Executive Summary

Taylor Shellfish Farms prepared this **Environmental Code of Practice (ECOP)** to ensure company operations are conducted in a manner that minimizes negative environmental impacts, maximizes positive impacts and demonstrates this organization's commitment to being good stewards of the tidelands. We believe this can only be accomplished through a comprehensive evaluation of the environmental impacts associated with the farming and processing of shellfish products in light of current trends in community and shoreline development, increased demand for limited resources, water quality degradation, changes in social/political attitudes, and increased regulatory scrutiny.

This document reviews practices conducted by Taylor Shellfish Farms and presents performance objectives that strive to minimize and/or mitigate current and potential environmental impacts. Strategies are identified to achieve each objective. Performance measures are listed a means of monitoring compliance and effectiveness of these strategies.

The company has developed many of its aquacultural practices as a result of innovative thinking and experimentation; and as such, continues to improve on many practices. Our goal is to establish a policy framework, through this document, that will help guide us in reviewing and minimizing the potential environmental impacts of our practices while not stifling innovation and the success of our operations.

For the most part, farming activities, as well as much of the company's other culture operations, take place on tidelands located in Washington State. Therefore this document focuses on issues relative to Washington State standards. This document does however provide an overview of the company's other national and international operations and their specific environmental initiatives.

*This is a living document to be evaluated and updated periodically by the **Environmental Code Task Force (ECTF)** and Taylor Shellfish Farms management.*

Company Overview

Taylor Shellfish Farms is the composite name for the five companies under Taylor United, Inc., the parent company. Taylor United, Inc. is a family held corporation established in 1969. These companies include Taylor Shellfish Company, Taylor Resources, Inc., Taylor Timberlands, Inc., Taylor Restaurants, Inc., and Taylor Finefoods, Ltd. Because of an increase in marketing and a demand for fresh seafood, a number of expansion efforts are underway and these companies have seen significant growth.

Currently, Taylor Shellfish Farms manages approximately 8500 acres of tidelands for shellfish culture in Washington State located in Samish Bay, Hood Canal, South Puget Sound, and Willapa Bay, a hatchery/nursery in Quilcene, and a hatchery/nursery in Kailua-Kona, Hawaii. See Appendix A for site maps.

A variety of shellfish species are currently cultured including:

Pacific oysters, Crassostrea gigas

Eastern oyster, *Crassostrea virginica*

Kumamoto oyster, *Crassostrea sikemea*

Olympia oyster, *Ostrea lurida*

European flat oyster, *Ostrea edulis*

Manila clam, *Tapes philippinarum*

Littleneck clam, *Protothaca staminea*

Geoduck clam, *Panope abrupta*

Blue mussel, Mytilus galloprocincialis

Diversification efforts, through research and development, continue to provide expanding market opportunities and will continue to be a focus for the company.

Management and Administration

Some practices are general and are required for all farms and facilities. This also includes administration and management activities that help build the foundation for accomplishing more specific environmental objectives. It is the policy of this company to dedicate the necessary resources to achieve the directives of this document.

Environmental Objective. Ensure all operations meet or exceed regulatory and environmental standards.

Strategies for achieving Environmental Objectives

◩ Review all statutes and agency rules against activities to ensure compliance.

◩ Periodically meet with farm managers to identify opportunities for conservation and protection of natural areas, functions and values on beaches they manage.

◩ Participate through company or industry representation on State and local policy panels, watershed groups, and other forums that promote environmental protection, especially water quality.

◩ Propose or support legislation that promotes environmental protection, especially water quality and aquaculture in general.

Environmental Objective. Promote company's environmental policies within the company.

Strategies for achieving Environmental Objectives

◩ Incorporate environmental policies into employee training and orientation.

◩ Provide incentives to employees for achieving environmental standards.

◩ Hold company managers accountable for non-compliance with environmental standards and policies. Incorporate environmental performance in annual job reviews.

◩ Make it a priority in the company budget to ensure adequate funding for implementing environmental policies.

◩ Provide environmental training in areas such as contaminated spill cleanup, bilge water disposal, and sewage disposal from boats.

Environmental Objective. Promote environmental policies outside the company.

Strategies for achieving Environmental Objectives

◩ Distribute this ECOP with promotional materials, at public forums and to resource agencies.

◩ Participate in fairs and festivals and other community activities that promote environmental protection or have an environmental theme.

◩ Educate consumers of the beneficial environmental aspects of purchasing farmed products. Provide tours of facilities. Provide educational materials at retail outlets.

◩ Taylor Resources managers conduct on-going communications with adjacent property owners to provide education and information of operations.

◩ Maintain company facilities orderly and litter-free.

Environmental Objective. Promote and support innovative practices and techniques that help protect the environment.

Strategies for achieving Environmental Objectives

◩ Reward employees for creating environmentally safe methods and techniques for operating equipment in the water. The use of vegetable oil as an alternative to other kinds of toxic or carbon-based hydraulic fluids is an example.

◩ Reward employees for implementing practices that will both improve environmental performance and profitability of the company. (e.g. finding a recyclable packaging that is cheaper, re-usable container for setting cultch, herring net clam bags to replace *Vexar*, 4-cylinder outboard engines)

Performance Measures for Management and Administration

- **Record of consultations with regulatory agency representatives**
- **Employee training records**
- **Budget allowance for environmental compliance**
- **Record of regulatory enforcement or compliance actions**
- **Record of fairs and festival participation**
- **Record of number of tours through processing plant**
- **Record of periodic and regular site inspections**
- **Record of complaints and communications from adjacent property owners**
- **Annual environmental performance review**

Hatchery, Nursery and Broodstock Management

Introduction. Taylor Resources' hatchery operations began on Dabob Bay, near Quilcene, Washington in 1990. Company expansion efforts resulted in two additional facilities. They include the Whiskey Creek hatchery in Oregon and the Kailua-Kona nursery in Hawaii. Current operations involve the production of molluscan larvae and seed for growout on company tidelands as well as for direct sale to other shellfish companies. Species reared include Manila and Geoduck clams, Pacific, Kumamoto, Olympia and Eastern oysters, and the Mediterranean or "Gallo" mussel. There is on going research and development activities to determine the viability and feasibility of culturing other molluscan species, including scallops and pinto abalone among others.

