



# Maine Aquaculture Workforce Development Strategy Summary



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# Project Introduction



Aquaculture holds great promise for maintaining – and expanding – Maine’s marine economy and working waterfronts. Through aquaculture, Maine’s coastal communities can continue their maritime heritage by augmenting wild fisheries with growing sustainable, premium-quality seafood. Maine is uniquely positioned for sustained aquaculture growth owing to an abundance of cold clean waters, proximity to large markets and distribution centers, the ‘Maine’ brand, strong industry representation, world class research centers, first-rate education and training institutions, and support from nonprofits focused on community economic development. However, the lack of a trained workforce could jeopardize Maine’s aquaculture future.

As part of its strategy to spur job growth in aquaculture, FocusMaine sponsored the Gulf of Maine Research Institute (GMRI) and Maine Aquaculture Association (MAA), in partnership with Educate Maine, to create a strategic roadmap for Maine aquaculture workforce development. The partners then contracted a team drawn from four Scottish consulting firms<sup>1</sup> to lead development of that roadmap to tap expertise from a country with a developed industry and to ensure complete objectivity. The consultants brought international aquaculture expertise in business development, workforce development analytics, and workforce training at both higher education and vocational levels. The Maine-based partners helped orient the Scottish team to the aquaculture and education landscape in the state and supported the research by organizing meetings with businesses

and institutions, organizing and convening steering committee meetings, and co-developing and administering surveys and interviews. This summary reflects the consultants’ recommendations from the comprehensive report: The Maine Aquaculture Workforce Development Strategy (see link below).

Direct input from Maine’s aquaculture industry – including established and prospective land-based operations, marine producers, service providers, and supply chain companies - formed the base of the analysis. Over the course of the work, the consultants met with 15 businesses and 62 businesses were formally interviewed or surveyed. In addition, they met with representatives of 17 of Maine’s education or training institutions and surveyed another 33. GMRI convened a steering committee of 30 representatives from various Maine education and training institutions to provide feedback throughout the project. The resulting strategy described in this summary leverages existing resources in Maine and anticipates how workforce needs will change as the industry develops over time.

Note: The analysis and strategy focused primarily on education or training programs with a direct connection to long-term employment at an aquaculture sector business. Although non-vocational programs fell outside the project’s scope, they complement workforce development efforts by increasing aquaculture career awareness and supporting development of some of the core skills valued by employers from a range of sectors, including aquaculture.

**Full report available at: [www.gmri.org/projects/maine-aquaculture-workforce-development-strategy](http://www.gmri.org/projects/maine-aquaculture-workforce-development-strategy)**

<sup>1</sup> Martyn Haines, Pisces Learning; Andrew Parker, Imani Development; Pamela Reid, Ekosgen; and John Bostock, University of Stirling

# Snapshot of Maine's Aquaculture Industry

The aquaculture sector has grown in Maine over the past 10 years and comprises large scale finfish production alongside a constellation of generally smaller firms operating in shellfish (oysters, mussels, scallops) and marine algae.

In addition, there are new entrants that reflect the growth of the sector and in some cases new production models:

