LABOUR MARKET INFORMATION

Canada's Sustainable Blue Economy: A Profile of its Relevant Sectors and Labour Force

IMPACT PAPER

PREPARED FOR: ECO CANADA
PREPARED BY: THE CONFERENCE BOARD OF CANADA

September 2022

Acknowledgements

This study was funded by the Atlantic Canada Opportunities Agency (ACOA). We are greatly appreciative of the support. We are also grateful for the services provided by Group ATN Consulting Inc., Training Works, and Cheryl Knight & Associates Ltd.

We also acknowledge the contributions of individuals that provided their expertise through interviews or working group discussions.

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Key Findings

Low ocean literacy and general interest in the oceans sector is a major challenge in Canada. More oceans education in the K–12 and post-secondary systems and better marketing, communications, and reputation-building from governments, industry associations, and companies can address this challenge.

By far, the most in-demand skills in the sustainable blue economy (SBE) are related to science, technology, engineering, and mathematics (STEM). The most in-demand STEM occupations include scientists, data analysts, and engineers. While some of these positions require highly specialized training specific to some subsectors, many others have transferability from non-ocean-related sectors into the SBE.

Advanced technologies are quickly gaining traction in the SBE. Technologies that promote remote work (e.g., remote telemetry) are already commonplace in aquaculture and predate the COVID-19 pandemic. It's no longer as necessary for workers to go offshore to complete their work. Artificial intelligence through remote sensors is also common throughout the SBE.

Affordable housing became less available as Canadians moved to the coasts during the pandemic, putting pressure on an already low housing stock. This is a new challenge for hiring and retention on the East Coast, and it will be difficult for wages to keep up with the increased cost of living.

While the oceans sector is traditionally very white and male-dominated, new efforts and organizations, including Ocean Allies, Ulnooweg, and Canada's Ocean Supercluster, are ensuring greater equity, diversity, and inclusion in the SBE. Increasing diversity in the sector can help lead to more innovation and growth.

Introduction

Canada has the longest coastline globally, is surrounded by three oceans, and could be a global leader in the sustainable blue economy (SBE). Despite this potential, Canada, at 1 per cent, is behind many other nations in the share of GDP generated from ocean-related industries, compared with an average of 2 to 5 per cent across member countries of the Organisation for Economic Co-operation and Development. In Norway, a leader in the ocean sector, the share is 25 per cent.[1]

The SBE is more than just the ocean economy. According to the World Bank, the blue economy is the "sustainable use of ocean resources for economic growth, improved livelihoods and jobs, and ocean ecosystem health."[2] The SBE includes the environmental, social, and economic sustainability of the oceans. Therefore, developing the SBE is about growing the sector and making it cleaner and more equitable.

This study focuses on six large and promising subsectors for the SBE in Canada: fisheries and aquaculture; marine transport, ports, and shipping; ocean technologies; offshore minerals and resources; marine renewables; and marine and coastal tourism.[3] These subsectors hold promise for Canada's future economic interests and the growth of its SBE. In addition, shipping, fisheries, and tourism carry social and cultural importance for Canadians.

Research Objectives

This report is part of a broader research initiative aiming to develop the SBE in Canada through codifying job requirements, helping workers transition, and guiding programming for credentials, curricula, syllabi, and training within the different subsectors. With rapid changes occurring in ocean-sector occupations, governments, academic institutions, workforce development organizations, and employers need to collaboratively update the necessary skills and knowledge requirements for SBE occupations. Before we can achieve these goals, however, we need a foundational understanding of the SBE in Canada, its major sectors, and its workforce.

This report provides an overview of the current state of Canada's SBE, emphasizing in-demand and essential occupations and skills development in the six subsectors. Specifically, we examine the SBE's workforce makeup, hiring needs and challenges, current labour and skills gaps, emerging occupations, and skills requirements. We use an environmental scan, a literature review, interviews, and an employer survey. (See Appendix A for our methodology.)

1 Hanlon, "Ocean Food."
2 World Bank, "What Is the Blue Economy?"
3 Other sectors are very ocean-centric, such as ocean conservation and marine defence; however, they were outside of the scope of this study.

Canada's Sustainable Blue Economy

Although Canada is not currently reaching its SBE leadership potential, its ocean economy employs 350,000 Canadians.[4] Six SBE subsectors of focus contain opportunities to grow and move toward greater environmental, social, and economic sustainability on all three coasts. However, this advancement will take a concerted effort from and alignment among government, academia, and industry to address challenges in the SBE.

Six Subsectors of Interest

Fisheries and Aquaculture

Fisheries include the commercial catching of finfish, shellfish, and other marine species. We categorize fish- and seafood-processing within fisheries, as there is a high degree of vertical integration in the industry. This industry is culturally and economically important in Canada, especially in the coastal communities of the Atlantic and Pacific coasts. Canadian fisheries contributed $3.7 billion to GDP and employed 45,907 workers in 2018, while fish- and seafood-processors contributed more than $6.6 billion and employed 26,429 workers in the same year.[5]

Canada's fisheries present several sustainability challenges and opportunities. Finding uses for fish and seafood by-products is one area that is gaining traction. Interviews also mentioned new and advanced technologies to help reduce bycatch. One of the largest recent challenges in this subsector is workforce diversity and inclusion and the conflict between Indigenous and non-Indigenous fish harvesters.

Aquaculture includes inshore and offshore farming of marine flora and fauna. Over a dozen types of fish and shellfish are farmed in Canada—Atlantic salmon, mussels, trout, oysters, and clams are the most prominent.[6] Aquaculture provides $2.1 billion to GDP and generates $5.2 billion in economic activity per year, employing 21,300 full-time positions.[7]

4 Canada's Ocean Supercluster, "About."
5 Chalupovitsch, Lafrance, and Nguyen, "Statistics for Canada's 2018 Commercial Fisheries."
6 Canadian Aquaculture Industry Alliance, "Aquaculture in Canada."
7 Canadian Aquaculture Industry Alliance, "Industry by the Numbers."

Globally, aquaculture has major sustainability challenges. In Canada, many industry players are working to control sea lice and reduce their threat to farmed fish and nearby wild populations. The industry is also moving toward newer farming methods such as closed containment ocean pens, land-based recirculating aquaculture systems, and sites farther offshore. However, these new methods have not yet seen wide-scale adoption in Canada.

Many aquaculture companies, especially on the West Coast, have also been hiring positions related to reconciliation (e.g., Director of Reconciliation), improving Indigenous workforce participation, and entering into partnerships with First Nations.

Marine Transport, Ports, and Shipping

Marine transport includes the marine import and export of goods, the ferrying of people, and tug services. This subsector is culturally and economically important in Canada. In 2016, the subsector directly contributed $3 billion to GDP and supported around 99,000 direct and indirect jobs.[8]

Ports include terminals for ferries, cruise ships, cargo ships, tankers, and other water vessels to land, dock, load, unload, and fuel. Container storage is also an activity for ports. Canada has 18 port authorities, with some of the largest in Vancouver, Montreal, Prince Rupert, Halifax, and Saint John.[9] In 2017, Canadian ports directly produced $8 billion in GDP, and 71,000 people were employed in the day-to-day activities of the ports.[10]

In this subsector, one of the biggest sustainability challenges is decarbonization. Much of the industry still relies on diesel and heavy fuel oil, though we are seeing transformations. For example, BC Ferries has replaced some of its fleet with hybrid diesel–electric ferries.[11]

8 Council of Canadian Academies, *The Value of Commercial Marine Shipping to Canada*.
9 This also includes port authorities in the Great Lakes (e.g., Thunder Bay).
10 Association of Canadian Port Authorities, "Economy."
11 BC Ferries, "BC Ferries' Fifth Battery Hybrid-Electric Vessel Launches."

Ocean Technologies

The ocean-technologies subsector consists of many different types of technologies and spans across the other subsectors. For this reason, reporting on the subsector in Canada is difficult as there is not yet any analysis of its economic contribution. We define ocean technologies broadly, including digital sensors and monitoring, automation and artificial intelligence technologies, subsea robotics and remotely operated vehicles (ROVs), marine biotechnology, and ocean clean technologies. The subsector is beginning to gain traction in Canada and has significant potential.