The purpose of the Quilcene hatchery facility is to rear shellfish for internal production, however sales to other companies, as well as to the State of Washington for enhancement purposes, serve to help diversify and replace natural shellfish populations. The Quilcene facility, located on the west shore of Dabob Bay, consists of a 12,000 square foot metal building, 4000 square feet of greenhouse space, and various outdoor tanks. Seawater is pumped from the bay via 800' intake pipes and from there through filters and heat exchangers into the building. There it is used for a variety of purposes relating to all aspects of the operation and returned to the bay. Operations can be divided into several areas: algal production, larval rearing, nursery seed culture and broodstock maintenance.

Algal production consists of growing a variety of single cell algae species for consumption by the larvae, seed, and broodstock animals. Treated seawater is used to fill algal tanks of various sizes and nutrients are added to provide nutrition for microalgae. This is accomplished by filtering and heating or cooling seawater followed by sterilization by one of two methods: pasteurization or by the addition of chlorine to kill microflora followed by neutralization with sodium thiosulphate. A variety of species of microalgae are grown and each is used as an inoculate to start larger cultures to be used as feed. Algal cultures are grown under natural and artificial light in several green houses associated with the hatchery facility, in addition to the main hatchery building. The maximum volume of algae growing at any one time at this facility is currently 326,000 liters. The majority of this volume is used as food for broodstock bivalves, larvae and seed or juvenile shellfish.

Larval culture consists of rearing bivalve larvae in static tanks between the time that gametes are spawned by adult shellfish until the larvae "set" or "settle out" and loose their ability to swim. This is accomplished in 40,000-liter tanks, where the larvae swim and feed. Seawater for this phase of the operation is pumped from the bay, then heated and filtered before being added to tanks. Seawater in larval tanks is changed every few days.

Nursery seed production is the phase of rearing larvae that are nearing settlement. Mature larvae are placed in smaller tanks where they can "settle out" onto screens. Water and microalgae are

pumped to these newly set animals. When the seed reaches a certain size, (depending on the species and time of year) it is removed from the facility and taken to a secondary nursery or to the bay for planting.

Broodstock maintenance consists of the feeding and caring for adult bivalves used for propagating future generations of various shellfish species. Broodstock obtained from outside Washington is approved by Washington Department of Fish and Wildlife prior to shipping. Taylor Shellfish is currently working on the development of a High Health Program for broodstock maintenance. The program will meet national and international standards of bivalve health.

Algae culture is a major part of operations at the hatchery. Only pure strains of algae are cultured.

Environmental Objective: Minimize potential impacts to surrounding property owners and users.

Strategies for achieving Environmental Objectives

◩ New structures and additions to existing structures will be finished in the same style and color of the existing facility.

◩ Trees, lawn, landscaping and native vegetation will be maintained to minimize impacts to views from the water. The beach near the hatchery will be patrolled on a regular basis to remove non-natural debris whether of company origin or otherwise.

◩ Plumbing and various hatchery supplies will be stored under cover or in an orderly fashion. Pumps will be maintained in an underground "pump vault" to reduce noise and visual impacts. Intake lines in the intertidal zone will be kept buried to reduce hazards and visual impacts.

◩ Light emission will be kept to a minimum by maintaining a light-blocking barrier on the waterside of the algae production buildings and minimizing nighttime exterior lighting (yard lights, etc.)

Environmental Objective. Minimize potential impacts to water quality.

Strategies for achieving Environmental Objectives

◩ Minimize the use of and properly dispose of any production related or experimental chemicals through the use of hazardous waste collection facilities.

◩ Use "environmentally friendly" cleaning agents for tank and pipe cleaning**.**

◩ Minimize the use of antibiotics for use in treating bacterial contamination larval and algal culture.

Environmental Objective. Minimize potential impacts to the flora and fauna of natural water bodies from seawater discharges and intakes.

Strategies for achieving Environmental Objectives

◩ Equip intake lines with fish-friendly screens to avoid pumping in larger fish and invertebrates.

◩ Use best available science for maintaining genetic integrity of the natural population of shellfish in estuaries farmed by Taylor Shellfish Farms.

◩ Keep broodstock from different areas separated in the hatchery when working with genetically isolated stocks.

◩ Culture only well documented or locally isolated algae species.

Environmental Objective. Minimize the potential for disease and invasive species transfers.

Strategies for achieving Environmental Objective

◩ Ensure compliance with Washington State Department of Fish and Wildlife transfer rules. (WAC 220-72)

◩ Ensure broodstock sources are disease-free. Inspect all animals upon arrival.

◩Continue development of a broodstock High Health Program.

Environmental Objective. Ensure viable progeny through a systematic broodstock management program.

Strategies for achieving Environmental Objective

◩Continue developing designated areas for holding broodstock.

Environmental Objective. Minimize general hatchery waste

Strategies for achieving Environmental Objective

◩Minimize general hatchery waste.

◩There is currently a reuse/recycling program for cardboard, metal, wood, plastic, glass, Styrofoam, light bulbs, and batteries

Taylor Shellfish hatchery on Dabob Bay, Hood Canal.

Performance Measures for Hatchery and Nursery Management

- **Record of complaints from adjacent property owners on environmental elements such as light, noise, aesthetics, etc.**
- **Measures taken to address complaints**
- **Record of broodstock origins, outplanting sites, and algae sources**
- **Pathology records for broodstock and source areas**
- **Record of chemicals used in production and cleaning agents**
- **Annual environmental performance review**
- **Record of tours**
- **Record of site clean ups and schedules**
- **Record of beach clean ups**
- **Record of hazardous waste disposal**
- **Record of basic water quality parameters**

Seed Floats, Floating Nursery (FLUPSY), and Remote Setting Sites

Introduction. Clam and oyster culture on Taylor Resources' tidelands requires seed of larger sizes than is generally economical to grow in an upland nursery. In upland nurseries algae must be cultured to feed young shellfish and large amounts of water need to be pumped upland for optimal flows. In order to offset these added costs and potential impacts, Taylor Resources has developed secondary nursery methods, to take advantage of abundant naturally occurring algae in Puget Sound and other estuaries. These include upland upwells that take advantage of abundant algae but still require pumping large amounts of water (primarily for oysters).

Seed floats are underwater platforms covered with a sand substrate and are normally used for clams. The advantage of these seed floats is that the clams feed on naturally occurring algae. Water exchange is accomplished through natural tidal flows.

