



BLUE BIOECONOMY DISCUSSION PAPER

2024



AMBITION 2035

GROWING CANADA'S OCEAN ECONOMY BY 5X TO \$220B BY 2035

In 2016, the OECD evaluated the growth of the global ocean economy, projecting it would double in size by 2030 to \$4 trillion dollars Canadian and outpace the broader economy's growth by 20 per cent. In the context of this global ocean potential and in developing ocean solutions that are urgently needed, Canada can achieve transformative growth with significant opportunities for Canadian businesses and workers from coast-to-coast-to-coast. This requires a collective approach and being bold in our ambition.

In the fall of 2022, Canada's Ocean Supercluster (OSC) released a discussion document introducing [Ambition 2035](#) - a 5X growth potential for Canada's ocean economy by 2035. Informed by more than 400 stakeholders and leaders from across the country as well as economists, it was developed to provide an ambition for all of Canada's ocean network to rally behind and consider the role they play in delivering on it.

Canada's achievement of this ambitious goal will require innovation in new sectors and the growth and evolution of existing industries.

This document provides a context to begin the discussion of how the blue bioeconomy in Canada can evolve and grow.

WE HAVE BIG
AMBITION FOR
OCEAN IN
CANADA

\$220
BILLION 5X
GROWTH
BY 2035



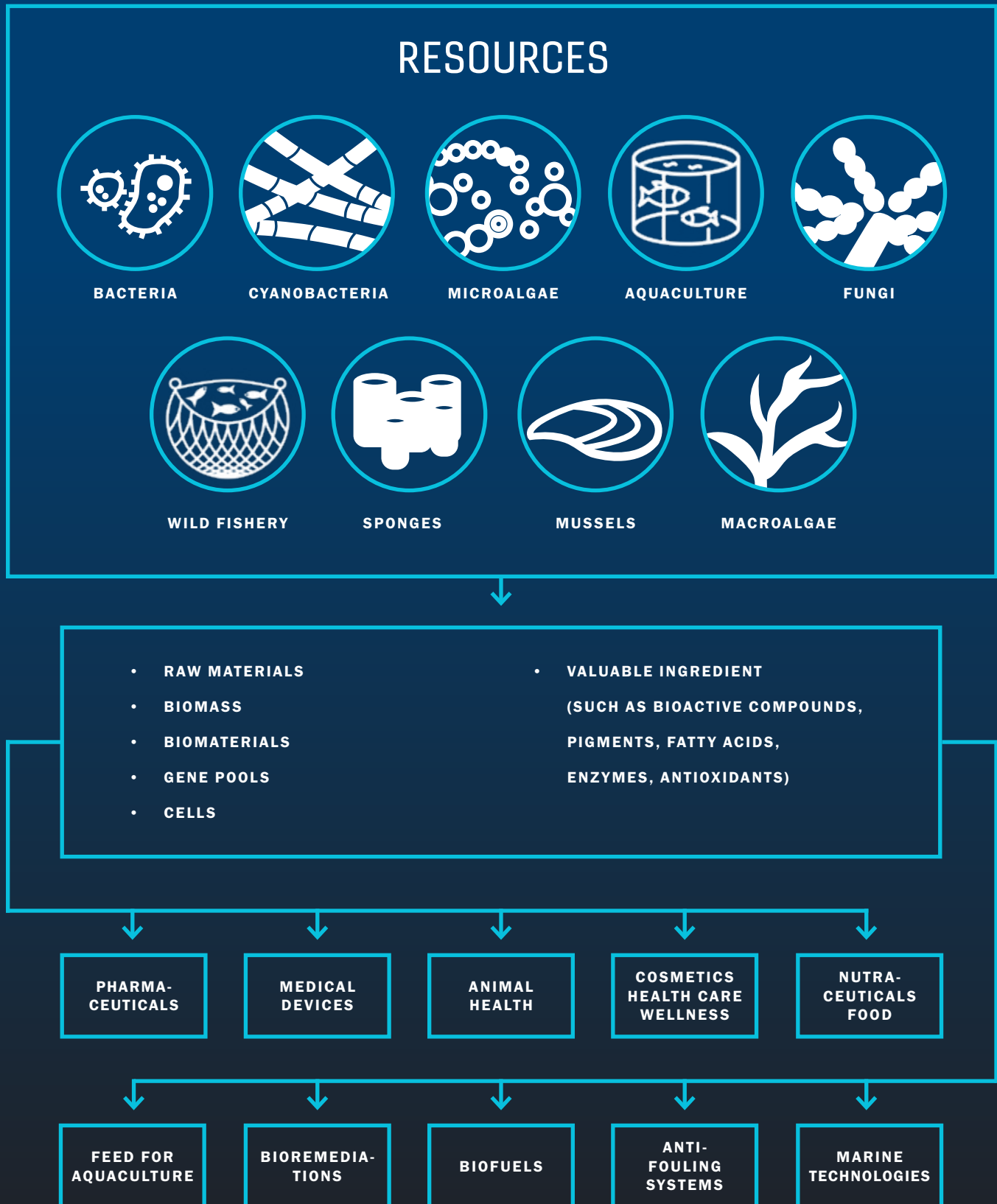
WHAT IS THE BLUE BIO-ECONOMY?

