

Example JARPA Language: On-Bottom Culture

Activity	Description
Timing	<p>Culture activities are generally tide-dependent but can occur year-round. On-bottom culture work may occur at any hour of the day or night for short periods of time, depending on the tides. During low tides, farm crews may be on the farm site for 3 to 6 hours before the tide re-floods an area. Activities may also occur at high tide when there is enough tidal inundation for a work vessel to access the farm site and may last up to 9 hours.</p>
Access	<p>Culture beds are accessed via work vessel or on foot at high and low tide. Work vessels that are used to transport farm crews, materials, and equipment to the farm site for low-tide work may either be anchored in a channel or deep areas during low tide or allowed to go aground. Once farm crews arrive at the farm site, culture beds within the site are typically accessed on foot.</p> <p>In limited areas, farm crews may access beds with an ATV. ATVs may be used to transport materials to and from the farm site from an upland location, as well as to conduct bed preparation and maintenance activities.</p>
Bed Preparation and Enhancement	<p>Bed preparation, if employed, is site-specific and may occur manually or mechanically. Manual bed preparation entails farm crews accessing targeted areas by foot at low tide to reduce irregular surfaces with a hand tool such as a rake and may disturb the sediment to a depth of 3 inches. Sediment disturbance from mechanical bed preparation activities varies by region due to bed conditions. In some instances, on-bottom beds are prepared for seeding using other mechanical farm implements. Other mechanical methods involve towing a farm implement, such as harrows, angle bars, or chains, behind a work vessel when the bed is submerged.</p> <p>Bed enhancement, if used, may involve the spraying of washed gravel or clean shell over the bed at a thickness of approximately 1 inch which may occur annually or after longer periods as needed. Bed enhancement activities are conducted by a work vessel when the bed is submerged, typically before the bed is seeded. A pump on the work vessel is used to withdraw water through a screened intake and to discharge seawater from the work area to wash the gravel or clean shell from the deck.</p>
Predator and Invasive Species Control	<p>Predator control techniques to protect crops include timing, passive exclusion, relocation, and removal. Activities may be timed, and crops may be planted during specific seasons or sited, to avoid predation. Use of transplanting oysters from “seed beds” to “grow-out” beds may allow farm crews to avoid predation. Once the oyster seed has grown larger, it is transplanted to grow-out beds where it may be more exposed to predators, but at a size large enough to better defend against predation.</p> <p>Predator exclusion techniques for on-bottom culture include the use of containment gear, such as bags to protect the crop. Mechanical bed preparation may also help manage the</p>

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	<p>invasive Japanese oyster drill in areas where drills are prevalent by removing the concentrated drills remaining after initial harvest. In limited instances, culture beds may be protected from predators using area netting that prevents predators from accessing the crop. When area nets are used, they are bundled together and loaded onto a vessel at high tide. At low tide, farm crews install area nets on the farm site. Nets are typically secured to the substrate with rebar stakes up to 30 inches deep along the perimeter of the net. Nets may also be secured using rope anchors with an end piece installed up to 5 feet deep. Area nets are made of materials designed to maintain their integrity in the marine environment and are installed in a square or rectangular configuration depending on the size of the culture bed. Nets sit flush on top of the substrate, so disturbance is generally limited to the top 1 inch of substrate (excluding rebar or rope anchors).</p> <p>Native shellfish predators may be relocated from farm sites to nearby areas. They include but are not limited to sea stars and moon snails. Invasive species including eastern oyster drill, Japanese oyster drill, and invasive European green crab may be removed.</p>
Seeding	<p>Farm crews plant seed directly on bottom at high tide by spraying seed off the deck of a work vessel with hoses or manually. Water intake lines for spraying with hoses are equipped with screens to prevent fish entrapment. At low tide, farm crews prepare bag-on-bottom areas for seeding by installing ropes on top of the substrate, which then attach to bags when the farm site is exposed. Ropes are secured using anchoring systems that may include rebar stakes, concrete anchors, or screw anchors. Rebar stakes are inserted 8 to 30 inches in the substrate. In some areas, farm crews manually or mechanically install rope anchors with an end piece at the bottom to better secure bags in soft substrate. In these instances, rope anchors may be installed up to 5 feet deep in the substrate. Concrete anchors are installed on top of the substrate. Screw anchors are typically installed up to 3 feet deep into the substrate but may be installed up to 8 feet deep.</p> <p>Seed is manually placed in ultraviolet (UV)-resistant reusable containment gear (such as plastic mesh net bags) and closed with secure ties. Seed is pre-loaded into the containment gear on the deck of the vessel and transported to the farm site. Farm crews then secure the loaded containment gear to ropes during low tide. Alternatively, farm crews may transport seed to the farm site at low tide and load the containment gear on-site.</p> <p>In some areas, farm crews manage naturally recruiting shellfish as part of an on-bottom culture bed. Farm crews may place shell or other seed-setting material in the bay in areas that naturally recruit to capture the wild set. If wild shellfish set on shell or seed setting material, they may be transplanted during high or low tide and redistributed to an on-bottom culture bed.</p>
Maintenance	<p>Culture crops are accessed regularly at low tide to perform maintenance activities, including inspection and inventory surveys. Culture ground may also be maintained by using mechanical farm implements such as a harrow to harden the shells of the crop. Harrowing</p>

