

Maine Aquaculture Occupational Standards for Shellfish and Sea Vegetable Farms

OCTOBER 2021

Standards produced by:



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INTRODUCTION

The Maine Aquaculture Occupational Standards specify the current workforce skills and training needs of Maine's aquaculture sector. They are intended to: (1) present education and training providers with a clear and comprehensive understanding of the specific technical skills and knowledge that are critical for the most common careers in each sector; (2) standardize workforce training in the state; and (3) establish an industry-led process to align training with workforce needs as the industry and workforce needs evolve. They are based on direct industry input through extensive one-on-one interviews with commercial businesses across Maine.

This document, produced by the Maine Aquaculture Association (MAA), is specific to the workforce needs at marine shellfish and sea vegetable farms. Occupational standards for land-based shellfish hatcheries, land-based recirculating aquaculture systems (RAS), and marine finfish farms are available at <https://maineaqua.org/education/>.

The project team will update the occupational standards (OS) regularly to remain current with the ever-changing workforce needs of Maine's rapidly evolving aquaculture sector.

BACKGROUND:

In 2020, The Gulf of Maine Research Institute (GMRI) and the Maine Aquaculture Association (MAA), in partnership with Educate Maine, and sponsored by FocusMaine, published the Maine Aquaculture Workforce Development Strategy – an in-depth analysis informed by direct input from Maine's aquaculture sector that documents the current and future labor needs of Maine's growing and developing aquaculture industry, and charts a course for Maine to establish a comprehensive workforce training system.

Occupational Standards to inform and standardize aquaculture workforce training are a pillar of the recommendations from the Maine Aquaculture Workforce Development Strategy.

To implement this recommendation, the Maine Aquaculture Association (MAA), which has over a 25-year track record of developing operating standards and best management practices (BMPs) for the Maine aquaculture sector, has worked with GMRI and Educate Maine to develop occupational standards that represent the needs of the sector, and are consistent with state educational standards.

MAA and GMRI built on top of the findings of the Maine Aquaculture Workforce Development Strategy by conducting a new series of interviews with a variety of commercial aquaculture producers and educational institutions to form the standards. The draft standards were then shared with the Maine aquaculture sector and educational community for final review and edits.

The occupational standards are segmented into several sections based on the sector, type of work, and job title. A table of contents and career pathway document are included to visualize the options available within the standards.

For questions, please contact Christian Brayden, Project Manager at the Maine Aquaculture Association, at christian@maineaqua.org.

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Marine Standards

SHELLFISH FARM – FARM HAND/CREW

The Farm Hand position is the most common point of entry into the aquaculture workforce. The position includes basic and intermediate marine duties along with basic shoreside duties. The responsibilities of a Farm Hand vary greatly from farm-to-farm, but experience, skills, knowledge, and understanding of the position and its duties, along with on-the-job learning and performance, will fast track future promotion to crew chief or manager.

This standard is intended to capture the core duties and skills involved in the operation of an oyster, mussel, and scallop farm at the entry-level Farm Hand position.

DUTIES

VESSEL AND VEHICLE OPERATION

Required:

1. Safely work on the water (on skiff, floating raft, dock, mussel raft, etc.) and at shoreside facilities consistent with relevant health and safety requirements

Potential:

1. Safely operate a small vessel (<25 ft.) and navigate the farm and surrounding waters in accordance with all rules and regulations
2. Launch and dock a vessel and navigate inside and around arrays of floating aquaculture gear in a wide range of tide and current conditions
3. Trouble shoot common problems that prevent a small gas-engine powered vessel from operating properly including outboard and small 2-stroke engines (pressure washer, generator, etc.), electrical connections, and hydraulics.
4. Drive a pickup truck

SHELLFISH CULTURE

Required:

1. Build, install, and repair shellfish aquaculture equipment under supervision from a crew chief or manager
 - a. Oysters – oyster bags, oyster cages, upweller, dragging, including use of basic tools (e.g., hog-ring pliers, pneumatic clip gun)
 - b. Mussels – spat lines, splitting lines, re-socking lines, attaching grow-out lines, predator nets
 - c. Scallops – lantern nets, ear tagging, longlines, aqua trays, bottom cages
2. Install, maintain, and occasionally repair lines, moorings/anchors, floats, rafts, and growing and processing equipment under direction or crew chief or manager
 - a. Oysters - Flip cages, lift lines, lift nets, and remove biofouling from gear via pressure washing