The Floating Upwell System, FLUPSY, is an efficient system for growing larger seed. The FLUPSY is an integral part of the company's seed production. Juvenile clams and oysters, 1-2 millimeters in length, are shipped to the FLUPSY from the company's shellfish hatchery as well as from other nursery settings. The seed is placed in bins where the algae-rich waters are continually pumped through the bins feeding the young shellfish. The nursery is equipped with overhead hoists on A-frame trolleys so the bins can be cleaned and moved. Seed harvested from the FLUPSY is planted out on assorted company beds or sold to other shellfish growers.

The bins are fabricated with aluminum, 38" square and 49" tall with stainless steel screen bottoms. These bins are supported in a float and connected to a central channel. Surface water is displaced in the channel by the constant turning of paddlewheels. The innovative paddlewheel design allows for 1100 gallons of water per minute to be pumped. A 2-hp electric motor provides the energy. The nursery is secured to pilings on the shoreward side and by concrete wedge anchors on the waterward side. A floating walkway accesses the nursery from the shore. The walkway is designed to allow light to penetrate to the intertidal benthos through aluminum grates.

Remote setting sites can be used in a variety of locations and conditions and can be an efficient way to produce cultched oysters. These facilities consist of upland tanks where oyster shell is submerged in water pumped directly form an adjacent natural water body. The water is normally heated to around 70^{o}F with either immersion heaters or some other heating system using propane or oil. A predetermined and measured number of oyster larvae are poured directly into the tanks so that they disperse around the oyster shell. Air pumps in the bottom the tanks help circulate the water for dispersion of the larvae. The larvae attach themselves to the oyster shells normally within a day. The cultch will stay in the tanks for up to a week depending on farming needs. At some of the setting sites, algae is added to the tanks to feed the young oysters or the tank water is drained and new water is added to provide naturally-occurring algae to the tanks to be used as food. Once the cultch is removed for planting on the tidelands, the water (which has been cooled) is drained. There are no chemicals used in this setting process.

Environmental Objective: Minimize potential impacts to water quality.

Strategies for achieving Environmental Objectives

◩Through the course of daily operations small amounts of potentially hazardous materials may be needed such as gasoline and oil. All precautions are taken when using these products to ensure spills are avoided and employees are trained in spill prevention and cleanup. In the event of a spill, FLUSPY workers are required to notify Coast Guard and immediately begin clean up. Oil-absorbing materials are kept and used when needed. Containers are kept on site for proper disposal of hazardous and toxic materials. MSDS sheets are housed in the shed for easy access.

◩Garbage containers are kept on site and at the landing on the access stairs. The cans are emptied once weekly at an upland facility. A general clean up is done once monthly. Parking area at top of stairs is patrolled regularly for removal of litter.

◩A sanican is provided on the upland stairs for employee and visitor use. A private company maintains the sanican. All waste is transported to an upland facility for disposal.

Environmental Objective: Minimize impacts to other aquatic life.

Strategies for achieving Environmental Objectives

◩Because the intertidal zone is an important area for aquatic plants and animals, aluminum grating is used in walkways that access the FLUPSY. This lets light through to this zone and minimizes impacts from shading.

◩Covers are used over the paddlewheels and other machinery to prevent access to the moving parts of the machinery. A protective grate in the channel protects seals or other animals from accidental injury by the paddlewheels.

◩All oyster shell used for cultch is stored upland for an approved period of time prior to returning to marine waters to control pest transfers. (WAC 220-72)

Performance Measures for Floating Nursery (FLUPSY), Seed Floats, and Remote Setting Sites

- **Record of Coast Guard notifications for spills**
- **Training records of employees for spill prevention and cleanup**
- **Results of checks made for machinery, lighting, etc.**
- **Annual environmental performance review**

Taylor Shellfish Floating Upwell System, FLUPSY, located in Oakland Bay in Mason County.

Manila Clam Culture

Introduction. Taylor Shellfish Farms cultivates Manila clams on several properties located throughout Washington State. The primary method of clam cultivation is bottom culture where clams are grown in the intertidal zone in natural or enhanced substrate**.**

Bed Preparation. Prior to planting clam seed on the tidelands, the tideland beds are prepared in a number of ways depending on the location. This bed preparation increases the chances of seed survival and allows for full use of available land. The types of preparatory work include raking debris, including old oyster shells, gravelling to enhance the substrate, burying geotech fabric, cleaning the beds of algae, mussel mats and other growths, and conducting environment assessments of conditions such as salinity and water quality. In addition to these types of activities, other preparations are done including laying predator netting, fencing, and boundary setting. In some areas, the netting is removed within a couple days after the clams have burrowed sufficiently into the substrate.

Seeding. Most of the clam seed used comes from Taylor Shellfish Farms hatchery and nursery facilities. Spring and early summer is the normal season for planting clams. The clams range in variable sizes depending on the site-specific environmental conditions.

There are several methods used for broadcasting clam seed onto the tidelands. Some of which include hand spreading seed on an incoming tide when water depth is approximately 4 inches, hand spreading seed on an outgoing tide when water depth is approximately 2 to 3 feet deep, or spreading seed from a boat at high tide.

The method of clam seeding is dependent on site-specific factors including types of predators and weather conditions.

In some areas a natural setting of Manila clams will occur, particularly in the Hood Canal. To prepare an area for capturing the natural set, substrate covers, or predator nets, are removed and the substrate cleaned of debris. These occurrences are unpredictable and are therefore not often exploited.

Bed Assessment and Maintenance. After each growing season, surveys and samplings are conducted to assess seed survival and spreading adequacy. One square foot of substrate is sampled using four screen sizes. Depending on the location, seed handling techniques, and bed preparation, the survival rate is expected to yield at least 20-25 clams per square foot at maturity.

Beds are maintained by removing debris, keeping nets in check, and monitoring clam growth and mortalities.

Harvesting. Annual surveys assess seed survival and estimated harvest yield for next fiscal year. Surveys determine whether additional seeding is required to supplement natural set or poor hatchery seed survival. The goal is to maintain maximum sustainable productivity of the ground. In some growing areas, harvests are conducted on the same beds every year. The harvest begins after bed boundaries are staked, all covers are folded back, and crews are formed. Crews hand dig clams, using a clam rake, shoulder to shoulder until the entire bed is blanket dug. Each digger maintains a lane that they are responsible for smoothing over upon completion. Only market size clams are removed, put in buckets, bagged, and tagged for trucking to the processing plant.

