Workforce Development *in* Aquaculture & Fisheries

LANDSCAPE ANALYSIS OF OCEAN-RELATED CAREER PATHWAYS FOR LEADERSHIP & CAREER DEVELOPMENT

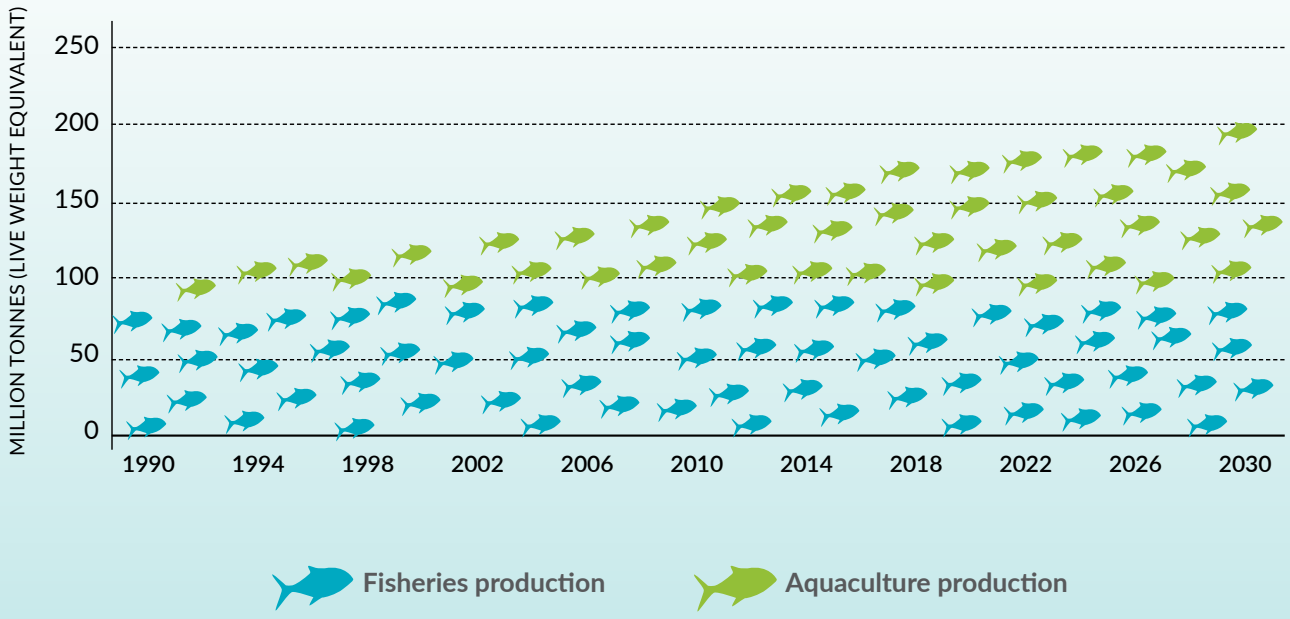
A report for the Builders Initiative, developed by Blue Earth Consultants, a Division of ERG

1 Background & Purpose

CURRENT STATE *of* AQUACULTURE *and* FISHERIES

Fish are a major diet staple, accounting for 17 percent of the animal protein that humans consume, and per capita consumption is continually increasing. To meet this increasing demand, between 2011 and 2016, aquaculture production increased from 61.8 to 80.0 million metric tons.[1] In the same timeframe, however, the worldwide production of fisheries (i.e., fish caught through capture methods, referred to as either "fisheries" or "wild-capture fisheries" throughout this report), decreased from 92.2 to 90.9 million metric tons due to ongoing overexploitation and declining fish stocks (Figure 1).

FIGURE 1. World Fisheries and Aquaculture Production, 1990–2030[2]



1 Food and Agriculture Organization (FAO) of the United Nations. *The State of World Fisheries and Aquaculture*, (Rome, 2018) 2–34. Available at: http://www.fao.org/3/i9540en/i9540en.pdf

2 Ibid.

LANDSCAPE ASSESSMENT PURPOSE

An educated and trained workforce is critical to ensuring that the aquaculture and fisheries sectors can sustainably adapt to ongoing changes and increasing demand. This workforce must be able to tackle emerging challenges and possess the requisite knowledge and skills to enhance industry sustainability. To better understand career pathway options for the aquaculture and fisheries sectors, the Builders Initiative hired Blue Earth Consultants, a Division of ERG, to complete a landscape assessment of North American (including the United States, Canada, Mexico, and the Greater Caribbean) aquaculture and fisheries education and training programs. Blue Earth conducted web-based research and qualitative interviews with representatives from ocean-related businesses and developed recommendations the Builders Initiative could use to strengthen training and career development opportunities. This report summarizes findings from the assessment.

Photo: Lida Pet-Soede. www.theseveseas.net/wp/wp-content/uploads/2019/08/shrimpfarm.jpg

This workforce must be able to tackle emerging challenges and possess the requisite skills and knowledge to enhance industry sustainability.

2 Landscape *of* Existing Institutions *in* North America

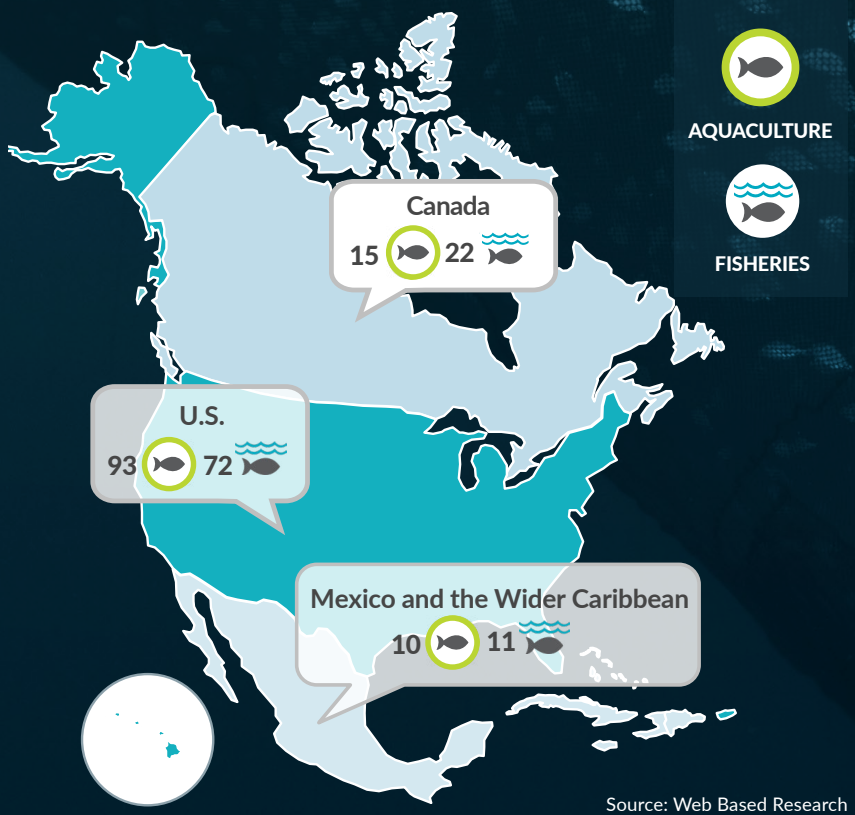
Summary *of* Findings

- The **U.S. North Atlantic and West regions are geographic hubs** for aquaculture, fisheries, and coastal marine academic institution, training, and certification program activities.
- **Aquaculture programs** excel in **business training** while **fisheries program** strengths focus on **biological aspects and quantitative assessments**.
- **Aquaculture and fisheries programs target early career professionals** – i.e., recent graduates of high school and undergraduate and graduate programs – providing them with **natural science expertise and business and resource management skills**.
- Programs increased **employment and provided new knowledge and skills** to participants.
- NGO and extension programs find it **challenging to maintain staff capacity and secure funding**, though **partnerships and tailored curriculums** offset some of these difficulties.