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- b. Mussels - Operate mussel seeding, harvesting, and processing equipment (line stripper, socking machine, conveyer, declumper, debearder, debysser, sorter, bagger); remove, clean, and replace predator nets.
 - c. Scallops – Raise lantern nets/ear hung lines, remove biofouling from nets via pressure washing
3. Tumble and/or grade oysters using an oyster tumbler/grader
4. Harvest, sort, count, and bag shellfish, following relevant health and safety requirements
5. Keep sites clean and orderly

Potential:

1. Operate a winch, hauler and/or other hydraulic equipment (OSHA safety course recommended)
2. Use power tools (e.g. drill, Sawzall, circular saw), generators, pneumatic tools, water pumps, pressure washer, and marine batteries
3. Monitor general shellfish health, growth, and inventory and notify crew chief/manager if any concerns arise
4. Track maintenance, repairs, safety issues, and other issues to be resolved, and report up the chain of command.
5. Identify when a site is not maintained according to regulations and alert Crew Chief or Manager

KNOWLEDGE AND UNDERSTANDING

VESSEL AND WORKPLACE SAFETY

Required:

1. Protocol for safely working on the water (vessel, dock, etc.) e.g. wet surfaces, lines underfoot, uneven footing, limited space, proper form to lift heavy objects, how to move heavy objects from vessel to raft/dock and vice versa, stepping from vessel to raft/dock/float and vice versa, how to re-board boat after falling overboard
2. How to wear or use safety equipment in compliance with Coast Guard requirements and use radio/cell phone to contact team co-workers and emergency services; how to behave if boarded by Coast Guard
3. How to appropriately dress and protect yourself in all seasons and weather conditions

Suggested:

1. Basic navigation and boat handling skills. Engine on vs. off, check fluids, how to place in neutral, raise and lower engine, fuel boat without spilling, and how to clean up a spill if one occurs. red vs green buoy/can.
2. How to read tide charts and weather reports and relay any concerns
3. How to anticipate and prevent (or convey to Crew Chief) dangerous situations out on the water. E.g. keep lines out of prop, avoid flotsam, knife safety and storage, dangerous weather.

SHELLFISH CULTURE

Required:

1. The importance of following specified schedules for flipping cages/bags, accurate counting of product, cleaning mussel lines, scallop cages, and tumbling oysters to prevent/remove biofouling and maintain product quality

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2. Level of care to be taken with different types of shellfish during different life stages and during different seasons and weather conditions e.g. sunny summer day vs blustery winter morning, also. 5 mm seed vs market size product. Using appropriately sized mesh to contain seed oysters.
3. The characteristics of healthy shellfish, an unhealthy or low-quality shellfish, and a dead shellfish
4. How care and handling of shellfish affects their mortality rate and quality related to customer preferences

Suggested:

1. Consistent, basic nautical knot tying e.g. bowline, fishermen's knot, sheet bend, half-hitch, square-knot, splice in a variety of situations e.g. installing or securing gear, tying up a vessel. Understand which knots work best for which application e.g. gear installation vs. quick fixes
2. How to tie on floats, buoys, and droppers, and install lines of cages, bags, and longlines for common methods of shellfish farming, all under supervision
3. General understanding of marine science to understand how their tasks effect growth, quality, health, biofouling, food availability, and food safety.

FOOD SAFETY & REGULATORY COMPLIANCE

Required:

1. The relevant health, safety, and biosecurity requirements associated with handling and transporting shellfish for human consumption – basic food safety, HACCP, and vibrio understanding
2. The storage and temperature requirements of harvesting shellfish for human consumption and implications of improper temperature

ESSENTIAL EMPLOYMENT SKILLS

Required:

1. Positive attitude, and knowing how to work through fatigue, hunger, and a variety of weather
2. Problem solving
3. Timeliness and consistency as they relate to coworkers and the business – understanding the importance showing up for work when scheduled, and on time, and how lack of timeliness or showing up to work can severely impact farm operations and coworkers.
4. How to listen to instructions and carry out tasks as directed and be willing to speak up, ask questions, and admit when you do not know or understand something
5. Willingness and ability to effectively communicate issues and concerns to crew chief and manager, including admission of your own mistakes
6. How to professionally engage with others on the water and riparian landowners, be a good company and aquaculture ambassador/neighbor, including boat launch diplomacy and personal hygiene e.g. how to use a head or bucket
7. How to work well as part of a team

Suggested:

1. Basic math and writing skills e.g. length of lines, pieces per container, pounds per line, etc.

SEAWEED SUPPLEMENT

DUTIES

1. Rigging seaweed grow lines
2. Back a boat down a grow line
3. Safely seed lines following protocol put forth by employer
4. Check on seaweed growth and record growth
5. In season husbandry (e.g., adding weights to counteract buoyancy)
6. Lift seaweed lines using a hauler
7. Harvest and handle seaweed, following all necessary health and safety requirements
8. Handle and transport seaweed, following all necessary health and safety requirements

KNOWLEDGE AND UNDERSTANDING

1. The characteristics of healthy seaweed growth and excessive biofouling
2. How to safely use, store, and sterilize a knife while harvesting seaweed
3. Basic biology and interest in seaweed, and knowledge of the marine environment

SHELLFISH FARM – CREW CHIEF

This occupational standard builds on top of the duties, knowledge, and understanding associated with the occupational standard for a marine shellfish farm hand/crew member. It is expected that a crew chief will possess mastery of all expectations of a farm hand/crew member, including the ability to teach and monitor these duties, the knowledge, and the understanding. The “Crew Chief” is responsible for overseeing teams of Farm Hands/Crew and is synonymous with “Assistant Farm Manager” or “Team Lead.”

DUTIES

VESSEL AND VEHICLE OPERATION

Required:

1. Operate vessels of varying sizes (up to 25 feet) in a variety of seasons and weather conditions in accordance with all rules and regulations, including warming up engine, hydraulics, drive belts, etc. during winter
2. Basic operation, troubleshooting, repairs, and overseeing the safe use of machinery, including those mentioned in the farm hand occupational standards e.g. outboard boat engines, upwellers, winches, hydraulics, pumps, electric, and moving machinery on/off vessel
3. Take decisive actions based on tides and weather and communicate them to crew

Potential:

1. Safely operate a forklift
2. Drive a pickup truck with a trailer, including backing up

SHELLFISH CULTURE

Required:

1. Lead farm hands in the building, installation, and repair of shellfish aquaculture equipment
 - a. Oysters – oyster bags, oyster cages, upweller, dragging, including use of basic tools (e.g., hog-ring pliers, pneumatic clip gun)
 - b. Mussels – spat lines, splitting lines, re-socking lines, attaching grow-out lines, predator nets
 - c. Scallops – lantern nets, ear tagging, longlines, aqua trays, bottom cages
2. Lead farm hands in the installation, maintenance, and occasional repairs of lines, moorings/anchors, floats, rafts, and growing and processing equipment according to the manager/owner plan
 - a. Oysters - Flip cages, lift lines, lift nets, and remove biofouling from gear via pressure washing
 - b. Mussels - Operate mussel seeding, harvesting, and processing equipment (line stripper, socking machine, conveyer, declumper, debearder, debysser, sorter, bagger); remove, clean, and replace predator nets.
 - c. Scallops – Raise lantern nets/ear hung lines, remove biofouling from nets via pressure washing
3. Work with manager and owner to lead crews in farm layout and gear installation
4. Operate a winch, hauler and/or other hydraulic equipment (OSHA safety course recommended)

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5. Use and demonstrate the safe use of power tools (e.g. drill, Sawzall, circular saw), generators, pneumatic tools, water pumps, pressure washer, and marine batteries
6. Lead farm hands in the tumbling and/or grading of oysters using an oyster tumbler/ grader
7. Lead farm hands in the harvesting, sorting, counting, and bagging of shellfish, following relevant health and safety requirements
8. Ensure that mortality and production remain consistent with the plan from the manager
9. Follow thinning, harvest, and food safety protocols as laid out by manager
10. Encourage farm hands to report any mistakes or issues with product or gear, and then report these issues to the manager
11. Monitor general shellfish health, growth, and inventory and notify manager if any concerns arise
12. Track maintenance, repairs, safety issues, and other issues to be resolved, and report to the manager/owner
13. Keep sites clean and orderly, including showing farm hands how to do this

Potential:

1. Lead farm seed/spat collection, including splitting lines/cages and socking, under direction of manager/owner
2. Track inventory and survival rate in logs and provide them to the manager

TEAM MANAGEMENT

Required:

1. Manage teams of workers to ensure safe, efficient completion of a workplan received from manager/owner, typically teams of 2-4, with some up to 6
2. Explain and show safety issues, along with relevant protocols
3. Task delegation, including identifying efficiencies
4. Identify efficiencies and provide a continuous improvement mindset
5. Operate with direction from, but independently of the manager/owner, to lead small crew and/or carry out task independently.
6. Resolve conflicts between workers, and effectively communicate up and down the chain of command, including when mistakes happen
7. Track and report performance, reliability, and leadership potential, with a focus on bringing up notable good/bad performance of workers