Multiple crops may be in the ground at any one time depending on the level of productivity. Beds may be dug annually or as infrequently as once every four years.

Clam diggers harvest Manila clams manually.

Environmental Objective: Integrated Pest/Predator Management

Strategies for achieving Environmental Objectives

◩A variety of pests and predators are controlled in clam beds. These include shore, rock, and Dungeness crab, moonsnails and drills, finfish, such as flounders and perch, and birds, including ducks and gulls. The methods for control are varied depending on the intensity, season, and location. Exclusion, such as substrate covers and fencing, is the preferred method used for most areas. In addition to exclusion other methods include, picking by hand, and timing activities to avoid predation. In all cases of pest/predator controls mitigation sequencing is employed.

In some areas, duck predation is significant. As a last alternative to control, harassment, hazing and hunting are conducted. Alternatives are considered first.

In some growing areas, burrowing ghost (*Neotrypaea califoniensis*) and mud (*Upogebia pugettensis*) shrimp are the main pest, particularly in Willapa Bay. These areas are treated by spraying *carbaryl*, a non-persistent pesticide. To minimize impacts, only targeted areas are sprayed under regulatory approval and by a licensed applicator; all directions and regulations are strictly adhered to, and research for alternatives is promoted. The application of *carbaryl* in the marine environment and the potential short-term and long-term effects is well studied.

Environmental Objective. Minimize impacts to other aquatic life.

Strategies for achieving Environmental Objectives

◩Seek opportunities to employ alternative methods of cultivation that minimize or eliminate impacts. An example is changing the type of carcover used to a weighted polyethylene cover with greater longevity.

◩All unnatural materials used in cultivation activities are removed after use. Covers, fencing, etc, is kept in good shape and checked frequently.

◩Minimize the use of vehicles and other heavy equipment on sensitive intertidal areas.

◩Comply with Washington State Department of Ecology water quality standards when applying carbaryl. Seek alternatives first.

◩Ensure compliance with Washington State Department of Fish and Wildlife transfer rules. (WAC 220-72)

Environmental Objective. Minimize impacts to surrounding properties.

Strategies for achieving Environmental Objectives

◩Farms are kept in an orderly way and all garbage and debris is kept picked up.

◩Identify areas where debris accumulates because of prevailing winds and currents. Patrol these areas on a more frequent basis removing litter and debris.

◩Taylor Resources' managers often inform adjacent landowners of operations and ongoing activities. Complaints from adjacent landowners are taken seriously and response is immediate.

◩Nighttime operations are conducted in a manner that is respectful of adjacent homeowners. Noise and lights are minimized.

Performance Measures for Manila Clam Culture

- ▶Record of complaints from adjacent property owners.
- ▶Measures taken as a result of complaints from adjacent property owners
- ▶Pathology records
- ▶Annual environmental performance review

Graveling of the beach is done to enhance the substrate for clam culture. Studies have shown an increase in biodiversity in areas graveled.

Mussel Culture

Introduction. Taylor Resources began mussel production 1992. The species of mussel currently being farmed is *Mytilus galloprovincialis* or "Gallos." This mussel is large, hardy and easily cultivated. Cultivation is done suspended from rafts that are visible all daylight hours, unlike intertidal culture of other species which are only visible on daylight (summer) low tides. As a consequence, an extra effort is made to continually maintain the mussel farms in a neat and orderly fashion to minimize aesthetic impacts.

Seeding. Hatchery seed is transported to the farms on 2 X 8-foot reusable screens framed with 1/2" PVC pipe and placed in an aluminum and net cage which is suspended into the water. The seed is scraped from the seed frames when it is 6-12mm long (usually taking several months in winter and several weeks in summer) and socked in a knitted polyethylene mesh sock with a strand of coir (coconut fiber) in the center of the sock as a filler. A concrete weight with a stainless steel wire hook is hung on the end of the mussel sock for tension. The sock is attached to the raft by Treelock (black polypropylene 1/4" lashing).

Growout. Growout of mussels occurs in the subtidal zone on floating rafts. The rafts are 30 X 34 feet and constructed of untreated lumber, galvanized steel, and plywood. The floatation is generally reused 55 gallon food barrels or coated polystyrene or vinyl-wrapped polystyrene. The rafts are anchored in place with concrete wedge anchors attached with nylon and polypropylene and/or warps. The rafts are enclosed with netting to exclude predators.

When the mussels are 1" in length, the weights are removed and put into bulk bags for pick up and are reused immediately or stored for later use. If there is excessive fouling on the nets, the nets may be removed and shell drop-off or other debris is cleaned out.

Harvesting. When the mussels are approximately 3" in length the raft is removed from the raft unit and floated over a harvest platform where the strings of grown mussels are dropped onto a submerged platform. The emptied raft is replaced back into the raft unit and the submerged platform is raised. The mussels are stripped from the socks and bulk-bagged for transport to shore and trucked to the processing plant. Concrete weights are retrieved for re-use and used socking is disposed of at an upland facility.

Environmental Objective: Minimize impacts to the benthos.

Strategies for achieving Environmental Objective

◩Ensure anchor lines are properly set to prevent dragging and anchors are of sufficient size to secure rafts.

◩Periodically remove all unnatural and non-biodegradable materials that accidentally f all from rafts and work areas onto the seafloor.

◩Conduct periodic benthic surveys to inspect the benthic environment for impacts.

Environmental Objective. Maintain safe navigation around farms.

Strategies for achieving Environmental Objective

◩Lights are installed according to US Coast Guard requirements.

◩All portions of the farm are kept within lease boundaries.

Environmental Objective. Minimize impacts to other aquatic life.

Strategies for achieving Environmental Objective

◩Use exclusion methods to control predation such as netting.

◩Keep farm maintained to ensure netting, lumber, tools, do not leave farm area.

◩Monitor adjacent marine populations for changes and potential impacts.

◩Periodically conduct benthic sampling under mussel farms to determine potential impacts to the benthic flora and fauna.

◩Conduct periodic vertical profiles of the water column adjacent to mussel farms to measure potential changes in dissolved oxygen concentrations.