EXISTING INSTITUTIONS *by* SECTOR *in* NORTH AMERICA

Of the 234 programs Blue Earth researched, 55 percent relate to aquaculture, 49 percent are fisheries programs, and 21 percent focus on general coastal and marine policy and management, with the majority (68 percent) of programs based in the United States (Figure 2). For the 128 aquaculture programs researched (Figure 3), the majority (66 percent) focus on nearshore saltwater aquaculture components and very few (11 percent) have aspects related to offshore aquaculture (Box 1).

FIGURE 2. Location of Aquaculture and Fisheries Programs in North America



Source: Web Based Research

FIGURE 3. North America Aquaculture Program Subcategories

FRESHWATER focuses on freshwater fish species.

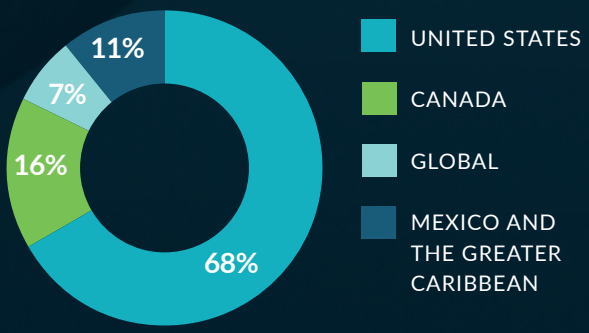
SALTWATER NOT OFFSHORE coastal and saltwater species, not including offshore aquaculture.

SALTWATER OFFSHORE are in the open-ocean and off the continental shelf.

NON-SPECIFIC programs that train participants in aquaculture but did not specify the type.

Source: Web Based Research

A majority of fisheries and aquaculture institutions researched in North America are **located in the U.S.**



BOX 1. Open Ocean Aquaculture Training

Open ocean aquaculture is a developing area that has less impacts (e.g., fish food waste, sea lice) than some forms of coastal aquaculture. As offshore aquaculture grows and regulations become more permissive (see Recommendation 2 regarding ways to help create a more favorable regulatory landscape), training programs will need to incorporate open ocean aquaculture into their curriculums. Institutions that contain open ocean aquaculture elements include the following:

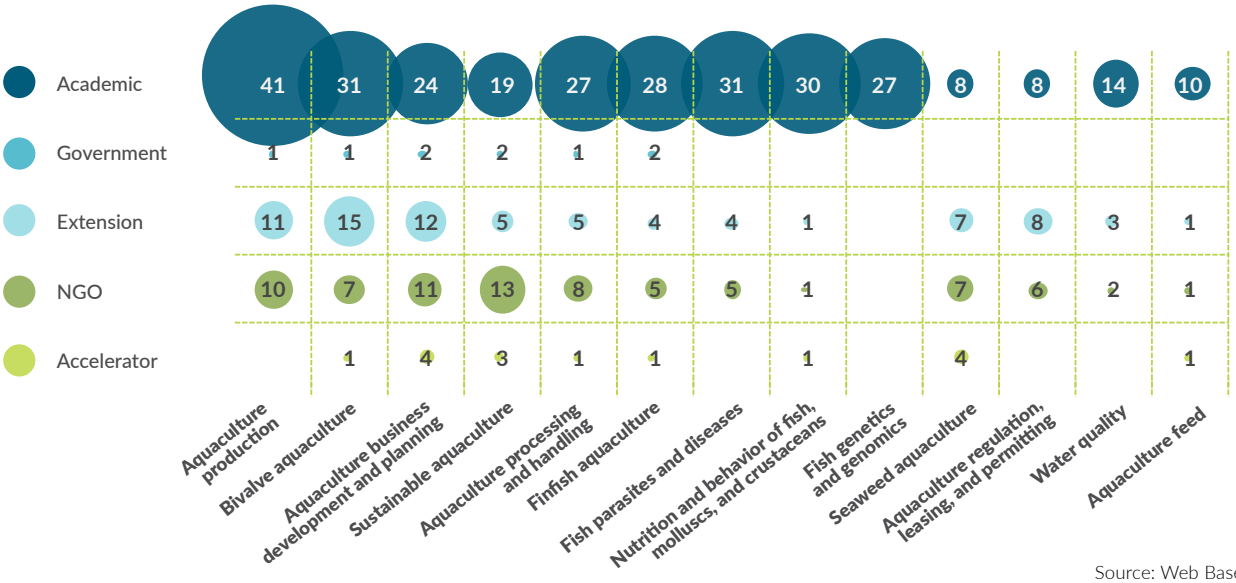
- Aquaculture Technology Program, Carteret Community College
- Fisheries and Aquaculture Program, Quebec School of Fisheries and Aquaculture
- Global Aquaculture Academy
- Gulf of Maine Research Institute, Marine Resource Education Program, Aquaculture
- Hatch Aquaculture Accelerator
- Master of Environmental Science and Management, Bren School of Environmental Science and Management, University of California at Santa Barbara
- Master of Professional Science in Aquaculture, Rosenstiel School of Marine and Atmospheric Science, University of Miami
- Pioneering Offshore Aquaculture Workshop and other workshops, Florida Sea Grant

Background photo: Shutterstock / Adnan Buyuk

AQUACULTURE *and* FISHERIES PROGRAM STRENGTHS

Analysis of program strengths demonstrated that **aquaculture production** and **fisheries biology, physiology, and ecology** are the top strengths of North American education and training programs. Geographically, the **North Atlantic**, which has the most aquaculture programs in the United States, has the greatest number of programs with strengths in topics such as bivalve aquaculture (62 percent) and aquaculture production (53 percent)[3] (Figure 4). For aquaculture, very few programs had strengths in water quality or aquaculture feed, highlighting the potential to expand these areas. For fisheries, the **West** has the greatest number of programs in the United States, with top strengths in topics such as marine fishery management (67 percent) and fishery biology, physiology, and ecology (63 percent) (Figure 5). Notably, very few fisheries programs in the United States have strengths in wild-capture fish processing and handling or wild-fish vessel and harvesting operations—even though these are useful practical skills for entrants to the workforce. The gaps in program strengths highlight the need for more programs that address these topics and prepare participants to enter the workforce (see Recommendation 5 for possible solutions and Box 3 for examples of programs that address gaps in the existing landscape).