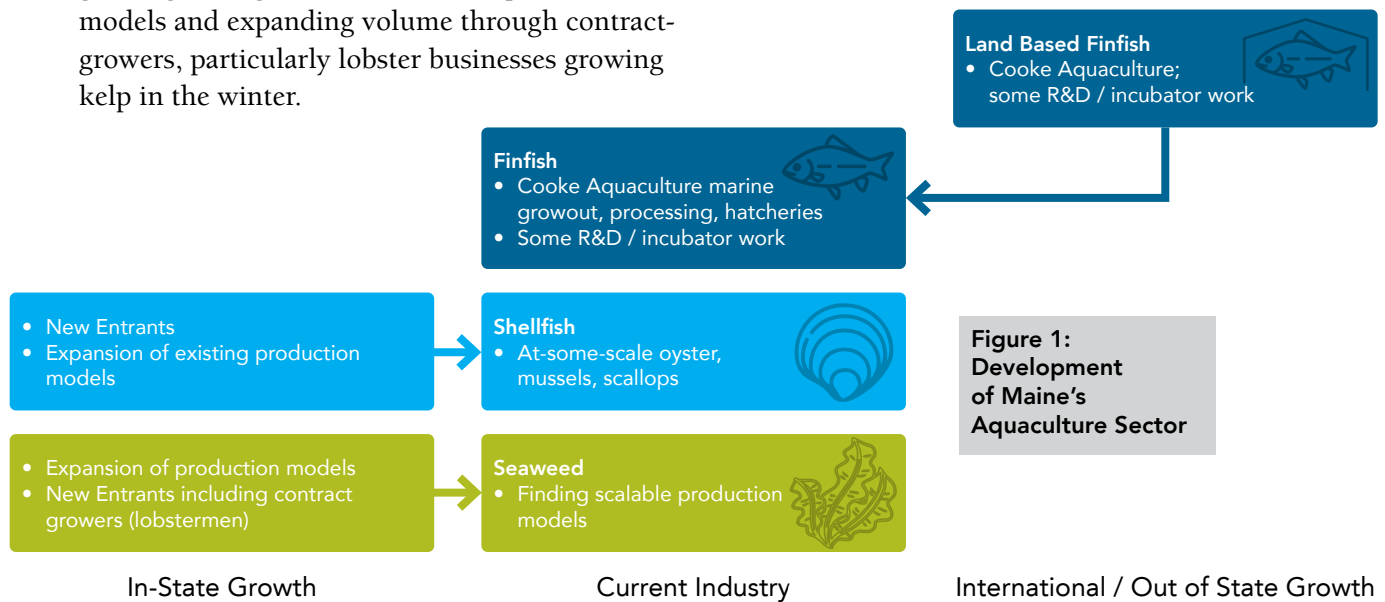
- In finfish, land-based Recirculating Aquaculture Systems (RAS) are moving from a globally nascent production model into a new finfish production system for Maine. Inward investment is coming from national and international firms.
- In shellfish, newcomers and existing producers are improving productivity to continue a scaling up of the sub-sector within the existing model.
- The sea vegetable (marine algae) sub-sector is growing through a combination of production models and expanding volume through contract-growers, particularly lobster businesses growing kelp in the winter.

## Current Employment and Growth Trends

Maine's total aquaculture workforce exceeds 600 direct employees, plus auxiliary services, further trades, transport, processing, equipment supply, and retail employment across the value chain.

Based on interviews with existing and prospective business owners, it is expected that:

- by 2022 the aquaculture workforce will comprise around 880 employees across production and related direct activities, and over 1,600 across the supply chain; and
- by 2030 the workforce could exceed 1,000 direct employees, and over 2,000 in the total production, supply chain and downstream markets.



**Figure 1:**  
Development  
of Maine's  
Aquaculture Sector

	2022			2030		
	Low	Medium	High	Low	Medium	High
Total Employment across aquaculture production, direct processing by producers, and selected relevant service providers	697	<b>884</b>	1,046	920	<b>1,175</b>	1,450
Total employment across aquaculture value chain	1,316	<b>1,669</b>	1,975	1,737	<b>2,218</b>	2,738