◩Ensure compliance with Washington State Department of Fish and Wildlife transfer rules. (WAC 220-72)

Environmental Objective. Encourage public access for educational purposes.

Strategies for achieving Environmental Objective

◩Provide, when possible, tours of the mussels farms and explain mussel growing operation.

◩Donate product to conservation groups and water quality advocacy organizations.

◩Continue experiments and development of alternative methods and conditions of culture.

Environmental Objective. Minimize impacts to surrounding property owners.

Strategies for achieving Environmental Objective

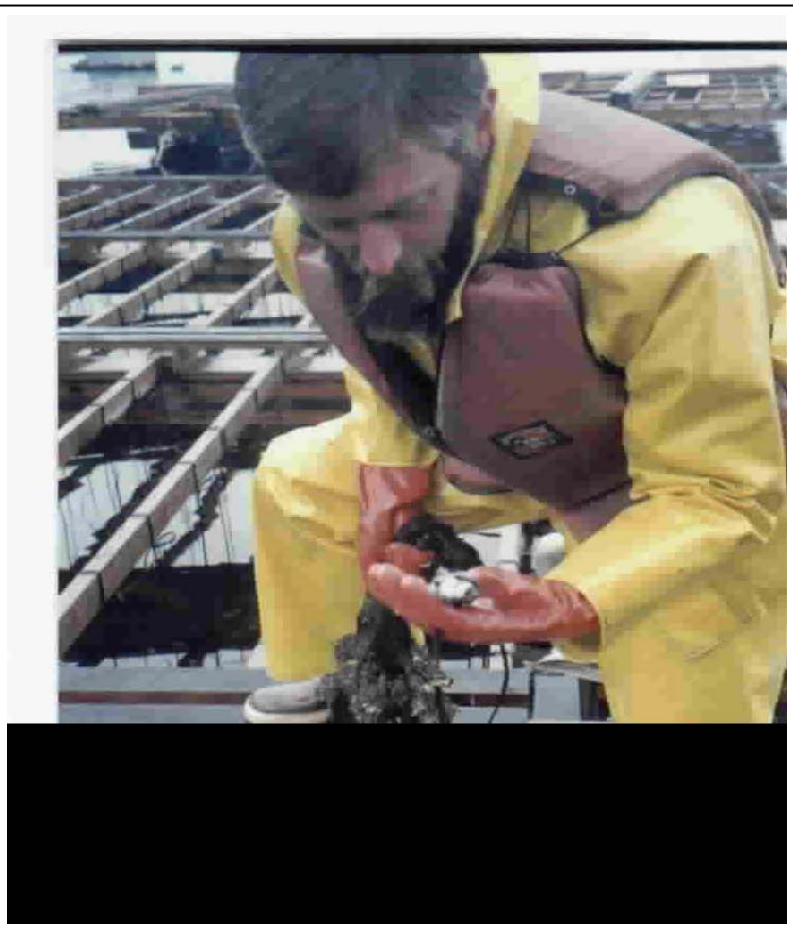
◩Keep farms orderly and litter-free.

◩Ensure equipment is in good working order to keep noise levels to minimums.

◩Be respectful to adjacent property owners by keeping them updated on farm changes.

Performance Measures for Mussel Culture

- **Record of complaints from adjacent property owners.**
- **Measures taken as a result of complaints from adjacent property owners**
- **Record of results of benthic surveys**
- **Record of results of vertical profiles of the water column**
- **Annual environmental performance review**



Mussel ropes are inspected frequently.

Oyster Culture

Introduction. The culture of oysters has taken place for many decades on tidelands owned and/or managed by Taylor Shellfish Farms. Many of the practices have improved and are now more efficient, productive and environmentally beneficial. Productive oyster ground is dependent on a number of variables including salinity, temperature, substrate, water quality, and types of predators. Oyster ground can be classified as seed ground, growout ground, fattening ground, or transplant area or by growout method such as longline or bag area.

There are different approaches that can be taken to oyster growout depending on the market, the beach, and the environment.

For oysters destined to supply the half shell market, the growout method can be bag or bottom culture. Although there are a number of other methods, Taylor Shellfish Farms primarily uses bags for growing small single oysters. For the shucked meat market, the method will be determined primarily by environmental conditions such as substrate and predators.

Taylor Shellfish Farms successfully cultures several species of oyster including the Pacific oyster (Crassostrea gigas), Olympia oyster (Ostrea lurida), Kumamoto oyster (Crassostrea sikemea), Eastern oyster (Crassostrea virginica) the European flat oyster (Ostrea edulis).

Bottom Culture. Ground that is sufficiently hard or prepared can support bottom culture. Seed oysters attached to cultch shell are sprayed from the deck of barges onto marked beds at an even rate to achieve approximately ten oysters per square foot. Oysters are left on beds until harvest.

Bed Preparation. Prior to planting a new crop of oysters, an oyster bed may be cleaned with the use of a dredge bag and cleaned of drills and other pests. Oysters remaining on the bed after a harvest as well as debris and mud build-up are removed during this process.

In areas suitable for bottom culture, substrate enhancement may be done to improve the substrate and prepare the ground for the spreading of a new crop. Some areas may have appropriate substrate to spread oysters directly onto ground without enhancement efforts. Substrate enhancement is done by spraying crushed shell and/or washed gravel from the deck of a barge using a pump and hose. Several runs are made over marked ground to ensure an even spread of material.

Harvesting. Bottom culture oysters are harvested either by hand or in some areas, such as Willapa Bay, oysters are harvested by using a mechanical dredge. In those areas, the mechanical dredge is lowered to the bottom at high tide by a boom or hydraulic winch and dragged along the bottom scooping up oysters. For hand harvesting, workers fork or hand pick oysters into large steel cage bins. The bins are equipped with ropes and buoys to be retrieved at high tide when they are hauled onto the deck of a barge at high tide using a

boom. The oysters are transferred from barge to truck for delivery to the plant for processing.

Longline Culture. On some tidelands, the substrate may be too soft and muddy and growing conditions do not allow for fattening and faster growth to support on-bottom cultivation and longline culture is used. Area to be cultivated is staked and lines holding seeded oyster shells is run between, and supported by, the stakes.

Taylor Shellfish Farms currently employs longline culture in Willapa and Samish Bays where substrate conditions warrant off-bottom culture.