FIGURE 4. Count of Institution Type by Aquaculture Program Strengths



Source: Web Based Research

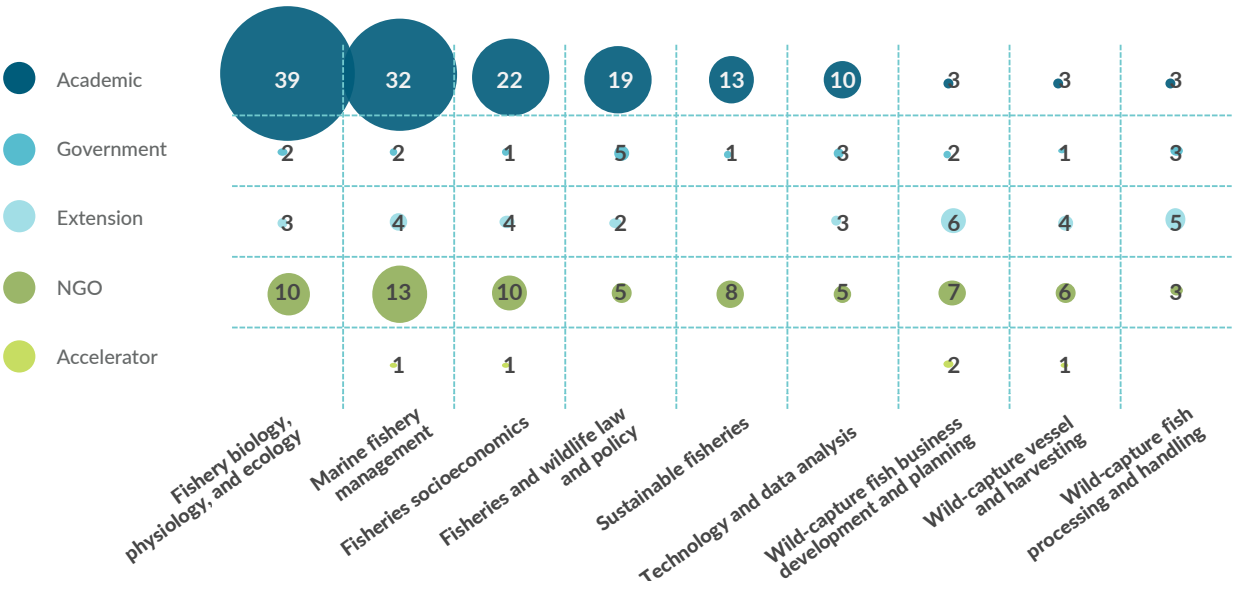
3 The private sector was not a focus of the landscape assessment web-based research. However, Blue Earth investigated a few organizations in the private sector that offered training and education related to aquaculture and fisheries, such as Fish Safe, SeaAhead, Centre for Ocean Ventures and Entrepreneurship (or COVE), and Infrafish. There may be more training and education programs offered by the private sector that were not identified in this research.

BOX 2. Spotlight: Models to Build Leadership and Capacity

Some programs focus on developing participants' leadership abilities and practical capacity to enter the workforce, addressing critical needs that many other programs do not cover. These could serve as models when expanding existing or building new programs (see Recommendations 3–5) and include the following:

- **SECORE International** aims to restore reef ecosystems around the world by building the capacity of locally based nongovernmental organizations (NGOs). SECORE transfers knowledge of the latest technology and restoration methods to its partners and provides training in skills such as project management.
- **Global Seafood Assurances' Sustainable Ocean Leadership Institute** is a four-day conference focused on climate change impacts on aquaculture and fisheries that combines classroom learning sessions with field trips. Participants visit local businesses and governments to see climate adaptation measures in action and then develop and implement a climate solution capstone project.
- **National Fisheries Institute's Future Leaders Program** provides hands-on training focusing on seafood production, processing, farms and hatcheries, cold storage, safety, and communications for industry professionals excelling in their careers. The program aims to develop leadership skills and connect industry workers.

FIGURE 5. Count of Institution Type by Fisheries Program Strengths



Source: Web Based Research

TRAINING METHODS *and* TARGET AUDIENCE

To better understand the demographics of programs, Blue Earth investigated their target audiences (Figure 6; also see Box 3 for more details on target audience demographics). Overall, the top two population groups targeted (n = 169) include:

• **Early career professionals (45 percent):** This was the most prevalent audience type, with at least 76 programs targeting early career professionals (i.e., recent graduates of high school, undergraduate, and graduate programs). Most programs that target early career professionals are at academic institutions.

• **Wild-capture fishers (17 percent):** At least 28 programs targeted wild-capture fishers. Notably, at least seven aquaculture programs specifically target fishers, training them to transition from wild-capture fisheries to aquaculture. NGOs are the most prevalent type of institution that targets wild-capture fishers.

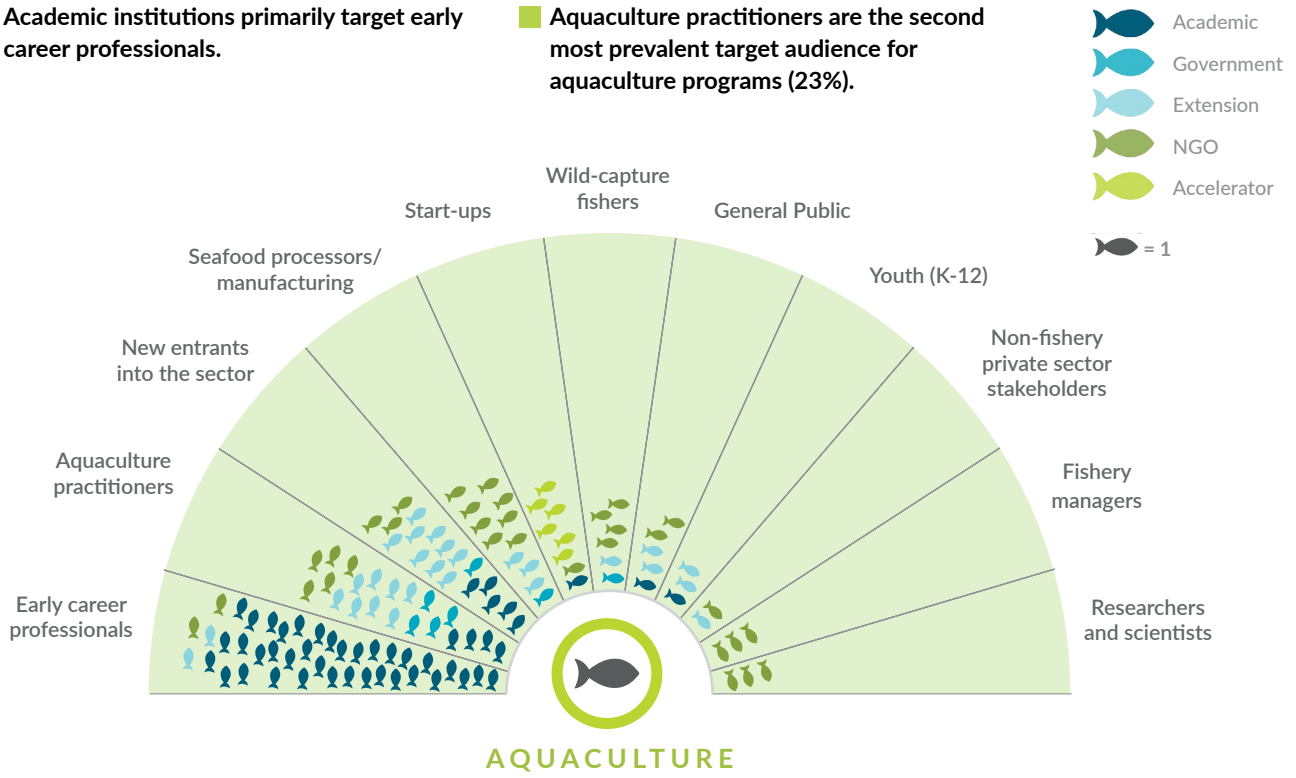
> “[We] specifically target working waterfront families—existing commercial fishermen or sons and daughters of commercial fishermen who are unable to get permits. ... Many fisheries closed. Kids in fishing families [are] unable to continue family tradition but could switch to aquaculture.”
>
> *– Interview informant*

