW Olympia, WA 98502 Attn: Don Rogers tel: (206)866-7417	Clam farming kit -Instruction manual -Predator control netting -10,000 seed clams Price - $130
Pacific Mariculture P.O. Box 336 Moss Landing, CA 95039 Attn: Chet Belknap tel: (408) 633-3548	Pacific oyster seed - singles. Minimum order - $250.
Rock Point Oyster Co. 235 Chuckanut Drive Bow, WA 98232 Attn: Bill Dewey tel: (206)766-6002	Pacific oyster seed- bagged shells. Minimum order-none.
Taylor United 130 SE Lynch Rd Shelton, WA 98584 Attn: Dave Robertson tel: (206)426-6178	Pacific oyster seed- bagged shells. Available after July Minimum order-none; 60-day advance notice.
Tokeland Oyster Co. Box 533 Tokeland, WA 98590 Attn: Tom Rotta tel: (206)267-0122	Pacific oyster seed- bagged shells, singles and eyed larvae. Manila clam seed. and eyed-larvae. Geoduck larvae. Blue mussel larvae.
Wescott Bay Seafarms 4071 Wescott Drive Friday Harbor, WA 98250 Attn: Bill Webb tel: (206)378-2489	Pacific oyster seed-singles. Minimum order: 50,000 seed
Whiskey Creek Oyster Farm 2905 Bayshore Rd. Tillamook, OR 97141 Attn.: Lee Hanson tel:(503)842-8365	Eyed larvae of Pacific oysters Post-set Manila clam seed. Minimum order $100
Wiegardt & Sons, Inc. P.O. Box 309 Ocean Park, WA 98640 Attn: Lee Wiegardt tel:(206) 665-4111	Pacific oyster seed - bagged shells and shell strings. Minimum order-none during April-May period; 100 bag minimum other times of year.

Materials

Englund Marine 2080 Wilson Westport, WA 98595 Attn: Barney Tole tel: (206)268-9311	Oyster lay rope - developed especially for longlining.
Bill Nelson Co. 1549 N.W. 49th Seattle, WA 98107 tel: (206)789-9053	French clam and oyster grow-out cages and accessories. Norwegian grow-out trays. Plastic netting.
Norplex, Inc. 7800 S. 192nd St. Kent, WA 98032 Attn: Ralph Schley tel: (206)251-6050	Oyster and clam grow-out bags. Plastic netting. Oyster cultch netting. Mussel netting. Orange plastic safety net. Ladder ties and plastic bags.
Shoalwater Bay Oyster Co. 7525 44th NE Seattle, WA 98115 Attn: Randy Shuman tel: (206)523-2702	Mexican nursery grow-out trays.

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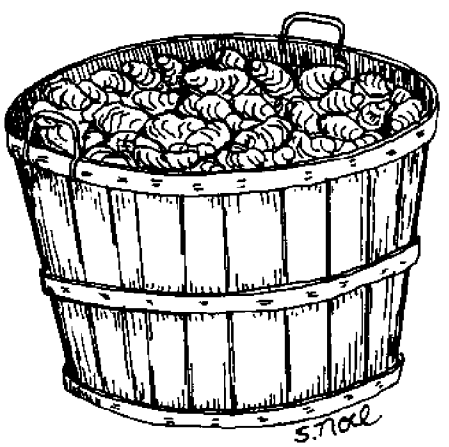
Terry Nosho is aquaculture specialist with Washington Sea Grant Marine Advisory Services. A graduate of the University of Washington, he has more than 20 years' experience with Washington's fishing and aquaculture industries. He coordinates educational programs, develops informational materials, and conducts applied research for both commercial and recreational aquaculturists.



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