Bed Preparation. Beds need very little preparation prior to installing longlined oysters. All unharvested oysters or "fall-offs" have been removed prior to the replanting. In some areas, silt builds up between rows and must be leveled at the end of a growing season. Some ground is left fallow between crops.

Harvesting. Longlined oysters are cut into individual clusters and placed in steel harvest tubs at low tide for retrieval at a higher tide. The tubs of oysters are barged and transported to the processing plant. Oysters dislodged from the line during grow out are harvested at a later time.

Bag Culture. Bag culture is used to grow single oysters for the half-shell market. Single set seed is placed into plastic netted bags. The bags are positioned in the intertidal zone either hooked to staked lines or rebar. Each bag contains approximately 150 to 200 oysters. The oysters are normally left until harvest time.

Bed Preparation. For bag culture there is very little bed preparation needed because the oysters are in bags. Normally a bed is prepared by removing debris and unused materials. The ground may be marked with stakes for working purposes.

Harvesting. To harvest bags, boats access the intertidal area and workers release bags and place in boat, then transferred to trucks for transport to the processing plant.

Environmental Objective. Integrated Pest/Predator Management

Strategies for achieving Environmental Objective

◩Promote where practicable non-lethal predator control methods such as exclusion and other physical deterrents.

◩Depending on the type of culture, pests and predators can be a significant cause of mortalities. Predation occurs the most with bottom culture because the animals are exposed. The types of predators include Japanese drills, moonsnails, and a variety of nematodes, echinoderms, crustaceans, fish, and birds. The type of method used for control depends on a variety of factors. In some areas, general husbandry techniques are effective in controlling predators such as planting larger seed.

◩In some growing areas, burrowing ghost (Neotrypaea califoniensis) and mud (Upogebia pugettensis) shrimp is the main pest, particularly in Willapa Bay. These areas are treated by spraying carbaryl, a non-persistent pesticide. To minimize impacts, only targeted areas are sprayed under regulatory approval and by a licensed applicator; all directions and regulations are strictly adhered to, and research for alternatives is promoted. The application of carbaryl in the marine environment and the potential short-term and long-term effects is well studied.

Environmental Objective. Minimize impacts to other aquatic life.

Strategies for achieving Environmental Objective

◩All equipment is kept maintained and in good repair.

◩Minimize the use of heavy equipment on the tidelands.

◩Keep artificial materials, such as netting and tubing, secured.

◩Precautions are taken to ensure that pests are not transferred from one area to another through compliance with regulatory transfer rules and company policies.

◩Ensure compliance with Washington State Department of Fish and Wildlife transfer rules. (WAC 220-72)

Environmental Objective. Minimize impacts to surrounding property owners.

Strategies for achieving Environmental Objective

◩Farms are kept in an orderly way and all garbage and debris is kept picked up. Taylor Resources' managers may inform adjacent landowners of operations and ongoing activities. Complaints from adjacent landowners are taken seriously and response is immediate.

◩Nighttime operations are conducted in a manner that is respectful of adjacent homeowners. Noise and lights are kept to the minimum amount necessary to safely work.

◩Farms are patrolled frequently and litter is picked up and disposed of at an upland facility.

Longline oyster culture at Samish Bay.

Performance Measures for Oyster Culture

- **Record of complaints from adjacent property owners.**
- **Measures taken as a result of complaints from adjacent property owners**
- **Record of results of benthic surveys**
- **Pathology records**
- **Record of results of vertical profiles of the water column**
- **Annual environmental performance review**

Bottom culture oyster bed located in Samish Bay in Skagit County.

Geoduck Culture

Introduction. Geoduck culture on Taylor Shellfish Farms and leased private tidelands began in 1993. As a relatively new species for culture, techniques are rapidly evolving and changing. A USDA Small Business Innovative Research (SBIR) grant was obtained by Taylor Resources in 1997 to assist with development of optimal culture techniques. As the culture techniques are developed, Taylor Resources is striving to assure they minimize potential adverse environmental impacts. Currently, broodstock are collected from one of the five genetic geographic regions identified by Washington Department of Fish and Wildlife where the out-planting of the progeny will occur. The broodstock are conditioned and spawned in the Taylor Shellfish Farms hatchery in Quilcene. The larvae are reared through metamorphosis in tanks. Following metamorphosis, the juveniles are placed in nurseries until they reach approximately 5 mm at which point they are transported to a bed for out-planting. Out-planting is done primarily in 6" PVC pipe that has been cut in 9" lengths. Each pipe has a plastic mesh net secured with a rubber band over one end to exclude predators. The pipes are installed in the beach by driving the non-netted end into the substrate approximately 6 " on 12" centers, leaving 3" of pipe exposed. Four seed clams are placed in each tube. Tubes are removed after approximately one year when the young clams have achieved an adequate depth to evade predators (approximately 14"). Once the clams achieve an approximate 2-pound weight, the crop is harvested. Harvest is achieved by pumping seawater into the substrate around the clam until it is fluidized enough that the clam can be pulled to the surface. Clams are transported to the processing plant by boat then truck for packing and shipping.

Hatchery-grown geoduck seed.

Geoduck seed digging in after planting.

Environmental Objective: Integrated Pest/Predator Management.

Strategies for achieving Environmental Objective

◩Most of the tidelands cultivated for geoduck are at a low tidal elevation (+1 to -2 MLLW) where predation is intense. Crab (red rock, Dungeness, shore crab) and scoter ducks are the dominant predators. Moonsnails can also be a significant predator. Exclusion is the primary and preferred strategy to minimize damage by predators. PVC tubes with nets are one example of how this is effectively accomplished.

Environmental Objective: Minimize impact to surrounding property owners.

Strategies for achieving Environmental Objective

◩**Maintain farm in an orderly fashion**. Install pipe or other predator exclusion devices in straight rows or blocks that are appealing to upland observers. Remove un-natural materials (pipe, nets) as soon as practical when young geoducks are not vulnerable. Remove mark stakes and buoys when they are no longer necessary.

◩**No un-natural materials should escape from the farm.** Pipe, nets, rubber bands occasionally wash out of the beach. Every effort should be made to assure this does not happen. Area beaches should be patrolled on a regular basis to retrieve Taylor Resources debris that does escape the farm as well as other non-natural debris.