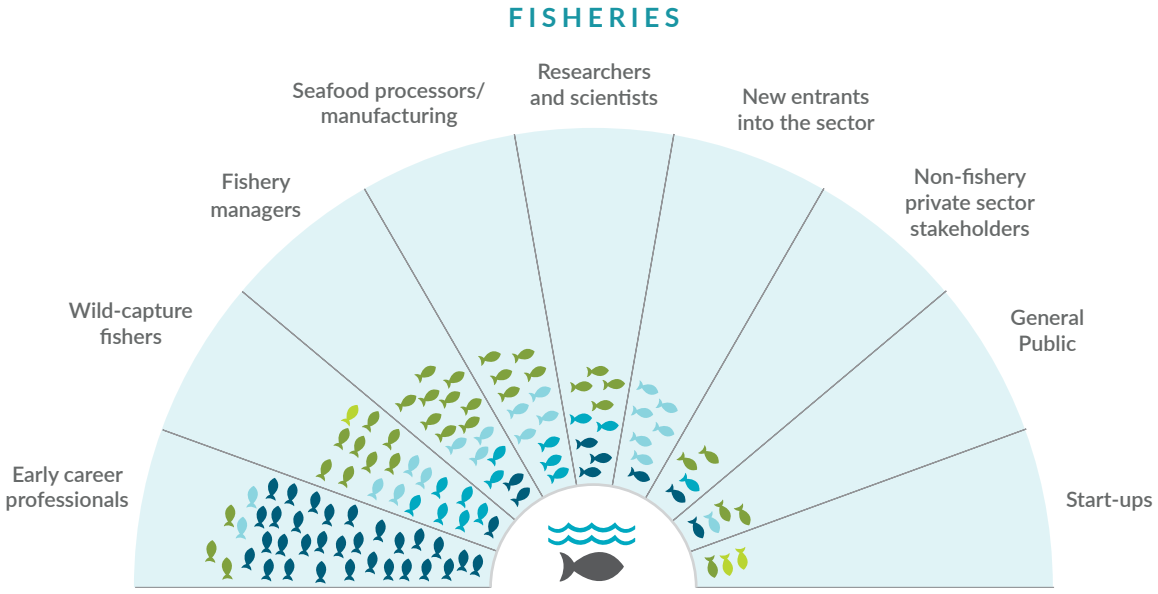
Photo: Hog Island Oyster Co.

FIGURE 6. Count of Institution Type by Target Audience (Aquaculture and Fisheries)

Academic institutions primarily target early career professionals.

Aquaculture practitioners are the second most prevalent target audience for aquaculture programs (23%).





Early career professionals are a key target audience for fisheries programs.

Notably, there are no identified fisheries programs that target aquaculture practitioners or youth (K-12).

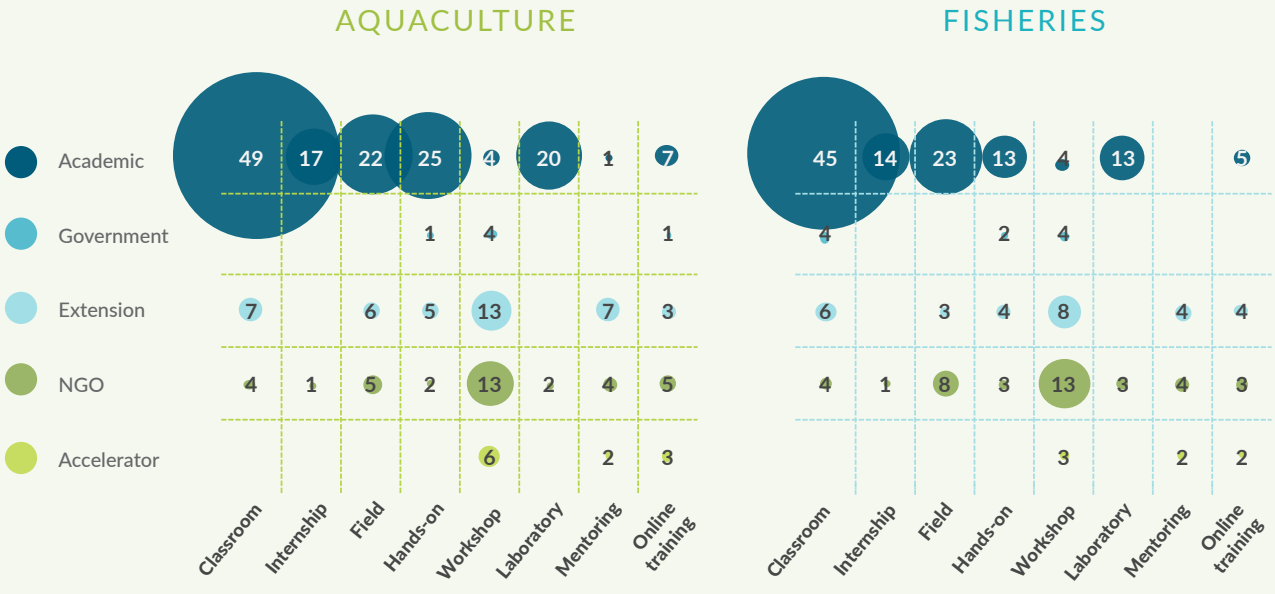
Source: Web Based Research

In regard to education and training (Figure 7), the **classroom setting**—generally offered by academic institutions—was the most common education type for both fisheries (57 percent) and aquaculture (47 percent) programs. For aquaculture programs, the next most common method was workshop training (34 percent), followed by in-the-field and hands-on methods (28 percent each). For fisheries programs, compared to the number of aquaculture programs, fewer programs provide workshop (35 percent) and in-the-field (33 percent) training. Findings demonstrated a lack of sufficient hands-on training in both sectors compared to the critical need for these skills that informants highlighted in interviews. This illustrates the opportunity to establish more programs that focus on providing hands-on training (see Recommendations 3 and 4 later in this report).

FIGURE 7. Count of Institution Type by Education and Training Method

Academic institutions train participants using multiple methods.

Aquaculture practitioners are the second most prevalent target audience for aquaculture programs (23%).



Source: Web Based Research

BOX 3. Spotlight: Targeting Diverse Audiences

Many programs are expanding their reach to target underserved audiences and help generate more diversity in both sectors. They are working to ensure that these groups are represented and have the financial resources and incentives to attend programs, a current need highlighted by interview informants. (See Recommendation 7 for solutions to address this issue.) Notable programs on this front include:

- **Oregon State University's (OSU) Bachelor of Science in Fisheries and Wildlife Sciences.** OSU offers a novel online degree in this field, with 600 to 800 students from all 50 states and 27 countries enrolling in the online program each year. The program attracts many students who return to school later in life and represent more diverse populations, including tribal representatives, first- and second-generation Latinos, students from large urban areas, and veterans.

- **Gulf of Maine Research Institute's Marine Resource Education Program** has diversified its audience by expanding its reach across the country. This program offers a regional workshop series for fishers in the Greater Atlantic, Southeast, West Coast, and Caribbean. It also brings together fishers, policymakers, and scientists so that fishers may learn about the regulatory and management processes that govern their work, and policymakers and scientists can learn about the inner workings of the fishing community.

- **Bridgeport Regional Aquaculture Science and Technology Education Center (RASTEC)** is a program for high school students that replaces the traditional high school experience with a vocational curriculum based in aquaculture science and technology in the Northeast. The institution prides itself on creating capable young adults ready to enter the aquaculture workforce, a critical need highlighted by many interview informants.

> "[RASTEC graduates] could go to work immediately in any aquaculture sector and be successful. ... I would take a Bridgeport kid who's 18 years old over a [graduate with a] Master of Science in marine biology any day."
>
> *– Interview informant*

Photo: RASTEC https://bit.ly/2vRUdpK

3 Perceived Projected Trends *in* Job Demand *and* Supply *in the* Aquaculture *and* Fisheries Sectors

Summary *of* Findings

Both the aquaculture and fisheries sectors are placing an **increasing empahsis on sustainable products.**

While the fisheries sector is likely to contract, **aquaculture is expanding**.