**Table 1: Employment Growth Through 2030**

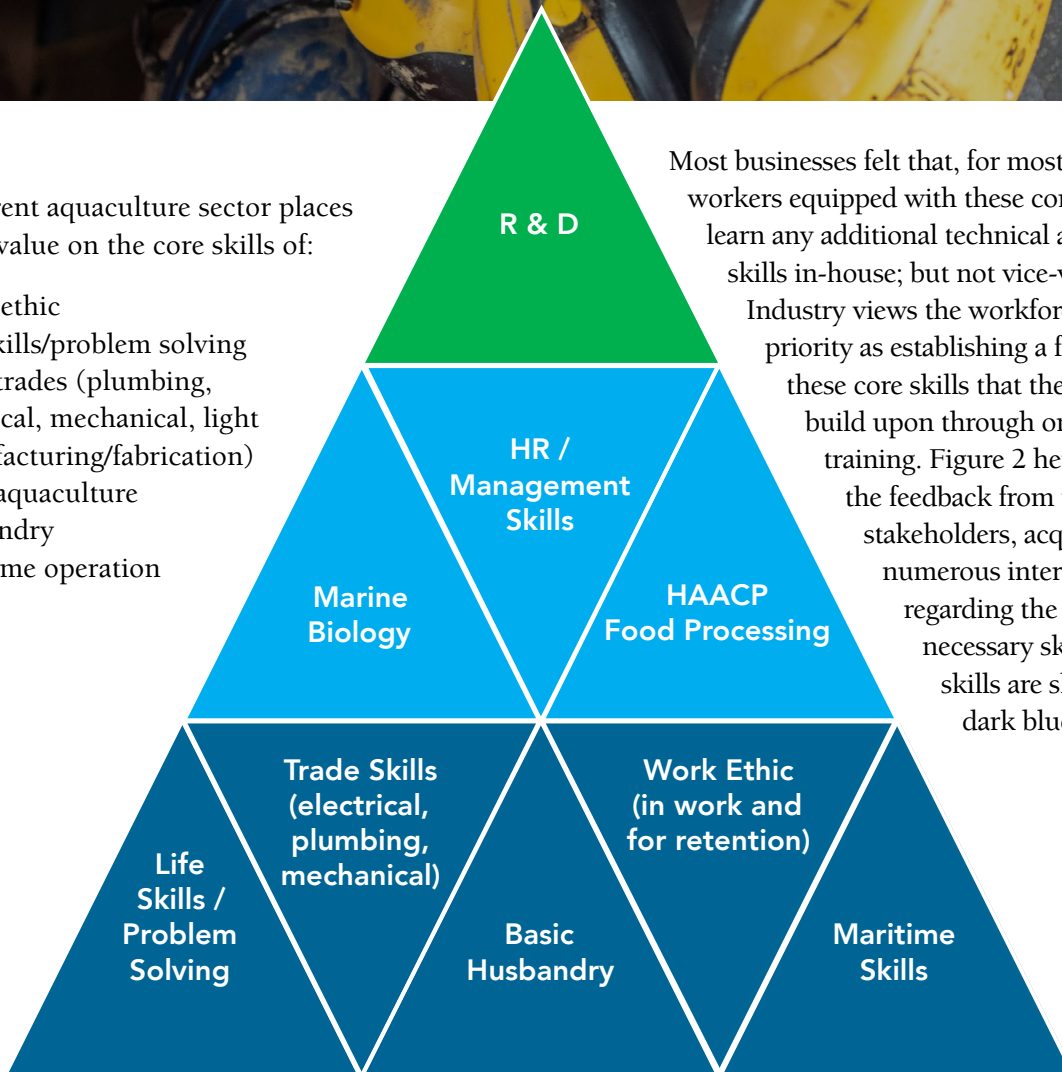
Note: High, medium, and low scenarios are estimated based on anticipated growth trends under different economic, technological, market, regulatory, and social drivers. See Growth Scenarios and Drivers section of full report for complete details.

# Skills Needed for a Vibrant Industry

## Core Skills

Maine's current aquaculture sector places the highest value on the core skills of:

- Work ethic
- Life skills/problem solving
- Basic trades (plumbing, electrical, mechanical, light manufacturing/fabrication)
- Basic aquaculture husbandry
- Maritime operation



Most businesses felt that, for most positions, workers equipped with these core skills can learn any additional technical and scientific skills in-house; but not vice-versa.

Industry views the workforce training priority as establishing a foundation of these core skills that they can then build upon through on-the-job training. Figure 2 here shows the feedback from industry stakeholders, acquired through numerous interviews, regarding the range of necessary skills. Core skills are shown as the dark blue base tier.

Figure 2: Maine Aquaculture Sector Skills Pyramid as Perceived by Industry

## Practical Experience

Businesses place a high value on practical know-how. Maine's industry stakeholders believe that on-the-job training is valuable but would be better supported through programs structured to develop and formalize occupational competencies.

## Positions Within the Industry

Various job types across the sector generally fall into seven position categories described in Table 2 (next page).