Ocean technologies can help drive greater environmental sustainability across the other SBE subsectors. Developing technologies like smart nets that reduce bycatch or oil cleanup technologies are obvious examples, but other technologies such as sensors and monitors provide SBE organizations with the data needed to make better sustainability-related decisions. More energy efficiency can also be gained through automation and artificial intelligence in the SBE.

Offshore Minerals and Resources

This subsector includes the seabed mining and offshore oil and gas industries. Newfoundland is the only province that currently produces offshore oil and gas, which makes up 25 per cent of its GDP.[12] There are sustainability opportunities in oil and gas through sequestering greenhouse gas (GHG) and connecting offshore rigs to renewable marine energy.

Globally, seabed mining for metals and minerals is in an exploratory phase. The first country to mine its seabed successfully was Japan in 2017.[13] A Canadian start-up, The Metals Company, is looking to be the first to launch a deep-sea mining operation, with plans to apply for extraction off the coast of Nauru by 2023.[14]

12 Canadian Association of Petroleum Producers, "New National Poll Shows Canadians Are Most Concerned About the Economy."
13 Ocean Foundation, "Seabed Mining."
14 Gillespie, "Your Next Car May Be Built With Ocean Rocks."

Marine Renewables

Marine renewables derive energy from the ocean itself (i.e., tidal and wave energy), their location in a marine setting (i.e., offshore wind), and offshore biofuel sources. Marine renewables are nascent in Canada and not yet operating at scale.

Marine renewables like tidal and offshore wind are an SBE area ripe for opportunity in Canada due to the size of our coastlines. But the only province that has yet to make efforts in this area is Nova Scotia. The province hosts the Fundy Ocean Research Centre for Energy, and international marine renewables companies DP Energy and Marine Renewables have deployed small installations.

Marine and Coastal Tourism

This large subsector includes Arctic, Atlantic, and Pacific cruises and tours, Indigenous marine and coastal tourism, marine and coastal eco-tourism, marine and coastal lodges, recreational fishing, recreational boating, and coastal tourism activities (e.g., scuba diving, kayaking, hiking, wildlife viewing). While analysis of the overall tourism sector in Canada is abundant, there has been very little focus on the economic activity and employment in marine and coastal tourism specifically.

This subsector has been heavily affected by the pandemic and will take a few years to return to pre-COVID levels. But this disruption provides a window of opportunity for the subsector to move toward greater sustainability as it regrows. Many destinations along the coasts are suitable for eco-lodges and carbon-free cruises and tours, especially in the high-end market, as Canada can be expensive for international travellers. Indigenous tourism also has a major growth opportunity as the Indigenous Tourism Association of Canada looks to bring the sector back to its 2019 levels by 2024.[15]

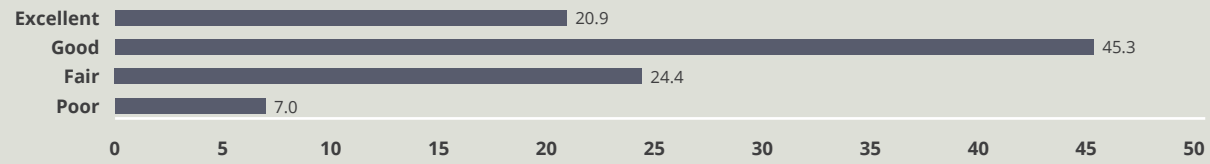
15 Indigenous Tourism Association of Canada, *Forward Together*.

Three High-Potential Transformation Areas

Rapid growth is expected in the global ocean economy over the next decade, with its size doubling to $3 trillion by 2030—a 20 per cent outpacing of the overall global economy.[16] Canada has a real opportunity to be a part of this high-growth area and lead in the development, use, and export of sustainable products, practices, and services in the sector. Ocean-sector employers appear to be confident in this growth. (See Chart 1.)

The first high-potential area for Canada's SBE is the transformation to more sustainable operations. All six subsectors still need much sustainable transformation to promote healthy oceans and increase the number of SBE occupations on Canada's coasts. These transformations notably include decarbonization and better and more efficient pest management in aquaculture.

Chart 1



Note: Respondents who chose "Other" reported fisheries biologists, physicists, naval architects, geographic information systems (GIS) specialists, information technology personnel, chemists, and recirculating aquaculture system technicians as in-demand STEM occupations for their organization.

Sources: The Conference Board of Canada; ECO Canada.

The second high-potential area for Canada's SBE is the development and adoption of new technologies. This trend is already happening in Canada's SBE but at differing levels across subsectors. For example, sensors, forecasting technologies, and advanced automation are already common in salmon aquaculture. But new technologies are a nascent trend in subsectors such as marine transport, fisheries, and tourism.

16 Canada's Ocean Supercluster, "About."

The third high-potential area for Canada's SBE is equity, diversity, and inclusion (ED&I). A recurring theme in our interviews was that the SBE subsectors are white and male-dominated, and there are opportunities to boost ED&I. Ocean Allies, a new organization, is working to identify ED&I gaps, provide training, and find ways to increase the diversity of talent in the SBE. Many organizations in the SBE have also now developed ED&I hiring policies and practices. However, the sector still has work to do to be more diverse and equitable.

Challenges for Canada in Reaching its SBE Potential

The first major challenge for the SBE in Canada is its geographic complexity. The three oceans are spread across vast and diverse coastlines, which all have different regulatory regimes, provincial and federal considerations, rates of infrastructure development, populations, and demographics. For example, aquaculture farm activities in British Columbia and Prince Edward Island are under federal oversight, but the other provinces and territories handle it themselves. However, drug and pesticide approvals are a shared responsibility between Canada's federal, provincial, and territorial governments.[17] This complexity makes it difficult to create a unified approach to managing and developing the SBE in Canada.

Another major challenge for the SBE in Canada is ocean literacy. A dominant theme in our interviews was a severe lack of understanding of and connection to the oceans in the Canadian populace. These remarks were not confined just to the centre of the country but existed also along the coasts. A 2019 study found that only 12 per cent of students in Nova Scotia were interested in a marine industry career.[18] Reasons for this disconnect may include subsector reputations, the lack of visibility into subsectors, and the fact that ocean-related occupations do not appear to be heavily promoted by governments or by secondary or post-secondary institutions in Canada.

To generate interest in and foster sustainability in Canada's SBE, we will need greater degrees of ocean literary and interest. Programs such as the Huntsman Marine Science Centre's Marine Academy are necessary to address these needs. The Marine Academy's new Ocean S.T.E.A.M. program will immerse high school students in science, technology, engineering, arts, and math in the ocean sector. Although such programs will not immediately affect hiring and labour needs, they are critical to the long-term development of the SBE in Canada.

17 Fisheries and Oceans Canada, "Infographic: How Fish Farming Is Regulated in Canada."
18 Heymann, Scully, and Franz-Odendaal, COVE Workforce Initiative.

Lastly, Canada's struggles with innovation and commercialization are also a major challenge for the SBE. Innovation is a perennial problem in many sectors in Canada, and the country is below average compared with its global peers when it comes to measures of innovation like business research and development (R&D), patent applications, and labour productivity growth.[19] Academia and industry must work together on innovation and commercialization for Canada to realize its ocean potential. Some efforts to build innovation skills and bring technologies out of the lab are under way, such as the Ocean Startup Project and the Canadian Alliance for Skills and Training in Life Science.

Iceland is a useful case study for Canada due to the country's grassroots efforts to advance sustainability and technology adoption in the fisheries.[20] Several interviews cited Iceland's fishery transformation as an inspiration for Canada. Because fish stocks are relatively stable over time, growth in fisheries lies in value rather than volume. Iceland demonstrated that fisheries could dramatically increase revenues by using waste products that would otherwise be dumped back into the oceans or in landfills. Similarly, the industry can grow by producing more value-added products (e.g., food supplements and pharmaceutical ingredients).