Canada's blue bioeconomy, rooted in its vast marine resources, encompasses a wide spectrum of industries contributing to sustainable biomass-based ocean economic activities. From fisheries and aquaculture to marine biotechnology and pharmaceuticals, the potential of Canada's blue bioeconomy is as vast as our coastline.

This paper aims to frame a discussion with stakeholders and rightsholders across the country regarding the assets, challenges and potential for Canada's blue bioeconomy. This process will be an exploration of how Canada could seize this sector's economic, societal and environmental benefits. We welcome your input on the proposed goals, principles, subsector choices and ecosystem approach outlined in this document.

The blue bioeconomy is defined as the **application of science and innovation to the use and conversion of live aquatic resources into value-added products and services**. Such products and services include food, feed, cosmetics, nutraceuticals, pharmaceuticals, biobased materials and bioenergy.

WHAT IS THE BLUE BIO-ECONOMY?



GOALS AND PRINCIPLES

STRATEGIC GOAL

The goal of Canada's Blue Bioeconomy Strategy is to establish the enabling conditions for research, development, and commercialization of bio-based ocean resources and increase the sustainable economic impact of sector companies. This growth will contribute substantively to Ambition 2035, Canada Ocean Supercluster's goal of five times economic growth by 2035.

PRINCIPLES

Pursuit and achievement of this goal will positively impact Canadian and global economic, societal and environmental outcomes. The following United Nations Sustainable Development Goals will be adopted as guiding principles:

#2: End Hunger

End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.

#8: Decent Work and Economic Growth

Promote inclusive and sustainable growth, employment and decent work for all.

#9: Industry, Innovation and Infrastructure

Build resilient infrastructure, promote sustainable industrialization and foster innovation.

#11: Sustainable Communities

A strong ecosystem approach would include community/Indigenous growth as well as commercial.

#12: Responsible Consumption and Production

Ensure sustainable consumption and production patterns.

#13: Climate Action

Take urgent action to combat climate change and its impacts.

#14: Life Below the Water

Conserve and sustainably use the oceans, seas and marine resources.

Engagement with First Nations, Inuit, and Métis communities, governments and organizations, will be essential to inform this strategy's development and implementation.



STRATEGY APPROACH

Canada's blue bioeconomy includes diverse subsectors ranging from the 500-year-old wild capture fishery to emerging marine biotechnology opportunities. These subsectors, as outlined below, will be factored into the blue bioeconomy strategy, as will a strong ecosystem approach.

SUBSECTORS

Four subsectors have been identified as emerging economic opportunities: macroalgae harvesting and cultivation, microalgae cultivation, marine biotechnology and co-product valorization. Global opportunities exist for these largely untapped subsectors. For example, the World Bank identified ten global seaweed markets, potentially growing by USD 11.8 billion by 2030. With its vast shorelines and water resources, Canada has the potential to secure a strong place in this market and other related markets.

Canada also has two well-established additional subsectors: aquaculture and wild capture fish and seafood. While these subsectors have extensive food production, commercial capacity, and infrastructure, they seek to evolve towards full sustainability while seeking additional economic value-creation opportunities. The included subsectors are described in detail later in this document.