POSITION	JOB DUTIES	HARD SKILLS	SOFT SKILLS
<b>Directors (13%) &amp; Senior Management (18%)</b>	Oversight and continuity of the business; understand all aspects of the business; financial well-being; strategic direction. <i>Smaller companies require all-around engagement by director. Larger firms will have directors focused on departmental functions.</i>	Financial planning and management; business administration; business development; operations planning and management; husbandry; regulatory compliance; HAACP basics; maritime; health and safety; sales; marketing; personnel management; logistics; general science.	Strategic thinking; communication; conflict resolution; problem solving; leadership; prioritization; delegation; work ethic.
<b>Scientific / Research (7%)</b>	Lab work; routine testing; molecular / genetic requirements. <i>Examples: Molecular biologist; aquatic veterinarian. May differ between service providers and production.</i>	Lab and research skills; regulatory compliance; disease management; fish health; molecular biology; genetics; testing / running assays; digital literacy; record keeping; grant writing	Analytical; critical thinking; ability to follow internal protocols; communication; writing; work ethic.
<b>Skilled and Intermediate Technician / Operative (7%)</b>	Day-to-day tasks in hatcheries, marine growout, land-based processing facilities, and laboratories. <i>Examples: Farm Crew; Processing Crew; Fish Health Coordinator; Vaccine Specialist.</i>	Equipment operation and maintenance; SCUBA; maritime; mechanical tool use; regulatory protocols; production techniques; seed stock handling; lab and research; digital literacy; record keeping.	Communication; Problem solving/critical thinking, conflict resolution; work ethic.
<b>Unskilled* Technician / Operative (42%)</b>	As above, implementing day-to-day tasks. <i>Farm and processing crew: fulfilling more basic functions of farm and processing crew. Non-technical lab technician: Cleaning, filling tubes, labelling, organization.</i>	Helping under supervision with activities listed for "Skilled (and Intermediate) technician / operative" above. <i>*Despite 'unskilled' categorization, are expected to quickly obtain technical skills.</i>	Communication; time keeping; teamwork; problem solving; work ethic.
<b>Maintenance / Engineering (6%)</b>	Maintaining and repairing a range of machinery and production functions (hydraulics, pneumatics, engines, electrical systems, plumbing, construction/fabrication)	Maritime skills; vehicle, machinery and boat maintenance (pneumatic tools); health and safety; natural science; production processes; time / temperature controls, thermometer calibration; digital literacy; record keeping.	Communication; problem solving and conflict resolution; organization; work ethic.
<b>Support / Administration (6%)</b>	Various: Sales; record keeping; accounting; human resources; information technology; financial management tasks; audit compliance. <i>More specialization of roles in larger companies. Smaller companies noted HR and IT as area not easily covered by managers.</i>	Various: office management; IT; accounting; HAACP basic; disease management; call handling; regulatory awareness, digital literacy; record keeping.	Problem solving; communication; teamwork; work ethic.

**Table 2: Overview of Common Skills Needs by Position Category. Percentages indicate representation within Maine's 2019 Aquaculture Sector. See full report for additional detail.**