Scientific and technical expertise, skilled labor, and business skills are critical needs for both sectors in the coming years.

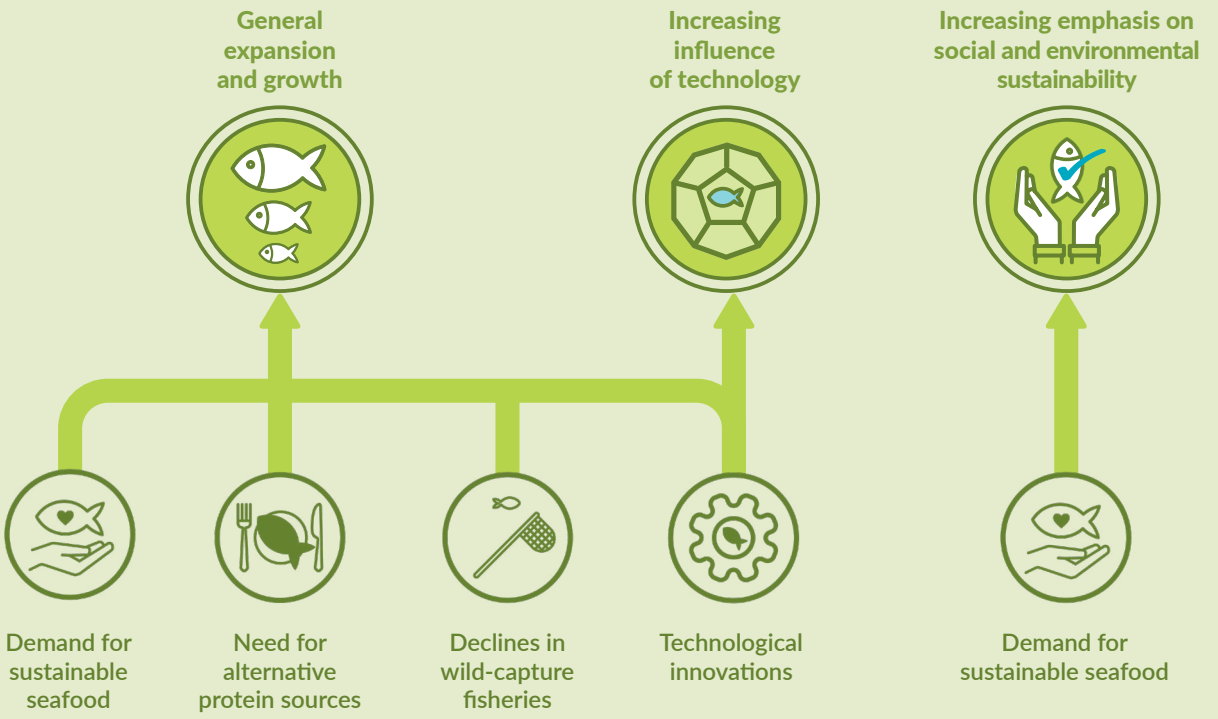
The **sustainability and technology fields are driving improvements** in both aquaculture and fisheries.

Employers are searching for staff who have both **strong technical and leadership skills** but face **difficulties finding qualified staff**.

PERCEIVED PROJECTED TRENDS *and* SHIFTS *in* AQUACULTURE

Interview informants shared their perspectives regarding projected trends and shifts in both the aquaculture and fisheries sectors. For aquaculture, their projections reflected global patterns regarding the growth of aquaculture and the decline of wild-capture fisheries: over three-fourths of informants cited growth of the aquaculture sector as the major change that will occur in the coming years. According to informants, the perceived decline of wild-capture fisheries and continued demand for seafood is helping the aquaculture sector grow, with influences from the technology sector and the social and environmental sustainability sector also spurring growth (Figure 8). Informants noted that there is still a need to further improve understanding of the positive triple bottom line value of aquaculture industries, as well as to counter a lingering stigma regarding negative environmental and health impacts of aquaculture products, as outlined later in this report in Recommendation 1.

FIGURE 8. Perceived Projected Trends and Shifts in the Aquaculture Sector

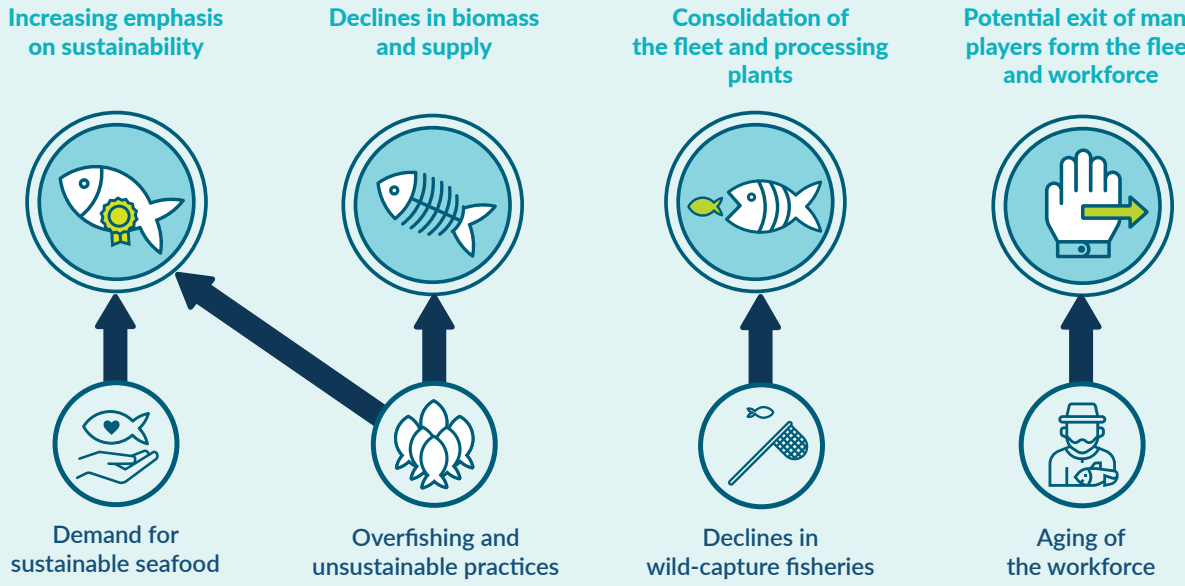


Source: Interviews

PERCEIVED PROJECTED TRENDS *and* SHIFTS *in* FISHERIES

In contrast to aquaculture, but also reflecting global trends, informants expect that fisheries resources will decline in biomass and supply—causing fishing vessels and processing plants to consolidate and the sector to stop growing or contract (Figure 9). Despite these changes, the fisheries sector is still making advances. For example, most respondents highlighted that the industry is increasingly emphasizing sustainability and has begun (and likely will continue) to focus on sustainability mechanisms, such as increasing certifications, conducting fishery improvement projects, and strengthening supply chain traceability. Technological advances—like remote sensing, vessel tracking software, and block chain technology—are also promoting sustainability by strengthening the ability of workers to track catch and landings.

FIGURE 9. Perceived Projected Trends and Shifts in the Fisheries Sector



Source: Interviews

EMERGING OPPORTUNITIES *in* BOTH SECTORS

For the aquaculture sector, growth will likely lead to an increase in multiple job types, from hatchery technicians and boat drivers to farm workers. Associated with these needs, employers will seek out individuals with greater skills in and understanding of the complexities of farm and hatchery management and operations to run facilities, as well as to provide skilled labor in the facilities themselves (e.g., individuals familiar with aspects of farm and hatchery operations such as observing fish population levels, optimal rearing conditions for specialized breeds). Additionally, technological advances will create demand for jobs related to the technical components of aquaculture, such as innovative genetic breeding methods, the development and implementation of new technology for regulating and monitoring fish feed and health, offshore communication technologies, and sonar.