	<p>also lifts shellfish out of the substrate in areas where the substrate is soft. Farm implements penetrate the substrate by up to 5 inches as they move along the bed.</p> <p>On-bottom and bag-on-bottom shellfish may be thinned or transplanted during their growth. Thinning and transplanting may occur by hand at low tide or mechanically at high tide. Bag-on-bottom shellfish may be transferred to bags at lower densities, a process called “splitting.” Shellfish may be manually or mechanically harvested for transplant. Bag-on-bottom culture requires regular maintenance at low tide. Bags are turned regularly by hand, typically once per tide cycle. Bags are also replaced if they become fouled with barnacles or other organisms. Material that washes onto the farm site such as coarse wood or unrooted algae may be relocated outside the farm site.</p>
Harvest	<p>Crops are harvested when they reach market size, which may be from 9 months to 6 years. A culture bed may be harvested in sequential years if there is a new crop to plant annually or may be completely harvested after a grow-out period. On-bottom and bag-on-bottom shellfish may be harvested manually or mechanically.</p> <p>Manual harvest for on-bottom shellfish entails a work vessel transporting harvest tubs to the farm site at high tide in the area where harvesting will occur. Tubs are equipped with buoys for retrieval by vessel at high tide. Farm crews manually harvest shellfish at low tide using a hand tool to place shellfish in harvest tubs or mesh sacks. Up to 6 inches depth of substrate may be disturbed during manual harvest.</p> <p>Mechanical harvest by vessel occurs using a basket that is lowered from a vessel by boom crane or hydraulic winch at high tide and drawn along the bottom to collect on-bottom shellfish. The baskets have a leading edge (blade) consisting of a steel frame with teeth and a steel mesh collection bag attached to the frame. A steel angled driving plate on the top of the device creates lift to pull shellfish up into the bag. Shellfish are unloaded from the basket onto the deck of the work vessel or into harvest tubs located on the deck of the vessel. Mechanical harvest may occur using 1 basket or 2 baskets simultaneously. Sediment disturbance from mechanical harvest varies by region due to bed conditions and ranges from 2 to 8 inches.</p> <p>Bag-on-bottom shellfish are frequently harvested using a work vessel equipped with a crane at high tide. Prior to harvest, at low tide, farm crews remove bags from lines, bundle them together, and attach a buoy line to the bundles. This activity may be conducted when the bed is completely dry or when there is 1 to 3 feet of water over the farm site. The bundles are then harvested at high tide using a work vessel with a boom crane or hydraulic hoist or emptied into tubs. Substrate disturbance from bag-on-bottom harvest is minimal and limited to farm crews walking on the farm site.</p>