# Workforce Education, Training Supply and Demand

	INDUSTRY DEMAND	SUPPLY	PROPOSED ROLE WITHIN CORE OF VOCATIONAL EDUCATION AND TRAINING PIPELINE	FUTURE ROLE
HIGHER EDUCATION	<b>Low.</b> Majority of jobs require foundation of non-higher education type skills, technical / science procedures do not require HE degree and are taught in-house.	<b>Ample.</b> Supply being met by marine biology, general-science, engineering, and miscellaneous degree programs in ME and the US.	Make aquaculture R&D facilities and staff available to CC & CTE vocational signature industry programs.	Demand for higher education graduates expected to increase as industry grows and rationalizes and new manager-level positions are created; RAS likely to require specialized higher-education training once operational.
COMMUNITY COLLEGE	<b>High.</b> Aquaculture sector values foundation of practical and trades skills typical of CC associates degree programs.	<b>Low.</b> Commercial Fishing & Marine Tech certificate program at Washington County Community College.	Establish vocational hub at Southern Maine Community College & Washington County Community College that tie to CTE signature industry program at Mid-Coast School of Technology and Aquaculture Apprenticeship program.	Establish 2+2 education pathways with higher education as future demand necessitates.
ADULT EDUCATION	<b>High.</b> lots of interest in aquaculture technical training programs for new farmers and fishermen.	<b>Ample.</b> There are two well-regarded and fully-enrolled programs being offered through Aquaculture In Shared Waters and the Aquaculture Business Development Program.	Status quo. Potential for linkages to mid-coast vocational signature industry program.	
CAREER TECHNICAL EDUCATION (9-12)	<b>High.</b> Aquaculture sector values foundation of practical and trades skills typical of vocational CTE programs.	<b>Very limited.</b> High school programs are not filling vocational skills void.	Establish CTE signature program at Mid-Coast School of Technology in Rockland that links with community college and Apprenticeship programs.	Expand to additional CTE centers as future demand necessitates.
HIGH SCHOOL STEM	<b>Low.</b> For direct employment, <b>critically important</b> to career awareness and achieving social license.	<b>Low.</b> A handful of aquaculture STEM-based programs exist at Maine's coastal high schools.	Develop aquaculture programs for high school teachers to enrich science curriculum and promote aquaculture careers.	Same
APPRENTICESHIP	<b>High.</b> Strong demand for workers with occupational-competency based experience.	<b>Low.</b> Limited internship offerings and no formal programs.	Establish formal Aquaculture Apprenticeship Program through the Maine Department of Labor	Achieve long-term financial sustainability; maintain relevancy of occupational standards as industry matures and evolves.

Table 3: Skills supply & demand and proposed roles within the aquaculture workforce development strategy.



# Workforce Development Strategy

The consultants recommend developing a vocational education and training (VET) system with: 1) three regional vocational hubs, 2) an apprenticeship program, 3) an occupational coordinator tasked with development of Occupational Standards, and 4) a marketing effort to inform learners and businesses about the VET. The approach leverages existing vocational-oriented partnership models between Community College, Career and Technical

Education (CTE), and Maine Department of Labor Apprenticeship (Apprenticeship) to foster long-term program sustainability; and account for regional macro-factors that make employee recruitment and program delivery difficult. The VET model caters broadly to the industry's diverse and evolving needs by providing a foundation of transferable core skills that can be built on through higher-education programs.

## 1. Three Vocational Hubs

At the core of the system are coastal community colleges and a CTE school to provide much-needed vocational training. Because they are financially accessible to most people and designed to cultivate local talent, Maine's community colleges are uniquely positioned to provide vocational aquaculture training. The strategy envisions a two-year aquaculture Associates Degree that includes the core skills cited by industry and can be built in large part from existing program offerings.

### a. Southern Vocational Aquaculture Hub: Southern Maine Community College

Southern Maine Community College (SMCC) in South Portland is well positioned to fill the vocational education and training gap to meet demand in the southern part of Maine. In addition to offering courses in trades and business management/administration, SMCC has a respected marine science program and staff with aquaculture husbandry and business experience. SMCC is adjacent to Casco Bay, where commercial aquaculture and the potential for industry linkages are widespread.

### b. Mid-Coast Vocational Aquaculture Hub: Mid-Coast School of Technology

The Mid-Coast School of Technology (MCST), a CTE center in Rockland, is well positioned as lead organization for vocational training in mid-coast Maine, with the University of Maine as a key partner. As a CTE school, the MCST is equipped to provide basic training in core practical skills and basic science at the high school level and can extend relationships with community college and Apprenticeship partners for specialized training as necessary. While interested and motivated to serve vocational aquaculture demand in mid-coast Maine, where aquaculture is established and growing, the MCST would need support for aquaculture-specific course delivery. The University of Maine, through the Darling Marine Center and Aquaculture Research Institute, has the high-quality staff and facilities necessary to train students (or provide exposure) in husbandry, specialized marine biology, wet lab, and RAS systems.

Marketing support for this signature vocational aquaculture program is critical, because CTE Centers draw from regional high school students who opt for the technical, career-oriented track at a CTE center instead of their local high school. Potential students must understand the distinction between any aquaculture STEM programming offered at their local high school and the CTE's in-depth vocational aquaculture track.