Environmental Objective. Minimize impacts to water quality and other marine life.

Strategies for achieving Environmental Objective

◩Conduct harvest activities during tides where the least amount of turbidity will occur as practicable. Refill or grade impacted areas where and when possible to prevent sediments from resuspending. Maintain equipment in good working order to prevent inefficient operations.

◩Ensure compliance with Washington State Department of Fish and Wildlife transfer rules. (WAC 220-72)

Performance Measures for Geoduck Culture

- **Record of complaints from adjacent property owners.**
- **Measures taken as a result of complaints from adjacent property owners**
- **Record of results of benthic surveys**
- **Annual environmental performance review**

Harvested geoduck ready for transport to Shelton plant and then on to market.

Receiving, Storage, Processing, and Shipping

Introduction. Taylor Shellfish Farms has one main processing plant and two smaller facilities. The main plant is located upland on Taylor-owned property in Shelton and the two smaller facilities are located at Samish and Willapa Bays. The smaller facilities are used primarily for offloading, storing product for retail sale, and re-washing product for retail sale.

The main processing plant in Shelton and the Samish Bay facility produce wastewater from their processing activities. A State Department of Ecology wastewater permit (ST6157) is maintained for Shelton plant and a National Pollution Discharge Elimination System (NPDES) permit (WA00267) is maintained for the Samish facility. The wastewater resulting from processing operations at the Shelton facility is reused in part through the irrigation of poplar and fir plantations in adjoining properties. A portion of the funding for the engineered design of the irrigation system was provided by a grant from the Rural Development Council of Washington. The grant was approved because of the innovative method by which wastewater was to be reused.

Bi-monthly monitoring of the wastewater stream is conducted to ensure compliance with water quality standards.

Receiving and Storage. Shellstock is delivered to the Taylor Shellfish Farms plant by vehicle from company growing areas or other harvesters. Once received at the plant, shellstock is kept under refrigeration until processed or placed in either dry storage or wet storage. Animals stored alive in a wet storage system are washed and culled prior to placement in the system.

Processing. All product received by the processing plant is maintained as separate lots and not co-mingled. Shellstock (live oysters, clams, and mussels) are washed using water from the plant well water system. Clams and mussels are culled and graded, packaged for shipment and place in coolers or wet storage. Product removed from wetstorage prior to shipping is washed and culled. Some product is frozen whole, shucked or topped off in a spiral blast freezer.

Shellstock to be shucked are delivered to the opening room and opened, packed and stored. Packers use fresh water to wash shucked meats prior to packing. Other processing methods are used for various products and markets including boiled crab and value-added products.

Water use averages approximately 70,000 gallons per day. Conservation measures are employed throughout the processing system. Automatic controls have been installed to prevent water waste.

One of the main by-products of processing shellfish is shells and shell fragments. Shell is recycled for use in reseeding or by grinding for other uses and can be sold to the US Army Corps of Engineers for substrate mitigation projects and creating or improving beds.

Shipping. All shellfish products are delivered by truck to wholesale dealers, retail outlets, and airfreight carriers. Shellfish are packed in Styrofoam insulated cardboard boxes.

Environmental Objective: Minimize waste generation through reuse, recycling, and reduction.

Strategies for achieving Environmental Objective

◩Recycle shells and shell fragments resulting from processing operations by reseeding or grinding.

◩Reuse of wastewater at the Shelton plant by irrigating a 5-acre parcel of poplars and 15-acre fir plantation. Poplars and firs are harvested on rotation.

◩Local companies recycle all waste cardboard generated during processing operations and inbound freight packaging**.**

◩Use water conservation methods wherever practicable. Reuse water during processing where animal and human health are not compromised.

◩Maintain high efficient energy systems including fluorescent lighting and high R-value insulation in areas requiring refrigeration. Keep equipment well maintained for efficient operations and use of energy.

Environmental Objective. Minimize impacts to ground water, flora and fauna.

Strategies for achieving Environmental Objective

◩Wherever practicable, use non-toxic lubricants and cleaning agents.

◩Ensure strict compliance with water quality standards identified in State regulations and outlined on wastewater permit ST6157. This includes maintaining annual average Total Dissolved Solids levels below 500 mg/l and Chloride levels below 250 mg/l at the Shelton plant. For the Samish facility compliance is maintained with State standards under the federal Clean Water Act authority.

◩Use non-toxic and non-lethal pest control methods where possible in the processing facilities and poplar crop.

◩Keep shell pile isolated to minimize odor impacts. To control flies around shell pile, swallow boxes are erected to encourage natural control of flies.

◩Oyster tubs and clam bags coming in from the bay have tags. Processing should ensure proper removal and disposal of tags to prevent their return to the bay by getting into the shell pile.

◩Keep tubs and equipment separated where pests can be transferred. As an example, Willapa Bay tubs are separated and steam-cleaned to prevent European green crab transfers.

Environmental Objective. Minimize impacts to surrounding properties.

Strategies for achieving Environmental Objective

◩Frequently patrol areas for litter and debris. Keep all access roads and driveways litter-free.

◩Keep buildings maintained, orderly free of weeds, trash and broken equipment.

◩Where possible, use decorative and attractive additions to building fronts in areas exposed to the public.

Final shellfish products packaged and ready for sale.

Performance Measures for Receiving, Storage, Processing and Shipping

- **Record of infractions and non-compliance**
- **Measures to address infractions**
- **Photo documentation**
- **Checklist on transfers to Department of Fish and Wildlife**
- **Annual performance review**

Right: Wastewater from the plant is reused for irrigation of fir and poplar plantations. *Below:* The clam truck pulls into the plant unloading area.

Shop and Maintenance Facilities

Introduction. Taylor Shellfish Farms shop provides mechanical, electrical and facilities support to all aspects of the company's operations. Shop personnel are trained in mechanics, electricity, refrigeration, welding, fabrication, etc. The shop facility was built after SEPA review was completed for determining environmental impacts such as surface runoff, light, noise and waste disposal. A Mitigated Determination of Significance was issued for the facility. The building is 10,000 square feet. The facility is on an approved septic system and has an oil and gas separator for carbon product disposal. The building is heated by recycled waste oil in an energy efficient stove.

Environmental Objective: Minimize impacts to ground and surface water.