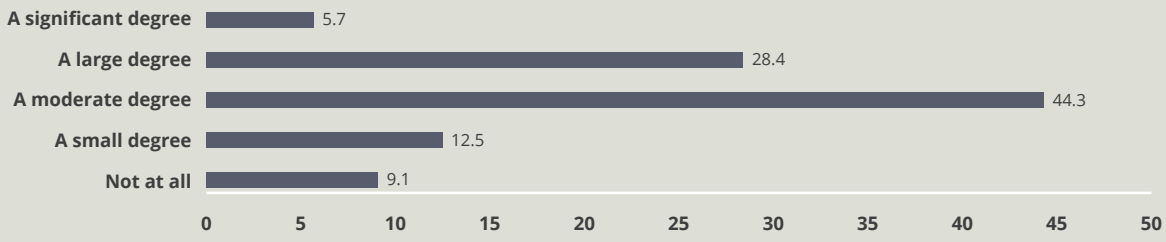
19 Conference Board of Canada, "Innovation Report Card 2021."
20 Sigfusson, "Iceland Ocean Cluster."

Sustainable Blue Economy Occupations

SBE occupations span a wide range of disciplines and trades. Many of these occupations require training and experience specific to certain subsectors, such as aquaculture technicians, fish harvesters, harbour managers, cultural ambassadors, and naval architects. In contrast, other occupations, such as captains and marine pilots, engineers, marine biologists, and ocean technologists, are significant and in demand across the subsectors.

There is a small labour gap in the SBE. (See Chart 2.) Our interviewees also noted a labour shortage, largely in STEM areas and fish- and seafood-processing.

Chart 2



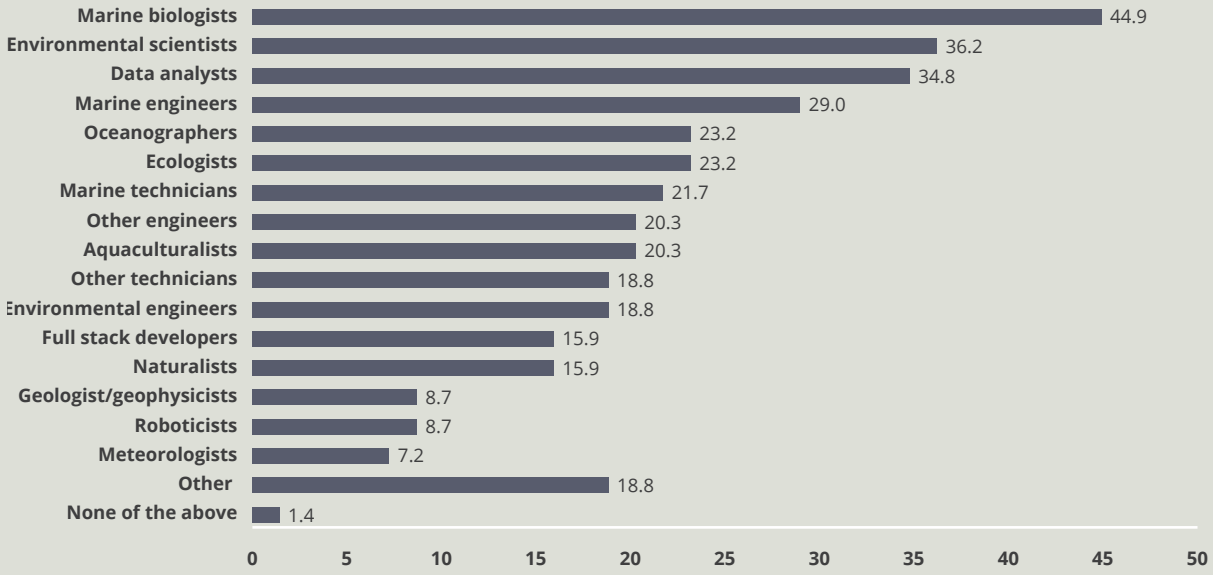
Sources: The Conference Board of Canada; ECO Canada.

The SBE is also trending toward automation, which may affect certain occupations. Only 13 per cent of our survey's ocean-sector respondents reported that they had not adopted any automation technologies. While this trend provides an opportunity for highly skilled engineers, it may mean that other positions will need upskilling or reskilling.

Emerging and In-Demand Occupations

Given the labour gap and high demand for STEM occupations in the SBE, ocean-sector workers noted various occupations needed in their organizations. (See Chart 3.) We also learned that there is a demand for non-STEM positions, such as mariners marketers.

Chart 3



Note: Respondents who chose "Other" reported fisheries biologists, physicists, naval architects, geographic information systems (GIS) specialists, information technology personnel, chemists, and recirculating aquaculture system technicians as in-demand STEM occupations for their organization.

Sources: The Conference Board of Canada; ECO Canada.

Scientists

Respondents reported that the top two most in-demand STEM occupations were marine biologists, at 45 per cent, and environmental scientists, at 36 per cent. These occupations are not particular to any single subsector and can find employment across the SBE. Interviews uncovered a particular demand for marine biologists who specialize in the effects of marine energy on ocean ecosystems.

The R&D that many scientists undertake is crucial for helping move the SBE subsectors toward greater sustainability. Some examples include learning to implement GHG sequestration in marine energy and discovering novel uses for fisheries by-products in pharmaceuticals and nutraceuticals.

Data Analysts

The third most in-demand STEM occupation among ocean-sector respondents is data analysts, at 35 per cent. This occupation also spans the SBE. With the introduction of sensors and artificial intelligence technologies across the SBE subsectors, including data from aquaculture net pens, tidal turbine data, and Parks Canada animal monitoring data, the information gathered is abundant. The sector now needs data analysts to identify the relevant information in order to improve business operations and sustainability.

In our interviews, we learned that an aquaculture company used an analyst in the United States to analyze the company's complex data because it could not find the talent in Canada. Data analysis is an area where specific SBE training is unnecessary and where greater awareness of ocean opportunities and ocean literacy can help SBE development.

Engineers and Technicians

The fourth most in-demand STEM occupation is marine engineers, at 29 per cent. Marine engineers are responsible for the maintenance and safe operation of vessels in Canada. They are trained in specialized programs that require courses and sea time and are certified by Transport Canada.

While marine engineers certified by Transport Canada are in high demand, we learned through interviews that there is a demand for engineers and technicians more generally, especially as many SBE operations are becoming more digital and electric. Several interviewees stated that while colleges and universities on the coasts have great engineering programs, those graduates commonly move into higher-paying positions in urban centres outside of the SBE. One program that received praise for helping to train SBE engineers is the Oceans Technology program at the Nova Scotia Community College.

Mariners and Marine Pilots

Another in-demand SBE occupation is mariners and marine pilots. Mariners are responsible for vessels going out to aquaculture and tidal energy sites, driving ferries and tugs, and providing ocean tours. According to our interviews, this occupation is in high demand for two reasons. First, the certification process is long, arduous, and not well known. Second, young people are not as interested in going to sea as previous generations. Both of these factors create a lack of supply for this occupation.

Marketing, Communications, and Community Relations Experts

Marketing, communications, and community relations were discussed often in our interviews regarding emerging and in-demand occupations. The ocean is a shared resource, and there are several layers of complexity to operating in the SBE. Tidal energy is a notable example here, as data collection and analysis on the effects of turbines on the oceans is still nascent, and the sector needs experts to communicate complex findings to ocean stakeholders.

Moreover, the oceans and their coastal areas are at the intersection of federal, provincial, and First Nations governance, with heavy involvement from non-governmental organizations and foundations. The sector needs community relations experts and negotiators to liaise and consult with the numerous stakeholders of the SBE. It also needs marketing and communications to promote the sustainability of SBE industry participants and increase Canadians' ocean literacy.

The sector shows opportunities for Indigenous tourism markets due to the high demand for Indigenous experiences from domestic and international travellers, especially in British Columbia. Canada's SBE requires marketers to promote these opportunities and help Indigenous coastal and marine tourism companies develop.