OPERATIONS MANAGEMENT

Required:

1. Ensure that tasks, outputs, and timelines stay within the manager's workplan
2. Direct site and gear maintenance and repairs
3. Problem solving including anticipating problems, identifying problems, troubleshooting problems, and communicating problems

Potential:

1. Aid in the collection of spat (mussels and scallops) and monitor the handling and seeding of seed stock, often all under the supervision of manager/owner

FOOD SAFETY & REGULATORY COMPLIANCE

Required:

1. Follow food safety and biosecurity regulations and protocols

Potential:

1. Print shellfish tags
2. Collect basic samples, including the monitoring and observation of water and product (taste, smell, sick animals), and provide to manager/owner

KNOWLEDGE AND UNDERSTANDING

VESSEL AND WORKPLACE SAFETY

Required:

1. Knowledge of basic radio and cell phone communication methods along with communication with other boaters; placing and responding to distress calls; How to accurately provide your location to other vessels or the coast guard
2. Reading weather forecasts, nautical charts, and use a GPS
3. How to navigate in low/no visibility conditions
4. How to act and communicate with Coast Guard when they board your vessel
5. First-aid, preferably Red Cross certified

SHELLFISH CULTURE

Required:

1. Ability to make production decisions based on understanding of marine science areas (e.g., biology, ecology, chemistry, oceanography) that relate directly to production techniques, growth, quality, and health, biofouling, food availability, and food safety.
2. Identifying areas to be improved and efficiencies that can be attained
3. Details of different gear, layout, and production methods, including how to set up a mooring field

Suggested:

1. How to collect spat, and ensure healthy growth and low mortality rates
2. How to sock mussel lines, or do so under the supervision of manager/owner
3. How to operate iPads in cases where apps are used for business/production management

TEAM MANAGEMENT

Suggested:

1. General human resources management training, including interpersonal conflict resolution, personnel management, compliance with employment law, and potential inclusion in the hiring process

OPERATIONS MANAGEMENT

Required:

1. How to record on-farm data using paper logbooks and tablets
2. How responsibilities relate to other parts of the business, including discussions on order quantity and timelines with manager (e.g. why they need to collect x oysters by x time – in order to fulfill deliveries to x, y, and z in x city);

Suggested:

1. Baseline understanding of production and financial analysis reports (profitability, cost per unit, etc.)

FOOD SAFETY & REGULATORY COMPLIANCE

Required:

1. All relevant rules and regulations, including food safety, compliance with on-the-water production and safety practices, and company practices and protocols

SEAWEED SUPPLEMENT

DUTIES

Required:

1. Direct a team, often in tandem with two boats, to lift the seaweed grow line and harvest the product
2. Safely direct all team members
3. Ensure strict adherence to all worker safety and food safety measures and regulations
4. Help to organize the layout and employment of moorings for seaweed grow lines, including floats, droppers, buoys, and lines, and the proper marking of sites, under direction of manager/owner
5. Ensure the uniform distribution of the farm layout and seeding of lines to prevent entanglement

Potential:

1. Operate a >30 ft. vessel, including the maintenance and basic repair of a diesel engine
2. Coordinate logistics with spool source/distributors

KNOWLEDGE AND UNDERSTANDING

Required:

1. Knowledge of seaweed growing standards, and noting deviations from projections
2. Identification, and communication the identification, of poor-quality product (rotten, over-fouled, etc.), biofouling, invasive species, and red tide

SHELLFISH FARM - MANAGER

This occupational standard builds on top of the duties, knowledge, and understanding associated with the occupational standard for a marine shellfish farm hand/crew member and crew chief. It is expected that a manager will possess mastery of all expectations of a farm hand/crew member and crew leader, including the ability to explain and monitor those duties, the knowledge, and the understanding. The manager must be able to manage multiple teams and oversee the marine growout of the business, which must occur in coordination with shoreside operations.