For fisheries, interview informants highlighted opportunities and skills that reflect the shifts they expect to occur in the sector, such as the increasing emphasis on sustainability and demand for sustainable, high-quality products. These changes could result in increases in jobs related to innovative fisheries technology, like new traceability apps and software, as well as processing jobs to develop higher-quality post-harvest products.

Employers in both sectors have a strong demand for skilled labor jobs and individuals well versed in technology, science, and business management, as they often struggle to find staff with these skills. Current education and training programs, however, do not commonly cover these topics, demonstrating an opportunity for the Builders Initiative to consider strategies that could help support the growth of the programs that do offer these critical skills (see Recommendation 5). Additionally, these practical skills highlight the need to strengthen collaboration between the industry and education and training programs, particularly in academia, to help ensure these programs meet the needs of future employers (see Recommendation 6, as well as Box 4 for details on a few programs that address the key gaps).

BOX 4. Spotlight: Promoting Growth in the Aquaculture and Fisheries Sectors

Certain education programs are deviating from traditional classroom learning to address gaps and provide needed skills like business management, marketing, technological innovation, and more. Notable examples include the following:

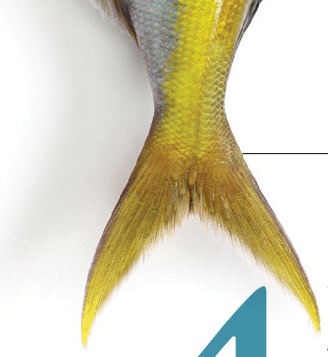
- **GreenWave** is based in the Northeast United States and hosts a competitive two-year seaweed and shellfish ocean farming training program. Participants receive free technical assistance regarding site and market selection, permitting and planning, and gear types, as well as hands-on farm training focused on seaweed seeding and harvesting.

- **Aquaculture in Shared Waters** is a multi-partner program involving University of Maine School of Marine Sciences; University of Maine Sea Grant; University of Maine Cooperative Extension; Maine Aquaculture Innovation Center; Coastal Enterprises, Inc.; Maine Aquaculture Association; and the Island Institute. This program helps fishers transition from wild-capture fisheries to aquaculture using a mix of training methods that introduce students to the issues important in running a successful aquaculture business.

- **University of Southern Mississippi's Thad Cochran Marine Aquaculture Center and Center for the Blue Economy** are pioneering new approaches to education and training. The Cochran Center is a research and graduate education center that focuses on hands-on aquaculture training; it also leases space and provides financial resources to support local aquaculture businesses. The new Center for the Blue Economy is still under development but will seek to bridge the gap between marine resource users and industry, local businesses, and sustainable financing in the Gulf of Mexico region.

> "[We are] seeing some growth in Maine. In last five years roughly 250 new farms have started. Roughly 60% of [these] farmers went through some type of training program [including the] Aquaculture in Shared Waters Program...."
>
> *– Interview informant*

Photo: Kathlyn Tenga-González, Maine Sea Grant https://bit.ly/2vTyJZW



4 International Institutions

Blue Earth researched 18 programs at international institutions across 13 countries and five continents (Box 5). The most common types of education offered by these international institutions included academic and training, followed by fellowships, certificates, and an online informational toolbox.

Blue Earth selected three programs to research in greater detail based on informant recommendations and discussions with the Builders Initiative, as well as their representation of diverse geographies, sectors, and education types. These programs use innovative methods that could apply in North America; they include the following:

- **University of Stirling, Institute of Aquaculture:** The Institute of Aquaculture—located in Stirling, Scotland—is the world's largest international aquaculture center. It offers bachelor's degrees in aquaculture and marine biology, as well as master's degrees in sustainable aquaculture, aquatic pathobiology, and aquatic veterinary studies.

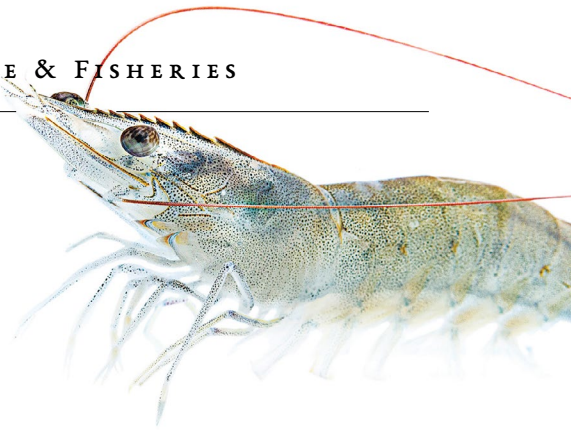
- **University of Bergen, Fisheries, Ecology, and Aquaculture:** The Department of Biological Science at the University of Bergen in Norway hosts a Fisheries Ecology and Aquaculture (FEA) research group. FEA members conduct research at both the individual level and ecosystem level through theoretical, experimental, and field-oriented approaches. Students enrolled in the biology master's program can specialize in aquaculture biology, fisheries biology and management, or marine biology and conduct research with FEA faculty.

- **WorldFish Centre:** WorldFish Centre is an international nonprofit research organization headquartered in Malaysia with offices in Africa, Asia, and the Pacific. WorldFish works with governmental and nonprofit partners in Bangladesh, Cambodia, Myanmar, Nigeria, Tanzania, and Zambia to provide environmentally friendly, selectively bred fish reared on sustainable feeds. WorldFish also researches the policy and management changes necessary to improve the resilience and productivity of small-scale fisheries.

BOX 5.

International Institutions Researched and Sectors Addressed

- EDGE Fellows; *general coastal and marine*
- European Union Horizon 2020, Tools for Assessment and Planning of Aquaculture Sustainability; *aquaculture*
- Institute of Fisheries Management; *fisheries*
- James Cook University; *aquaculture and fisheries*
- Katapult; *aquaculture*
- Pacific Community, Sustainable Pacific Aquaculture Development Project; *aquaculture*
- United Nations University Fisheries Training Program; *aquaculture and fisheries*
- United Nations, Division of Fisheries, Aquaculture, and Marine Systems; *aquaculture and fisheries*
- Universidad del Atlántico de Cartagena; *aquaculture*
- University of Aberdeen, International Centre of Aquaculture Research and Development; *aquaculture and fisheries*
- University of Galway, Carna Research Institute; *aquaculture*
- University of Stirling, Institute of Aquaculture; *aquaculture*
- University of Tasmania, Institute of Marine and Antarctic Studies; *aquaculture and fisheries*
- University of Bergen, Fisheries, Ecology, and Aquaculture; *aquaculture and fisheries*
- WorldFish Centre; *aquaculture and fisheries*
- University of Western Australia, Oceans Institute; *aquaculture and fisheries*
- Wageningen University, Aquaculture and Fisheries Group; *aquaculture and fisheries*



5 Analysis *of the* Landscape

Summary *of* Findings

IN AQUACULTURE

- Demand for **trained workers** in farm and hatchery operations.
- Lack of programs offering training in **technology and data analysis** as well as business entrepreneurship, despite demand for skills.
- Need for more programs that offer **internship and hands-on work experiences**, so participants have the practical skills they need to enter the workforce.

IN FISHERIES

- **Exodus** of trained workers due to age and lack of opportunity
- Few programs focus on training related to modernizing the industry in **applied technology methods** (e.g. traceability), though these are in high demand.
- Need for programs to target a **greater array of audiences** (e.g., mid-career professionals) through accessible education methods (e.g., online courses and degrees).