Three Significant Areas Facing Disruption

Fish-Plant Workers

In our interviews, the most commonly cited occupation at risk of disruption was fish processors or fish-plant workers. Disruption in this occupation occurs for several reasons. First, the industry has struggled to find enough Canadians to work in the fish-processing plants, with some using the Temporary Foreign Worker Program to help fill the gap. This constant struggle to find labour is pushing the industry toward automation. Second, automation technologies for fish-processing, commonly used in places like Iceland and Norway, are already quite advanced and could easily be implemented in Canada. Third, automated fish-processing machines are highly efficient and can quickly process fish and seafood, decreasing time for processing and packaging. Lastly, the pandemic has added extra precautions and processes that slow down operations and decrease the possible output at plants.

All of these factors make it likely that fish-processing will move toward greater automation. This change will open the door to high-skilled workers but may put pressure on the unskilled labour in coastal communities who work in these plants.

On-Site Workers

While remote work became much more common during the COVID-19 pandemic, this trend was already happening in the SBE. Working out on the ocean can be dangerous, and workers are faced with rough water and being offshore for long periods. With the development of advanced technologies, workers can now complete tasks without going offshore. Fisheries monitoring can be done through cameras, remote feeding is now common in aquaculture, and digital twinning is making more operations accessible from shore.

One potential downside of this trend for coastal and remote communities is if offices move away from their coastal operations. This change could further reduce the opportunities available for these communities and act as another push factor toward urban areas.

British Columbia Open-Net Pen Salmon Farmers

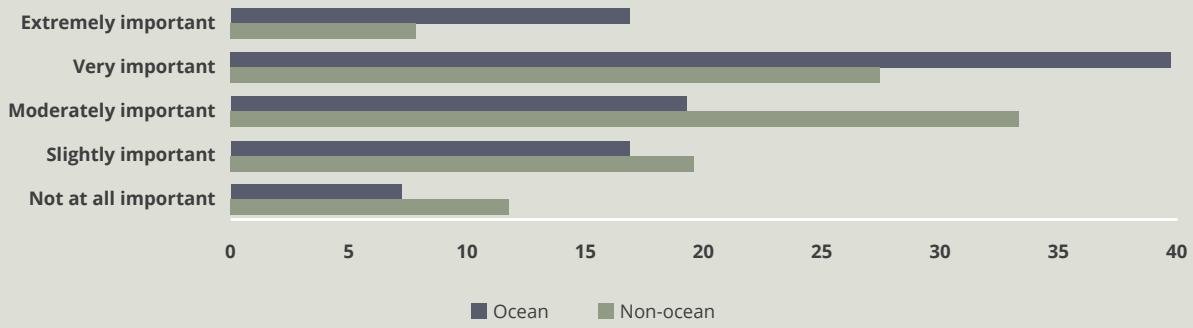
The recent decision to phase out salmon farms in the Discovery Islands, coupled with the B.C. government's 2025 salmon aquaculture transition plan, puts the open-net pen farming of Atlantic salmon on B.C.'s coast in uncertain territory. Almost all aquaculture interviewees stated that occupations in this region are at risk, and the uncertainty is likely pushing potential candidates away from aquaculture.

More clarity on the government's transition plan could provide the certainty the SBE needs to make large-scale investments toward more sustainable operations.

Occupations Related to Climate Change Are in Demand

Climate change and environmental degradation often affect the SBE to a greater degree than outside the ocean sector. Ocean acidification, fish stocks at critical levels, rising seawaters, and industrial effluent are major issues affecting all subsectors and need to be addressed. But these challenges also provide several job opportunities for climate change–related and environment-related occupations. (See charts 4 and 5.)

Chart 4

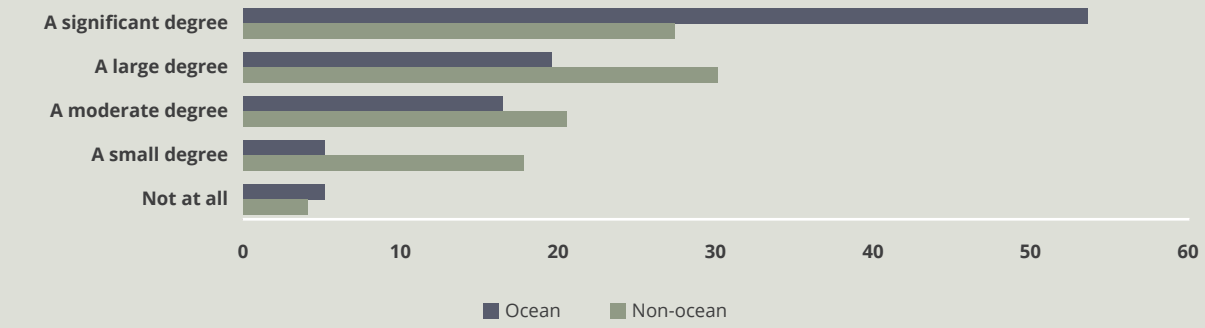


Sources: The Conference Board of Canada; ECO Canada.

Interviews demonstrated a demand for environment teams at Canadian ports to produce environmental assessments, audit practices, and liaise with the marine transport sector around sustainability. Similarly, environmental compliance officers are needed in subsectors like aquaculture. Engineers who specialize in greening operations and builders certified in Leadership in Energy and Environmental Design are also in demand across the SBE.

Across all subsectors, we also see a demand for scientific and R&D activity related to climate change and the environment, such as understanding the effect of shipping in the arctic and developing better fish-stock models. Marketing such opportunities to STEM university students outside of coastal areas can increase the talent pool for these opportunities and help address these SBE challenges.

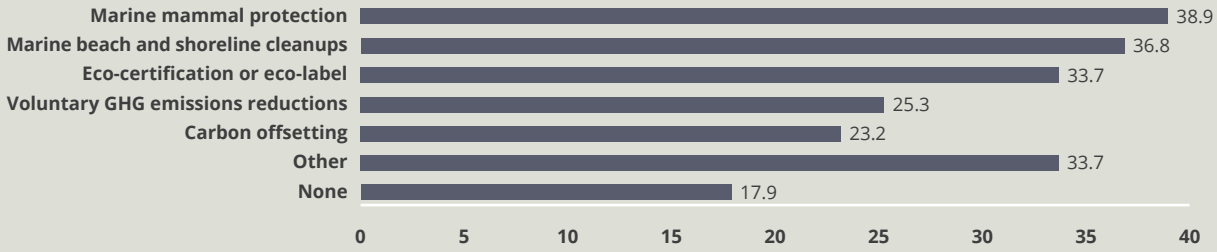
Chart 5



Sources: The Conference Board of Canada; ECO Canada.

Internal projects and programs are another way ocean-sector organizations help manage climate change and environmental challenges. (See Chart 6.) Still, 18 per cent responded that they had no projects or programs, showing that many ocean-sector organizations have yet to take internal actions in this area.

Chart 6



Note: Respondents who chose "Other" mentioned having implemented programs and projects such as managing marine protected areas, creating support for wild salmon, recycling marine debris, installing renewable energy, using plastic-free packaging, and employing the Green Marine certification.