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### c. Downeast Vocational Aquaculture Hub: Washington County Community College

Washington County Community College (WCCC) in Calais is well positioned as lead organization to fill vocational aquaculture training demand in Eastern Maine. This region's aquaculture industry is primarily salmon farms, a hatchery, and value-added processing facility, all operated by Cooke Aquaculture. A partnership with the Downeast Institute on Beals Island, would give students access to aquaculture-specific husbandry and science. This program should be designed broadly, to include proximate sectors with similar skills needs such as commercial fishing.

## 2. Aquaculture Apprenticeship

A Maine Department of Labor-approved aquaculture apprenticeship program has a vital role to play within the aquaculture workforce pipeline by providing practical experience and competence testing in a commercial setting. The program would also provide credits toward a community college associate degree.

## 3. Occupational Standards Development and Coordinator

Effective aquaculture workforce supply relies on close collaboration with the industry and should adhere to specific standards that are developed in partnership with industry and routinely updated. This will be particularly important as Maine's current industry professionalizes and pioneering land-based aquaculture companies become operational. The process should be led by a full-time Occupational Standards Coordinator, housed within the community college system, working closely with the Maine Aquaculture Association and industry to capture the skills requirements of aquaculture staff at all levels within each subsector. For the system to remain responsive, regular skills evaluation and forecasting must become a part of the aquaculture workforce development review system to constantly flag the need for new credentials, to ensure training is technically current.

## 4. Marketing of Signature Programs

Initial marketing support is required to complement and support the signature vocational aquaculture programs until industry recognizes the credentials as providing the core skills they want their employees to have. Over time, industry will increasingly respect formal vocational aquaculture education and training and preferentially seek qualified new entrants. As this becomes apparent, the demand from learners will grow, increasing the viability of these signature programs.

# Key Additional Elements

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## Partnerships

A strategically driven collective effort between education and training providers and industry is necessary to maximize and braid funding opportunities together to develop the new essential core VET programs initially and then to achieve long-term financial sustainability. Continuation of the Aquaculture Workforce Development Steering Committee, formed and led by GMRI and Educate Maine during this process, is a natural forum where these discussions can continue.

## Lessons from Abroad: Oversupply / Misalignment Failure

It is critical to align programing with student and industry demand. Programs need sufficient enrollment to be financially viable; supply and expectations of graduates should match available jobs; and industry must recognize and respect formal qualifications. In the short term, funding should be allocated to address the vocational education and training gap identified by our research as the highest priority. The quality of

the new provision, the reputation of providers and the credibility of the credentials and qualifications delivered, are all dynamic parameters that will shape the ebb and flow of demand over time and require constant management.

## Potential for Maine as an International Aquaculture Training Hub

There is potential for Maine's higher education sector to attract international students. The United States has a strong reputation for higher education and as an English-speaking country will be attractive to a wide variety of students. While college fees are generally high in the US by international standards, costs for universities in Maine are not too different from alternatives in UK or Australia. Given the projections for global aquaculture growth, there should be a clear case for US institutions to develop similar capacity, and Maine may be sufficiently diverse in its production, with active aquaculture educators, to be a good candidate. To deliver this would require a significant investment in faculty/staff.

# Conclusion

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The full Maine Aquaculture Workforce Strategy report provides detailed, practical recommendations for developing, instituting, and sustaining a comprehensive workforce development system for the state. Maine's aquaculture industry is poised to grow across all existing and nascent sub-sectors. It is the perfect time to embark on the strategy to provide the industry with skilled, dedicated labor and create pathways for Maine talent to enter this important growth sector.

As partners in FocusMaine's initiative to grow jobs in Maine's aquaculture sector, GMRI, MAA, and Educate Maine are grateful for FocusMaine's support and essential funding, to the members of the steering

committee who devoted significant time to ensure a rigorous product, the team of consultants who brought insights and objective analysis to the topic, and the many businesses who offered their time and experience to inform the work.

The strong, open partnerships that helped create this strategy will remain crucial to its long-term success. The more the educational institutions remain connected to the aquaculture industry and each other, the more effective and generative their offerings will be. As the industry grows and evolves, new opportunities and needs will arise, which will reward innovation and elevate Maine's aquaculture industry even further.

Full report available at: [www.gmri.org/projects/maine-aquaculture-workforce-development-strategy](http://www.gmri.org/projects/maine-aquaculture-workforce-development-strategy)