Strategies for achieving Environmental Objective

◩Ensure building and associated facilities are in good repair and meet all applicable county codes.

◩Hazardous waste and toxic materials are disposed of according to manufacturer recommendations and environmental codes.

Environmental Objective. Minimize impacts to surrounding properties.

Strategies for achieving Environmental Objective

◩Although Taylor Shellfish Farms owns all adjacent properties, some of the facility can be viewed from the county road and access road to the office and other facilities. To minimize aesthetic impacts, the shop area is kept orderly and litter-free. Vehicles are parked in an orderly fashion.

Performance Measures for Shop and Maintenance Facilities

- **Disposal records**
- **Annual performance review**

Other Taylor Shellfish Facilities

British Columbia, Canada Mussel Farm. Taylor Shellfish manages two mussel farms in British Columbia located in Okeover Inlet and Church Point. The total acreage for both farms is approximately 50 acres. These farms are currently in a development phase and produce approximately 154,000 pounds annually. The mussel species produced are *Mytilus galloprovincialis* and *Mytilus edulis*. For the environmental codes of practice employed at these farms, please refer to the "Mussel Culture," section in this document.

British Columbia, Canada, mussel farms.

Kailua-Kona Hatchery/Nursery. Taylor Shellfish Farms manages a hatchery/nursery located in Kailua-Kona, Hawaii. Currently Taylor Shellfish Farms ships animals to the Kona facility to rear until planting size is achieved. Algae is cultured and controlled in two 250,000-gallon tanks used also for shrimp culture. Taylor Shellfish Farms sought a tropical climate for a nursery site to achieve the following goals: reduce high cost of over-wintering seed in intensive Washington nursery systems, increase seed availability at appropriate sizes for early spring planting, and increase economically to meet increased farm demands.

The Kailua-Kona Hatchery/Nursery currently sits on 1.7 acres of land and consists of raceways, upwellers, algae tanks, and algae/shrimp system. Algae is started from pure cultures obtained from a high health facility and progressively grown in larger and larger tanks.

This facility currently accepts Manila clams, Pacific and Kumamoto oysters, and *Mytilus sp*. from the mainland. The shrimp (*Penaeus sp*) used in the large algae tanks is obtained from Hawaii High Health. This seed source is certified disease and pathogen free.

A comprehensive monitoring program is in place and consists of water sampling, shrimp health exams, and clam and oyster pathological exams. The monitoring program has been approved by the State of Hawaii and the State of Washington for import purposes. All seed is soaked in a fresh water bath containing chlorine prior to shipping.

Algae tanks are cleaned regularly.

Large algae tanks are maintained to provide feed for young shellfish.

Endangered Species Act and Critical or Unique Marine Environments

Salmon. Washington State, under the Endangered species Act, listed several species of salmonids as "threatened." These species of concern include: Puget Sound Chinook, Bull Trout, Hood Canal Summer Chum, Coastal Bull Trout and Coho (proposed). In response to these federal listings, Washington State embarked upon a comprehensive strategy for salmon recovery.

Shellfish and salmon share a common marine environment, and as such, require us as shellfish farmers to interact with salmon and their habitat during the course of our operations. Potential habitat impacts from shellfish farming operations can be positive as well as negative. To understand the nature of these impacts, our company has promoted and supported scientific research through a variety of organizations and funding sources. Representatives from academia, industry and resource agencies join us in this effort. One of the guiding principles in Washington's Statewide Salmon Recovery Strategy is the use of best available science for developing recovery options. It is our goal to identify and prevent potential negative impacts to salmonids while ensuring the future of a viable aquaculture industry.

Our company continues to be a leader in promoting water quality protection initiatives at both the local watershed and State levels. Water quality impacts have been identified in the State's salmon plan as one of the impediments to a successful recovery. Our common goal and combined efforts in this area will benefit both fish and shellfish.

This **ECOP** is a first step toward ensuring compliance with the Endangered Species Act and the State's salmon recovery plan. Additional steps under consideration by our company include development of a Habitat Conservation Plan under federal authority or a programmatic Environmental Impact Statement under the State's Environmental Policy Act.

Environmental Objective. Ensure our operations support the State's salmon recovery efforts.

Strategies for achieving Environmental Objective

◩Adhere to federal and state guidelines for protection measures for endangered species.

◩Promote water quality protection through participation at local and State forums.

◩Continue to promote scientific endeavors that help identify areas of impacts and viable mitigation options.

Performance Measures for Endangered Species Protection

▶Record of salmon returns in applicable farm areas

▶Record of water quality participation efforts

▶Record of scientific studies supported by our company that address salmon issues

Eelgrass. Several estuaries in Washington State support eelgrass beds. These beds are considered to be a critical component of the marine ecosystem in the intertidal and shallow subtidal zones. Two species of eelgrass predominate in Washington waters: Zostera japonica and Zostera marina, the former being an introduced species. Eelgrass beds are nurseries, foraging areas, refuge areas for a variety of fish, including salmon, and their prey.

Taylor Shellfish Farms owns and manages several tideland areas that support healthy eelgrass beds. In some areas of Samish and Willapa Bays, as well as parts of Hood Canal, there is variable coverage of eelgrass. Different management strategies are employed in these areas to minimize and/or mitigate potential impacts. The potential impacts on eelgrass beds from shellfish operations have been the focus of several scientific studies. Our goal is to understand these impacts using best available science and minimize or mitigate negative impacts. It has been our observation that the eelgrass beds continue to proliferate in areas of active shellfish culture activities. Additionally it has been shown through research that certain types of shellfish culture provide comparable functions and values to those found in eelgrass beds.

Environmental Objective. Minimize impacts to existing eelgrass beds.

Strategies for achieving Environmental Objective

◩Conduct certain operations that potentially impact beds during seasonal periods when eelgrass may be absent.

◩Avoid, when and where possible, intensive operations in eelgrass beds.

◩Comply with Washington State Hydraulic Code on timing restrictions.

Environmental Objective. Support efforts to understand eelgrass systems

Strategies for achieving Environmental Objective

◩Promote scientific research of eelgrass beds and their functions and values

◩Participate in forums that focus on eelgrass bed protection

Performance Measures for Endangered Species Protection

- **Record of eelgrass beds in farm areas**
- **Record of research proposals on eelgrass issues**
- **Record of participation on eelgrass studies**