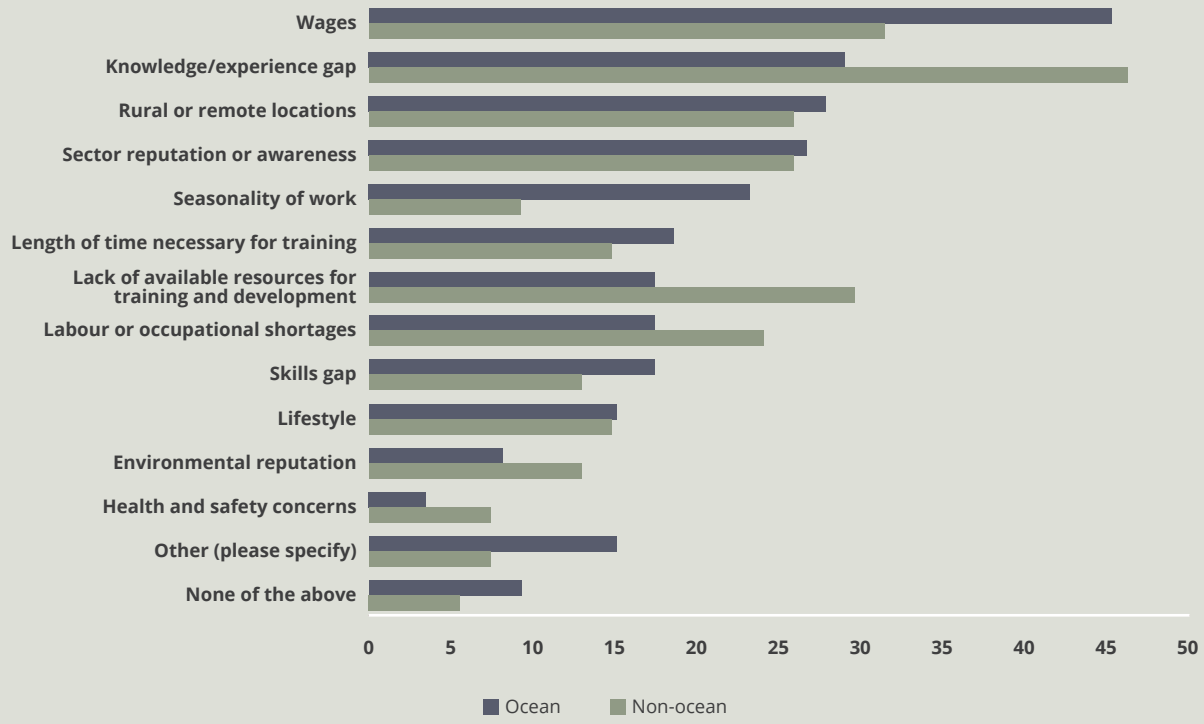
Sources: The Conference Board of Canada; ECO Canada.

Hiring and Retention in the SBE

Challenges Include Wages, Experience Gaps, and Rural Locations

Given the lack of interest in the oceans sector among youth, the lack of ocean literacy in the general population, the rural locale of many positions, and regional skills gaps along the coasts, hiring and retention can be a major challenge for organizations in the SBE. (See Chart 7.)

Chart 7



Sources: The Conference Board of Canada; ECO Canada.

The largest talent barrier for ocean-sector organizations in our survey is around wages. Outside large coastal population districts like Halifax, Victoria, and Vancouver, wages are often below average, and a few coastal provinces have low minimum wages compared to the rest of the country.[21]

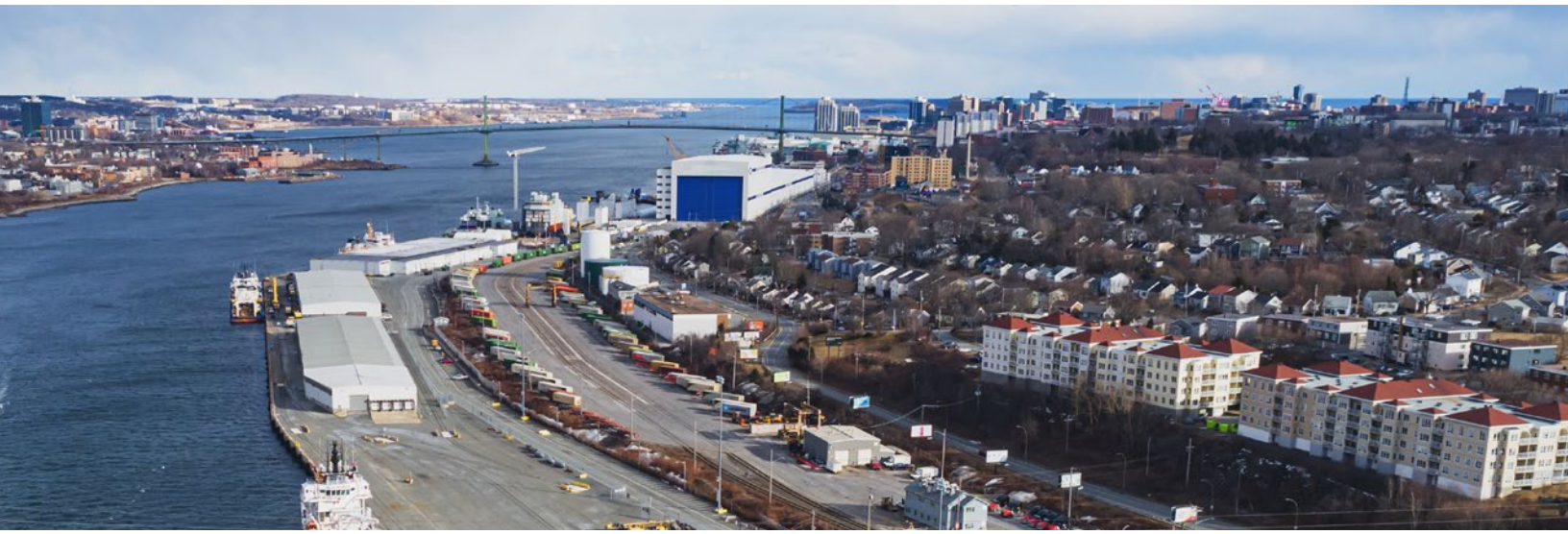
21 Retail Council of Canada, "Minimum wage by Province."

Several interviewees said it can be hard to retain graduates from universities like Dalhousie and Memorial, as these graduates often seek work in other provinces for higher wages. While lower wages have historically been matched by a lower cost of living on the East Coast, recent increases in housing costs in this region have reduced that advantage.[22]

The second-largest hiring and retention challenge in our survey is a knowledge and experience gap. However, at 46 per cent, this challenge was higher among non-ocean-sector respondents. This discrepancy may exist for several reasons, such as the fact that many SBE workers may come from families who have worked in the oceans, or more alignment between training programs and industry needs. Nonetheless, almost a third of ocean-sector respondents reporting this gap highlights that more skills training and opportunities to gain experience before joining the industry would be welcome in the SBE.

The third-largest challenge in the ocean sector, according to our survey, is the rural and remote locations of work. This was also one of the most significant issues for hiring and retention noted in our interviews, as positions in the SBE are often in rural or remote areas of the coasts, especially in the Arctic. These areas already have smaller—and, on the East Coast, older—populations to draw from, and attracting urbanites can be challenging. The rural and remote areas of the coast can have less infrastructure and education, fewer services, and reduced recreational opportunities, making it even more difficult to attract families or those who wish to start a family.

Another major issue in SBE locations is housing. Many communities do not have the available housing to bring new workers in or do not have any rental opportunities. Housing affordability and availability in pockets of Eastern Canada that previously experienced a low cost of living are pressing issues. One interviewee located in a small coastal resort town on the East Coast said that a candidate recently backed out of a position after realizing there was no available housing for them. On the West Coast, housing affordability and availability have been issues for longer, but it is worse in Nunavut, with long wait-lists for housing. Seasonality is also a factor in the SBE, and many small communities do not have adequate rental or housing stock for seasonal positions, as communities may prioritize tourists or long-term renters.



22 Arsenault, "On Canada's East Coast, COVID-19 Fight Brings Pricier Housing."

Interviewees also noted that a significant challenge for hiring is the many certifications required in the SBE, including fisheries licences and certifications, mariner certificates, boating certificates, vessel inspections and certifications, professional engineering licenses, marine safety and security certifications, remotely operated vehicles (ROVs) and drone certifications, diving certifications, and marine medicals. The cost, complexity, and time to acquire these licences and certifications can push potential workers to seek alternative employment. For smaller organizations, the cost of licensing and certifying all crew and operations may be out of reach and limit their hiring abilities.