AQUACULTURE GAPS *and* UNMET NEEDS *in the* LANDSCAPE

Given the continued growth of the aquaculture sector, both internationally and in the United States, it is critical to consider existing gaps in the landscape of education and training programs and determine opportunities to expand that landscape. Blue Earth analyzed the strengths of 122 aquaculture programs with available data and compared them to the key skills demanded of workforce entrants (Figure 10). Overall, the greatest number of existing aquaculture programs focused on training participants in **skilled hatchery and farm labor**, despite it being only the fourth most common skill set demanded in the sector. Far fewer programs focused on training participants in two important, in-demand areas: **technology and engineering** and **data analysis and business entrepreneurship**. This is a notable gap in the landscape given the aquaculture sector's increasing emphasis on technology and engineering innovations—from changes in feed and fish health monitoring technologies to the development and expansion of

Photo: Shutterstock / Mati Nitibhon

new technologies for recirculating aquaculture systems and offshore aquaculture facilities. Additionally, informants continually stressed the importance of entrepreneurship skills that would allow workforce entrants to start and manage new businesses. Growing demand in both of these areas demonstrates an opportunity for programs to place greater emphasis on these skills to better prepare participants for entering the workforce (see Recommendations 3–5 for potential solutions).

Other gaps included the following:

Audience

Though many institutions target early career professionals, fewer extension and NGO programs target existing practitioners or new entrants to the sector—both those who are early or mid-career and wish to enter the sector or transition from wild-capture fisheries to aquaculture. There are opportunities to expand the number of programs that focus on these professionals.

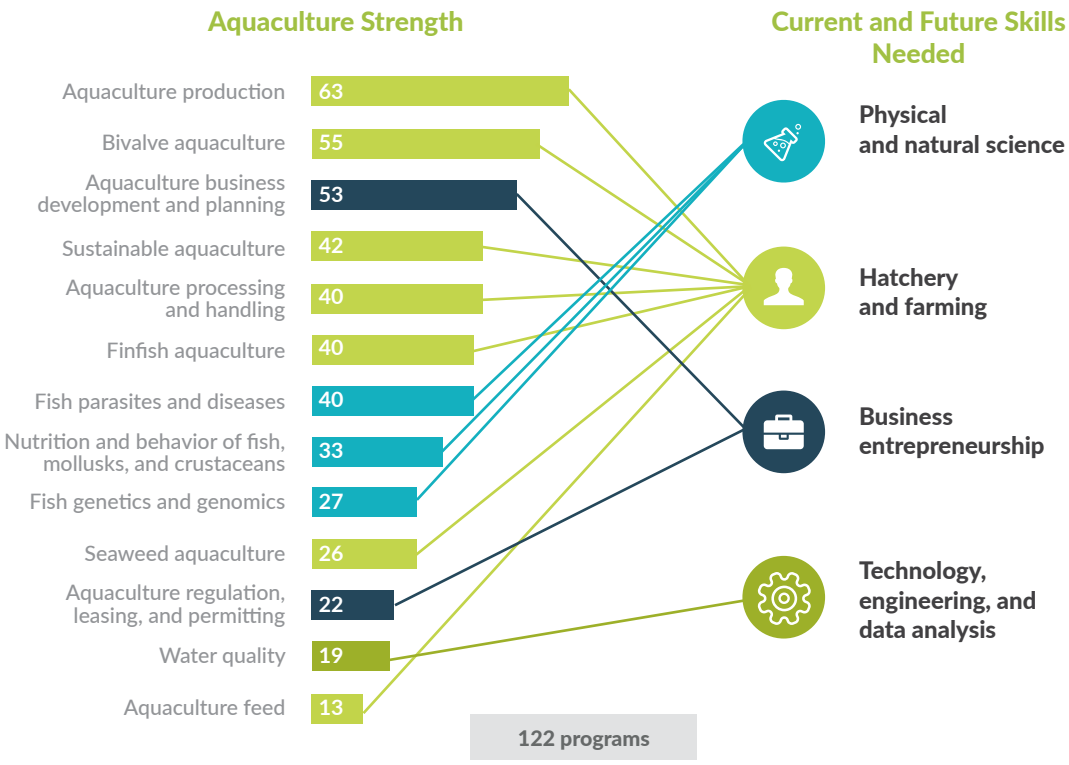
Education and training methods

Most aquaculture programs that Blue Earth reviewed focus on classroom training. There is a noticeable gap in the number of programs that offer hands-on training or professional internships, which workforce entrants need to gain the practical skills necessary to address job requirements and be strong assets to their companies (see Recommendations 3, 4, and 6 for potential solutions).

Geographic distribution of programs

Only two out of 12 programs in Mexico and the Wider Caribbean focused on aquaculture. According to the Food and Agriculture Organization, in 2016, North America employed 9,000 individuals in the aquaculture workforce, whereas Latin America and the Caribbean (notably, a much larger area than

FIGURE 10. Comparison of Job Skills in Aquaculture



Source: Web Based Research and Interviews

covered in Blue Earth's analysis) employed 381,000, or 2 percent of the total global workforce.[4] Additionally, due to less stringent regulations on aquaculture, Mexico has seen increased investment in and development of aquaculture operations. These considerations point to a potential need to strengthen the number of education and training programs in Mexico and the Wider Caribbean—where many existing workers may not have formal training in aquaculture—which could help expand sustainable aquaculture development (see Recommendation 3 for potential suggestions).[5]

Offshore aquaculture

Blue Earth only identified 14 total programs across 10 institutions with training and education related to offshore aquaculture. Given the potential growth of the offshore aquaculture sector in the next decade, particularly if permitting in the United States allows more of these facilities (see Recommendation 2), there is a clear need for more programs that provide offshore operations training.

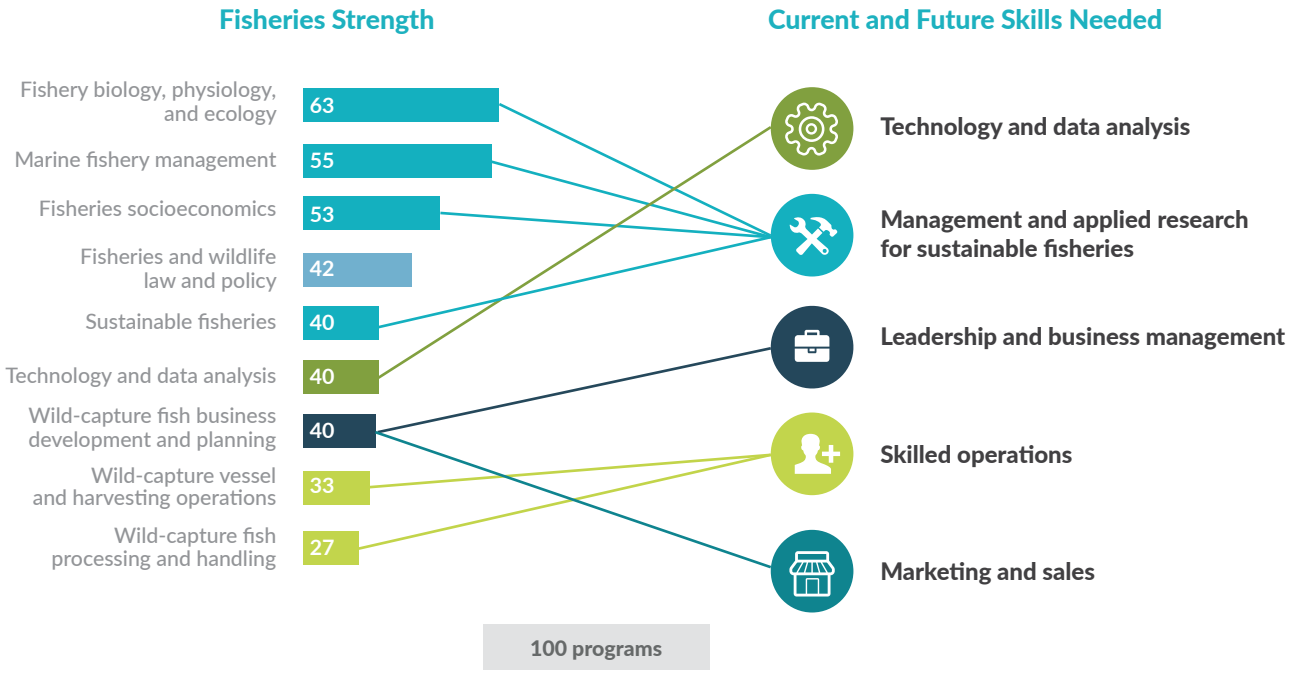
4 FAO of the United Nations. *The State of World Fisheries and Aquaculture*, (Rome, 2018) 2–34. Available at: http://www.fao.org/3/i9540en/i9540en.pdf