DUTIES

VESSEL SAFETY

Required:

1. Lead activities and train workers in operation, maintenance, and troubleshooting related to the business' vessels
2. Ensure safe vessel operation, maintenance, and troubleshooting by crew chief and farm hands
3. Read weather reports and determine when/where crews will work

BUSINESS MANAGEMENT

Required:

1. Input production-tracking and environmental sample data into production and financial management databases
2. Analyze production and environmental data to optimize operations and hit targets.
3. Manage multiple projects and adhere to a strict timeline and budget, while still working with enough flexibility to move beyond roadblocks
4. Ensure farm is operating within its projected production levels, revenues, expenses, budgets, as well as on the proper timeline
5. Basic record keeping on production and sales
6. Identify and purchase equipment and seed in coordination with owner

Potential:

1. Financial management analysis.
2. Manage relationships with vendors e.g. gear, restaurants, chefs
3. Speak at public events or in recorded videos

SHELLFISH CULTURE

Required:

1. Work with owner to determine farm layout
2. Lead and oversee farm gear installation
3. Train crew chiefs and farm hands on proper farm gear maintenance and shellfish handling methods
4. Ensure that mortality and production remain consistent with projections and sales
5. Ensure crew chiefs know and follow thinning, harvest, and food safety protocols
6. Encourage tracking and reporting of any mistakes or issues with product or gear
7. Lead farm seed/spat collection, including splitting lines/cages and socking

OPERATIONS MANAGEMENT

Required:

1. Manage and plan the workflow, including the production schedule and strategy, of the business – plans for each week and each day
2. Consolidate feedback from crew leaders to create appropriate work plans
3. Distribute work plans for crew leaders, and approve work plans for work crews
4. Organize efficient use of several crews of teams, and communicate decisions and protocols up and down the chain of command

Potential:

1. HAACP, OSHA, and overall regulatory compliance and certifications, including constructive interaction with regulators and acquiring necessary permits

HUMAN RESOURCES MANAGEMENT

Required:

1. Talent management, including hiring and firing decisions in collaboration with the owner
2. Manage worker schedules and monitor employee performance to hit targets and keep labor costs within budget
3. Provide training to crew chiefs and farm hands
4. Compliance with employment law (e.g., OSHA, insurance, culture) and safety paperwork

KNOWLEDGE AND UNDERSTANDING

BUSINESS MANAGEMENT

Required:

1. Understand how production and operations fit into business development strategy
2. Basic proficiency in word documents, email, spreadsheets (e.g. Excel), possibly social media and farm management apps e.g. Oyster Tracker (Blue Trace)
3. How to manage multiple, often large project, including developing project strategy
4. Good recordkeeping, including tracking projected vs. actual

Suggested:

1. Business and operational strategic development
2. Budgeting
3. Basic business understanding

OPERATIONS MANAGEMENT

Required:

1. How to coordinate with other departments of the business e.g. aligning hatchery seed timelines and production levels with grow-out planning to ensure they fit in with projected sales numbers and timelines; understanding logistics and timelines for product harvest, processing, and delivery
2. Health and safety protocols – including the ability to explain them and ensure adherence to them in operations management e.g. OSHA, HAACP, Coast Guard safety checks

Suggested:

1. How to help draft lease paperwork and navigate the leasing process

SHELLFISH CULTURE

Required:

1. Know the different types and sizes of seed
2. Detailed understand of aquaculture production methods; best management practices for production management, including farm design protocols and schemes.
3. Detailed understanding of marine science as it relates directly to production techniques, growth, quality, size/shape, food availability, environmental stressors, product health, food safety, seasonality, and biofouling.

HUMAN RESOURCES MANAGEMENT

Required:

1. Basic human resource best practices and legal compliance
2. Team building
3. Talent recruitment and retention best practices
4. Conflict resolution and problem solving
5. How to be a good neighbor, and teaching crew how to follow these guidelines

Suggested:

1. How to create a healthy company culture, including creating an atmosphere where crew will admit mistakes rather than hide them

SEAWEED SUPPLEMENT

DUTIES

Required:

1. Design layout of farm
2. Work with crew chief or farm hand to install gear
3. Operate >30 ft. boat and direct a separate skiff in tandem with harvest
4. Diesel engine maintenance and repair
5. Ensuring collection/pickup and quality of spore
6. Oversee threading of grow lines with spools
7. Check on growth of seaweed
8. Training crew chief and farm hands on how to safely harvest seaweed, including hoist and knife use
9. Maintaining relationship with buyer/processor
10. Ensuring sale and pickup of product
11. Recruit necessary labor and equipment/vessels for harvest
12. Provide proper training for labor, and ensure functionality of equipment

Potential:

1. Post-harvest processing

KNOWLEDGE AND UNDERSTANDING

Required:

1. Best practices for monitoring and growing seaweed
2. How to accurately manage finances and production of seaweed farm with other i.e. fishing business
3. Regulatory Compliance or

Suggested:

1. Production development
2. Experience working with regulators and applying for leases
3. Social media and marketing