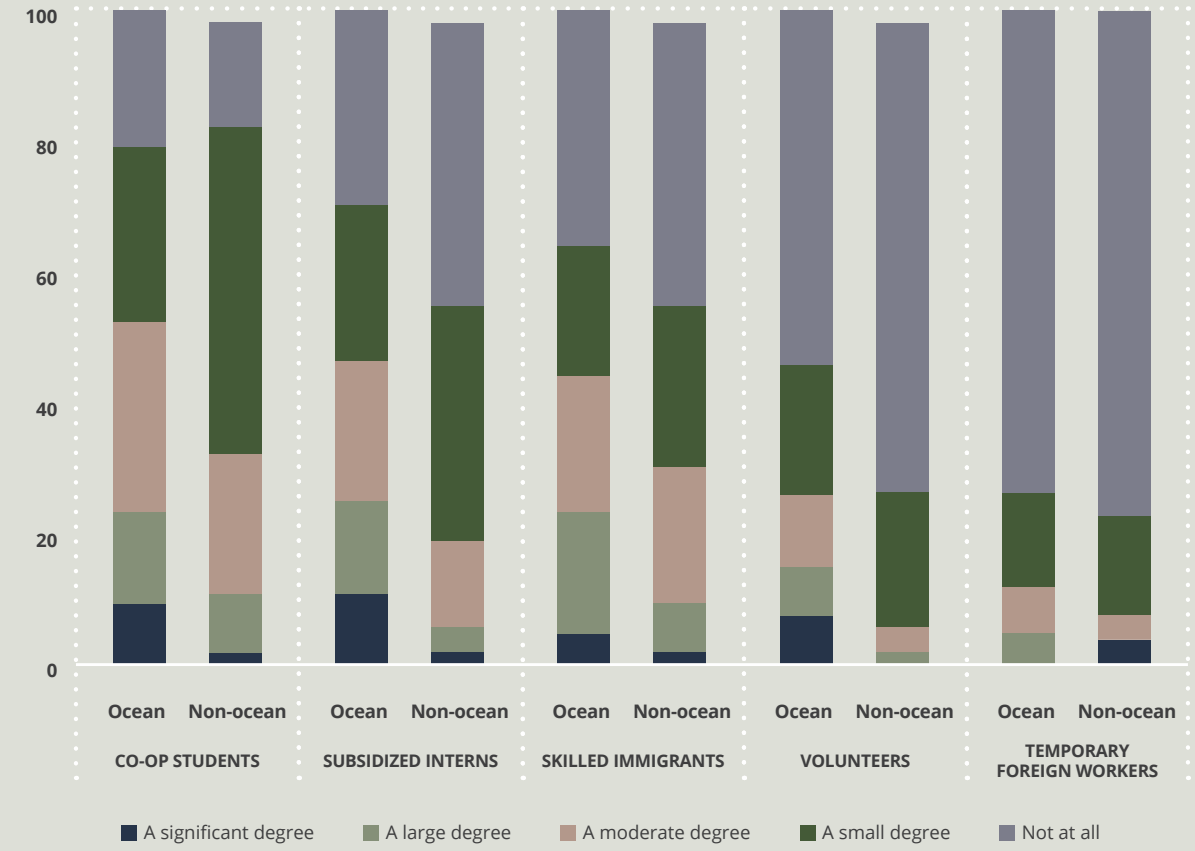
More SBE interest can alleviate the certification challenge, as grassroots support for all things oceans could lead to more people getting certifications on their own accord. It also may be helpful for governments to find ways to reduce red tape without sacrificing safety. Similarly, governments can support smaller SBE players through grants and funding to help with employee training and certification that is otherwise unfeasible to provide.

Organizations Are Crafting Strategies to Overcome Hiring and Retention Challenges

In our interviews, organizations mentioned several strategies for addressing personnel and other challenges. Student outreach was one of the strategies most often mentioned. The seasonality of ocean-sector jobs can work well with summer employment for students and provide the initial appeal to continue working in the SBE after graduation. Boosting secondary and post-secondary outreach across Canada will also be crucial in combatting the lack of interest in ocean-related occupations, increasing ocean literacy, and developing the SBE to its full potential.

Organizations are alleviating some of the wage issues by relying on non-full-time employees and alternative job arrangements. (See Chart 8.) Ocean-sector respondents were more likely than non-ocean-sector respondents to say they relied on alternative arrangements.

Chart 8



Sources: The Conference Board of Canada; ECO Canada.

Another strategy the SBE uses for retaining workers is to have employers provide training and education, especially in aquaculture. These programs are centred on training for promotions and identifying leadership potential. Some organizations also partnered with post-secondary institutions to help provide skills training. Another strategy is to pay for promising employees to complete MBA or PhD programs to move up within the organization. This strategy can help foster worker loyalty and demonstrates to employees that their employer values them.

A challenge for these strategies is that many SBE positions are "lifestyle" occupations in that they extend beyond a typical 9-to-5 job. Many positions require workers to spend days, weeks, or months at sea or on remote coasts. Sometimes, workers have strong familial connections to their roles. Interviewees mentioned promoting a marine and coastal lifestyle and increasing the reputation of these subsectors as a potential hiring strategy that has not been used enough.

Lastly, the use of government programs for hiring and retention features prominently in the SBE. Ocean-sector respondents, at 39 per cent, were much more likely to report using a government program for workforce hiring, compared with 13 per cent of non-ocean-sector respondents. Some of the programs respondents mentioned include Canada Summer Jobs, NRC IRAP programs, and Canada's Ocean Supercluster programs. Our interviews and survey responses highlighted Nova Scotia's START and Graduate to Opportunity programs as useful, and these programs may provide a model for other provinces in developing the SBE.

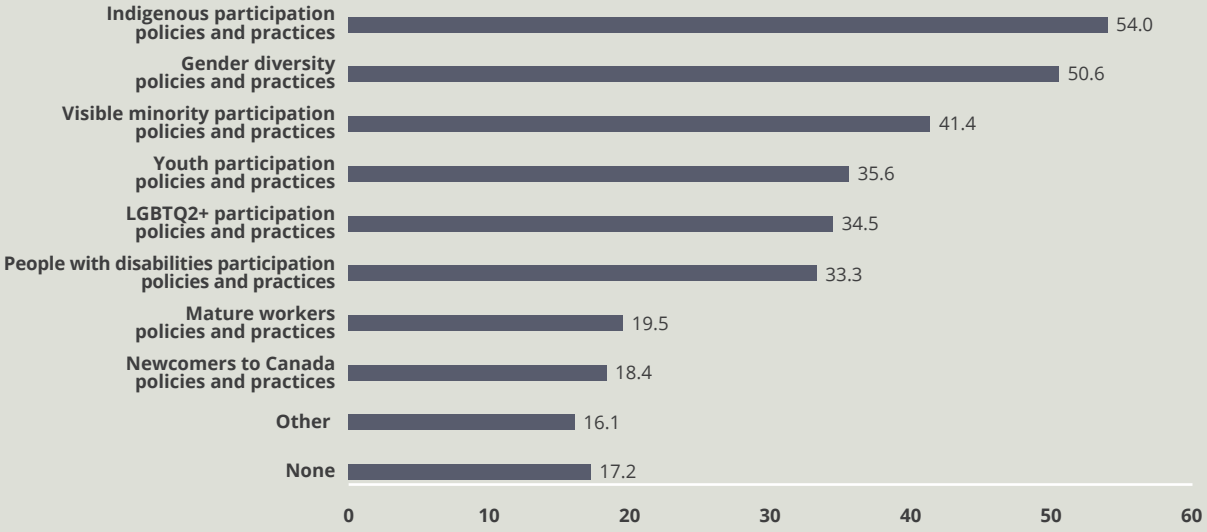
Equity, Diversity, and Inclusion in the SBE

While ocean-sector occupations are largely dominated by older, white, and male workers, there are efforts to increase ED&I in the SBE.[23] Ocean Allies is a key player in this effort, providing training and workshops, reporting on ED&I in the ocean sector, and partnering with some of the biggest companies and organizations in the ocean sector.

The Centre for Ocean Ventures and Entrepreneurship (COVE) is another major SBE stakeholder with a mandate for ED&I and is working toward greater representation in the ocean sectors. Its programs are critical for the social sustainability of the SBE, and the organization is already making strides in ED&I through its connections with key ocean stakeholders like Canada's Ocean Supercluster.