5 A caveat to this potential gap is that Blue Earth's research in Mexico and the Caribbean was not as extensive as it was for the United States and Canada. Though we conducted searches in both English and Spanish, additional information may exist in other countries that we were unable to find through basic web research.

FISHERIES GAPS *and* UNMET NEEDS *in the* LANDSCAPE

Blue Earth reviewed 100 fisheries programs with data on strengths and compared the available data to the top skills demanded for workforce entrants (Figure 11). Most existing fisheries programs focus on training participants in multiple aspects of natural and social fisheries science. Although these topics are in demand for individuals entering the workforce, technology and data analysis are the most demanded skills, as they enable workers to better monitor catch and use new technology (e.g., catch tracking apps). Only 22 of the 100 programs researched, however, have strengths in this area. Other needs include business, marketing, and sales skills to help sell products to new markets and increase demand for new or high-quality post-harvest products, as well as skilled laborer training in areas such as boat and gear handling to support on-board labor. These findings highlight that while programs may excel in preparing participants for jobs related to management and applied research for sustainable fisheries, more opportunities exist for training in relation to the technological and analytical, leadership and management, and skilled labor aspects that are demanded of new workforce entrants (see Recommendations 4–6).

FIGURE 11. Comparison of Job Skills in Fisheries



Source: Web Based Research and Interviews

Photo: Coast Guard Compass / Petty Officer 3rd Class Casey J. Ranel.

Additional gaps include the following:

Audience

As with aquaculture, fisheries education and training programs tend to target a fairly limited audience, with the most common audience also being early career professionals. Other institution types, like NGOs and extension programs, target fishers, fishery managers, and processors. Academic institutions, however, are not targeting these groups, and although multiple extension programs target processors, fewer target fisheries managers and fishers. There is an opportunity to strengthen outreach to these individuals, particularly those who may already be in the field but wish to pursue continuing education (e.g., through a professional master's degree program) to face upcoming challenges in the sector.

Education and training methods

Similar to aquaculture, the most prevalent education type is classroom training, mainly offered by academic institutions; NGOs and extension programs generally focus on short-term workshops. All institutions need to provide more hands-on training and internships to offer participants a diversity of potential professional experiences and better prepare them to enter the workforce (see Recommendation 4).

6 Recomendations *for* Future Investments

Throughout North America, an array of institutions offer diverse aquaculture and fisheries education and training programs to a variety of audiences. However, there are still gaps in program offerings as compared to the skills demanded in the workforce—particularly in relation to the business, management, and leadership skills that will help workforce entrants in both sectors meet upcoming shifts and challenges. Blue Earth developed the recommendations below for Builders Initiative to consider as it defines its investment strategy in aquaculture and fisheries workforce education programs.

AQUACULTURE PROGRAMS

Recommendation 1—Improved perception of sector: There is a lingering stigma upon the aquaculture sector, particularly in the United States, fueled by environmental concerns and low-paying employment options. This stigma contributes to some of the public's disinterest in the industry and in potential workforce entrants' decisions to focus on other career types. To increase the attractiveness of the aquaculture industry, the Builders Initiative could *raise the public's awareness of the sector's ability to provide quality employment options to individuals interested in supporting an industry that could help solve food security and sustainability issues.*

Recommendation 2—Strengthened regulatory framework: Along with its workforce development efforts, the Builders Initiative should also consider finding ways to address the U.S. aquaculture sector's lack of global competitiveness. The Builders Initiative could support industry development efforts in coastal areas and the open ocean, as well as land-based initiatives. Specifically, it could *encourage U.S. states and coastal communities in important aquaculture regions (North Atlantic, Gulf of Mexico, West) to develop planning and policy strategies that support the sector's sustainable growth.*

Recommendation 3—Hands-on aquaculture training opportunities: Existing aquaculture programs still lack offerings on topics critical to sector growth, such as technology, data analysis, and engineering, as well as business entrepreneurship. Additionally, very few programs in North America focus on offshore aquaculture. These topics are necessary to advance the growth of the sector. Geographically, there is a need to strengthen education and training programs in countries like Mexico, where the aquaculture sector is growing. The Builders Initiative could *provide funding to support and expand aquaculture education and training program—particularly those with hands-on components—that address key topical gaps and needs in the sector (e.g., technological innovations and offshore aquaculture).*

FISHERIES PROGRAMS

Recommendation 4—Hands-on fisheries training opportunities: Like aquaculture, the fisheries sector still needs programs that focus on more applied research and training, particularly in areas such as technological advances and the leadership and management skills necessary to support fisheries businesses. More research and training need to happen both in the classroom and on the water to facilitate the conditions required to produce outstanding, sustainable products and develop new innovative methods and technologies that further advance sustainable fisheries. The Builders Initiative could *provide funding to support fisheries education and training programs that provide greater applied training opportunities and prepare participants to address key gaps in the sector, such as technology, data analysis, leadership and management, and skilled labor*.

AQUACULTURE & FISHERIES PROGRAMS

Recommendation 5—Centers of excellence: To build a stronger workforce for both sectors—one that is technologically astute, business savvy, and scientifically innovative—the Builders Initiative could help develop or strengthen centers of excellence for aquaculture and fisheries within strong existing institutions. These centers could be based at universities and target diverse audiences, depending on the institution, from undergraduates to mid-career professionals wishing to broaden their skills and expertise. Specifically, the Builders Initiative could *support coordinated efforts to develop aquaculture and fisheries educational centers of excellence that address key gaps in the sectors and offer cross-disciplinary training.*

Recommendation 6—Collaboration among industry and academia: Despite increasing efforts of some institutions to better integrate the academic and private sectors, there is still a great disconnect between the two. This lack of integration limits academia's ability to ensure that programs target the current needs of the aquaculture and fisheries sectors. Additionally, strengthened connections between industry and academia could provide opportunities for more practical experiences for students, like hands-on training and internships. The Builders Initiative could *support strengthened integration of industry and university programs in aquaculture and fisheries.*

Recommendation 7—Participant incentives: In many instances, high education costs and limited job opportunities can derail students' trajectories, depriving the aquaculture and fisheries sectors of bright individuals and reducing their workforces' diversity. Increased funding for award-worthy students with opportunities to study at prominent institutions and centers of excellence would create a pipeline of capable workforce entrants. To address these issues, the Builders Initiative could *provide outstanding aquaculture and fisheries students with financial support to attend education and training programs.*

Workforce Development *in* Aquaculture & Fisheries

LANDSCAPE ANALYSIS OF OCEAN-RELATED CAREER PATHWAYS FOR LEADERSHIP & CAREER DEVELOPMENT

A report for the Builders Initiative,
developed by Blue Earth Consultants,
a Division of ERG