Our survey asked ocean-sector workers which ED&I policies and programs they had in place. (See Chart 9.) The most common ED&I program was Indigenous participation policies and practices. Aquaculture interviewees reported that this program had been a focus of theirs for the past decade. West Coast and Arctic-based interviewees discussed Indigenous participation more than those on the East Coast, a finding that highlights potential regional differences in this area of ED&I. That said, Ulnooweg, an Indigenous development group based out of the East Coast, is partnered with Canada's Ocean Supercluster to support more Indigenous participation in the oceans.

Chart 9



Sources: The Conference Board of Canada; ECO Canada.

23 Ocean Allies, *Navigating Change*.

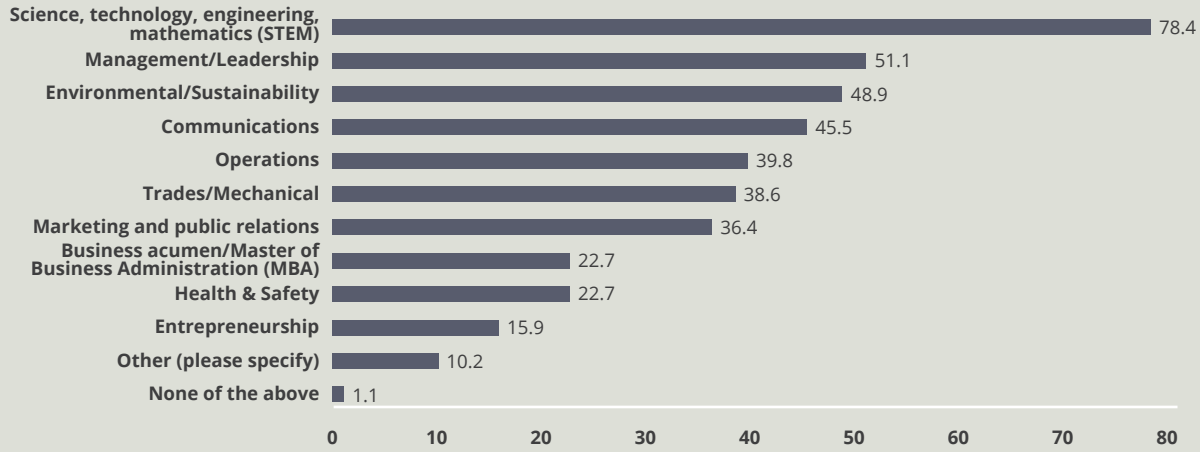
The second most common ED&I program was gender diversity policies and practices. Several interviewees noted that while gender diversity is increasing in the SBE, the management level is still male-dominated. Some subsectors have progressed more in this area than others. For example, gender diversity can be a challenge in fisheries and aquaculture due to safety concerns and the sleeping logistics of long-term stays on the ocean or remote coasts.

The least common ED&I programs were for mature workers and newcomers to Canada. And almost one in five respondents said they had no ED&I policies or programs, demonstrating that organizations need to do more work to support ED&I in the ocean sector.

Skills Demand, Gaps, and Training

While many skill sets are transferable across the SBE and from the non-ocean sectors into the SBE, others are unique, especially in STEM fields. (See Chart 10.) The SBE needs to address several skills gaps for Canada to reach its full potential. Aligning industry, government, and academia around skills training and college and university curricula will be required to address these gaps and ensure a high-quality talent pool.

Chart 10



Sources: The Conference Board of Canada; ECO Canada.

STEM Skills Are the Most In Demand

A wide array of STEM skills is necessary and in high demand for the SBE. Some skills, like modelling and data analysis, are needed across the SBE. Others are more specialized, such as those used by biologists and bioengineers looking to find new ways to use fish and seafood by-products from the fisheries.

The second most in-demand skill set is management and leadership skills. These skills are not unique to the SBE, and greater general interest in the oceans can help fill skills gaps in this area by drawing people into the SBE. However, finding leadership skills may be more difficult in the remote regions of the SBE. One organization based out of Newfoundland noted that most of its leadership has come from Ontario, but it is actively trying to localize its leadership. Setting up more in-house leadership training programs can help with some of this demand.

Environment and sustainability skills was the third most in-demand skill set. The high percentage of ocean-sector respondents who see environment and sustainability skills as in demand demonstrates the transition toward more ocean sustainability in Canada. One interviewee reported that it has not been difficult to find engineers, but it has been difficult to find engineers specializing in environment and sustainability. Post-secondary and training institutes in the SBE need to ensure that their programs adequately focus on the environment and sustainability.

Significant Skills Gaps Exist in the SBE Due to New Technologies

Given that the second most common challenge for hiring and retention is a knowledge/experience gap, SBE employers sometimes lack skilled applicants. The biggest skills gaps reported in interviews were primarily in STEM skills and trades. A common refrain was that many operations are becoming more specialized, complex, and digital.

Developing and deploying new technologies in the SBE (e.g., artificial intelligence) can add to skills shortages. These changes pose a challenge as industries move toward electrification and digitization, and many workers likely need upskilling and reskilling to keep up.

For example, recirculating aquaculture systems are used for on-land hatcheries and as an alternative to open-net pens. However, growing fish on land requires electricians, maintenance workers, and fish culturists with different skills than those required for open-net pen aquaculture. One land-based aquaculture company noted that, while capital used to be the limiting factor for this type of farming, labour now acts as the limiting factor. This skills gap also affects the large salmon aquaculture companies in Canada. Many of them are now rearing young salmon in facilities using this technology before moving them to the ocean.

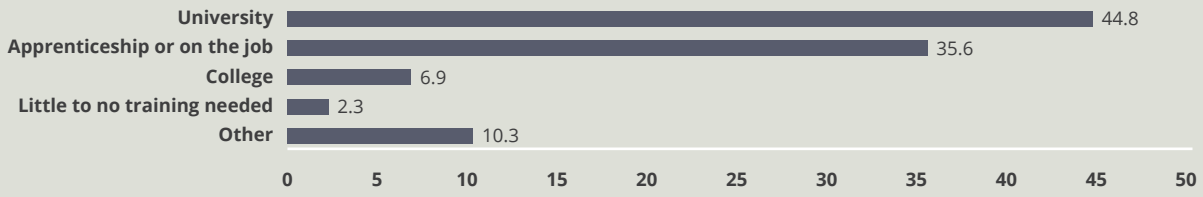
Another skills gap reported by several interviewees is an entrepreneurial spirit—a lack of desire and encouragement for SBE entrepreneurship. In a May 2018 study in New Brunswick, only 4 per cent of youth had an interest in entrepreneurship.[24] Several new organizations have been launched to remedy this. The Ocean Startup Project, for example, is associated with Canada's Ocean Supercluster and develops early-stage entrepreneurs in the blue economy. Similarly, EKKO.Acadie is associated with the University of Moncton and aims to foster entrepreneurship and innovation, especially in more rural French communities on the East Coast.

An advantage of developing the SBE is that there is a lot of skills transferability within the sector. Offshore oil and gas workers can move to marine renewables relatively easily, fish harvesters can work in tourism in the off-seasons, and many ocean-technologies workers can move into any area of the SBE that uses advanced technologies. Workers from occupations unrelated to the ocean also have many opportunities to move into the SBE. Still, many workers are not considering moving because of their lack of ocean literacy and awareness of ocean-sector occupations.

Academia, Industry, and Government Need to Align on Skills Training

Our survey showed that with STEM skills in high demand, many SBE organizations are looking for university graduates. (See Chart 11.) In contrast, several interviews highlighted that ocean-sector professionals were looking to hire more college graduates than university graduates because of the applied skills the college graduates learn.

Chart 11



Sources: The Conference Board of Canada; ECO Canada.

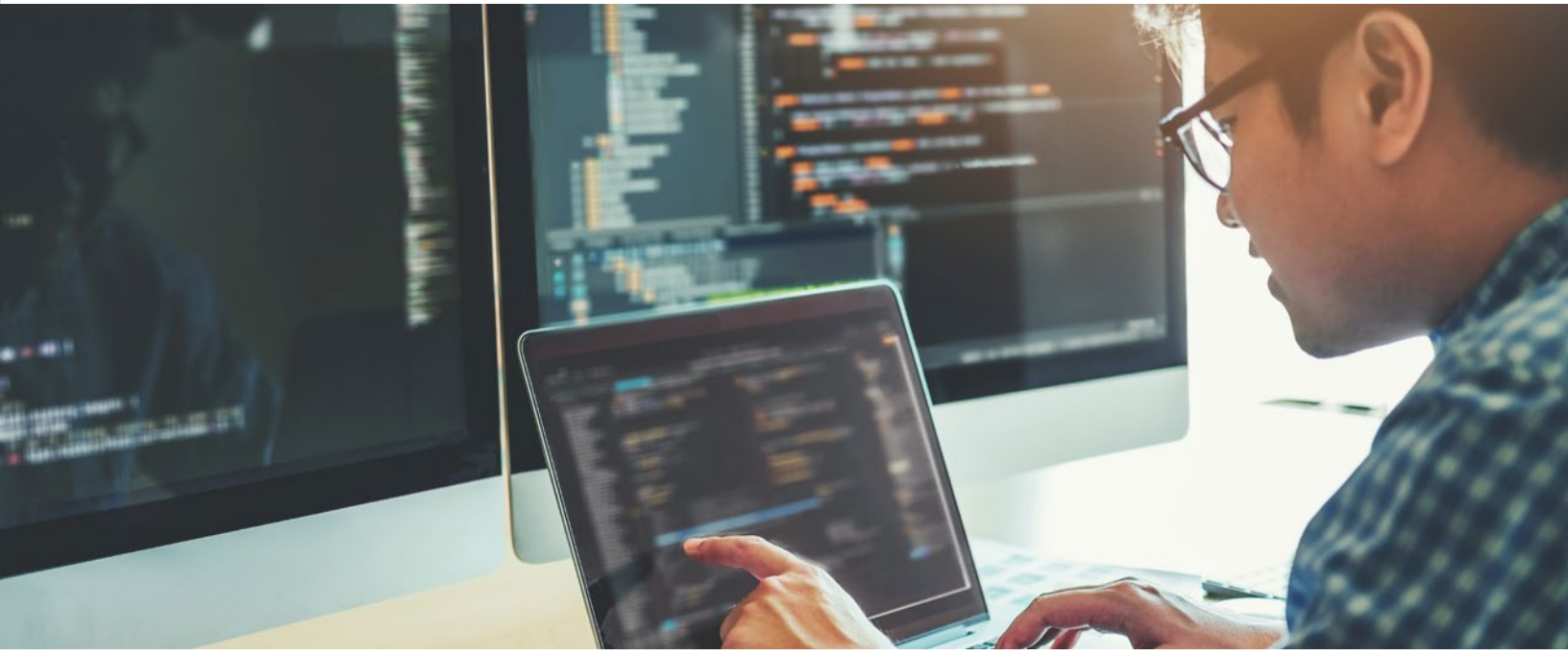
24 Scully and MacLeod, *Marine People Partnership*.

But even if candidates come with great skills, certain positions always require on-the-job training. For example, in a port, someone may have training in logistics but not know the inner workings of that specific port.

Several notable colleges and universities on the coasts provide talent to the SBE, such as Dalhousie University in Nova Scotia, the University of British Columbia, Nunavut Arctic College, and the Marine Institute of Memorial University of Newfoundland. Central Canada also provides crucial training in this area. For example, Fleming College in Peterborough, Ontario, was the most discussed academic institution in our aquaculture interviews. The University of Guelph was also mentioned for its strong marine-related programs. The marine colleges are particularly important to the marine transport sector, where workers obtain the certifications to work aboard vessels.

Academic institutions must be agile to keep up with the fast-changing and rapidly growing SBE. They must liaise with industry stakeholders to ensure their curriculums and syllabi quickly adapt to the new needs of the SBE. Beyond college and universities, other programs have been developed to help with SBE training and address skills gaps. The Canadian Alliance for Skills and Training in Life Science (CASTL) program, for example, will help bolster the ocean-technologies subsector through its focus on marine biotechnology.

CASTL is an exemplary program as it looks to partner with industry, academia, and government to ensure that potential workers are more prepared with the necessary skills to enter the SBE. Enrolling in programs like CASTL can also help individuals learn about the opportunities available in the oceans. Through addressing skills and labour gaps, more programs like these will be critical in meeting Canada's SBE potential.



Conclusion

With a concerted effort on the part of industry, academia, and governments, Canada can be a global leader in the sustainable blue economy. Fisheries, aquaculture, marine transport, marine energy, ocean technologies, and marine and coastal tourism all have exceptional job opportunities in Canada. To fully realize this potential, industry, academia, and governments must unite and align themselves to develop the SBE.

This transformation will require clarity and support from governments, a willingness from industry to move toward more social and environmentally sustainable operations, and agility and alignment from academia in their ocean-related programs. These groups must work to address the lack of ocean literacy across the country so that talent is more aware of the potential economic growth and development the SBE can provide.

Moreover, in addressing skills gaps, labour shortages, and hiring and retention challenges, SBE organizations must work toward greater equity, diversity, and inclusion. Canada's SBE growth potential can be reached with the participation of all groups, many of which have not traditionally been aware of or engaged by the ocean sector. More diversity in the SBE means more diversity of ideas, leading to new ways of innovating that can transform businesses.

Appendix A

TBD

Methodology

TBD

Interviews

We interviewed 43 individuals from 33 organizations across Canada. Our interviews consisted of companies and other organizations (e.g., industry associations), including seven in fisheries, six in ocean technologies, six in marine transport, five in aquaculture, five in marine and coastal tourism, three in marine energy, and two in multiple sectors.

We used a purposive sample for the interview component of the project, reaching out to SBE professionals within the six subsectors of interest. We then used a snowball sampling strategy to select the remaining participants based on recommendations from our interviewees.

Interviews were semi-structured and based on five primary themes: the SBE in Canada, occupations, hiring and retention, skills, and workforce transitions.

Each participant was interviewed for 30 to 60 minutes over Microsoft Teams. The interviews were recorded with each participant's permission. We then undertook a thematic analysis of the interviews.

Survey

The survey was administered online using SurveyMonkey from June 14 to July 30, 2021. It sought to assess ocean-sector and non-ocean-sector workers' views on 20 questions related to skills, occupations, training, diversity and inclusion, automation, and sustainability. We collected 170 responses from workers in a variety of organizations and industries across Canada. See Table 1 for details on the survey sample.

Table 1

Demographic Information of Survey Respondents

	Percentage of respondents
SECTOR	
Ocean	57
Non-ocean	43
OCEAN (FOR OCEAN-SECTOR RESPONDENTS)	
Pacific	63
Atlantic	58
Arctic	23
LANGUAGE	
English	98
French	2

	Percentage of respondents
ORGANIZATION SIZE	
1 to 4	19
5 to 99	32
100 to 499	18
500 to 2,499	12
2,500 or more	18
SUBSECTOR	
Ocean technologies	14
Marine transport	11
Aquaculture	8
Ocean literacy and conservation	7
Fisheries	5
Water management	5
Oil and gas	5
Defence	5
Marine energy	4
Education	4
Engineering	4
Government	3
Coastal/Marine tourism	2
Food and beverage	2
Consulting	2
Not-for-profit	2
Technology	2
Aquaculture and fisheries	1
Shipbuilding	1
Marine defence	1
Marine consulting	1
Marine construction	1
Marine science	1
Forestry	1
Banking and finance	1
Construction	1
Energy	1
Professional services	1
Retail	1
Steel	1
Utilities	1
Health	1
Mining	1
Chemicals	1
Research and development	1

Appendix B

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The Development of Canada's National Occupational Standards for a Sustainable Blue Economy project is funded by the Government of Canada's Future Skills Centre.

Le projet « Élaboration des Normes Professionnelles Nationales Canadienne pour une Économie Bleue Durable » est financé par le Centre des Compétences Futures du Gouvernement du Canada.