INNOVATION ECOSYSTEM

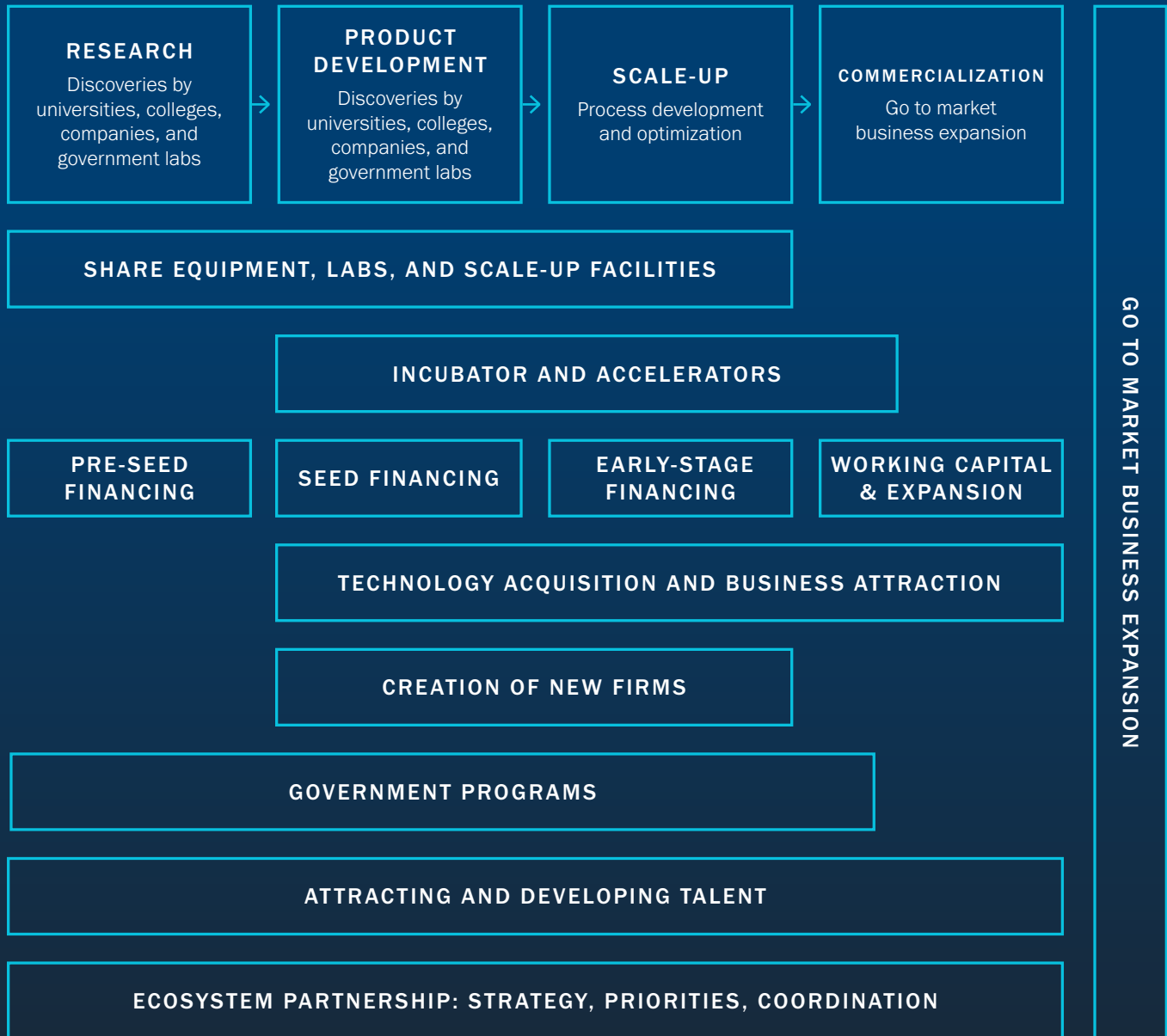
To achieve Ambition 2035, Canada will require a strategic ecosystem approach focused on creating conditions to spur innovation and growth of commercial enterprises. Specifically, the strategy must ensure that subsector commercialization pathway partners—from researchers, small businesses and coastal communities to investors and small and large enterprises—have what they need to collaborate and contribute to developing and commercializing new products.

An innovation ecosystem approach considers the stage of the companies as well as the layers of enabling conditions required to move from early-stage research and development to commercialization and global market engagement.

It is proposed that the Blue Bioeconomy Strategy focus on creating strong ecosystems related to infrastructure, research and development, access to capital and financing, and regulatory and needed talent requirements.

STRATEGY APPROACH

INNOVATION ECOSYSTEM CHART



EMERGING SUBSECTORS

MACROALGAE HARVEST AND CULTIVATION

Canada's macroalgae industry is poised for significant growth and innovation, driven by the global recognition of seaweed as a valuable marine resource. This subsector includes the harvesting and cultivation of large, multicellular marine algae, commonly known as seaweeds, for various industrial, agricultural, and commercial purposes. This product has potential uses in food, biofuels, pharmaceuticals, and environmental management.

The World Bank Group estimates that by 2050, the global seaweed industry will generate 28 billion USD annually and supply nearly 10% of the world's food stores (Source NOTE). Currently, nine species of kelp, sea lettuce, and Irish moss are commercially cultivated in Canada.

There is a healthy ecosystem of university/college and public and private-based research, but there are gaps in support for applied research, new product development, and commercialization. Building and expanding on this emerging market will require all ecosystem elements to be in place.

Canada's potential in seaweed cultivation remains largely untapped; its diverse coastal ecosystems, commitment to sustainability and alignment with international initiatives position it well to harness this emerging industry's economic and environmental benefits.

- Cascadia Seaweed in British Columbia cultivates local seaweed species on low-impact ocean farms in partnership with coastal First Nations. This seaweed is then used to manufacture products such as RegenaGrow BioStimulant and Sea-X liquid seaweed extract for land-based farms. In addition, research into applications for animal health and beyond is underway.
- Acadian Seaplants, founded in 1981, has a long history in Nova Scotia. It started as a seaweed supplier and began selling its first seaweed extract for plants in 1991. The company has expanded its offerings to include plant, animal and human applications. For example, Acadian Seaplus Wellness ingredients provide seaweed-based nutrients and bioactive ingredients for skincare products.
- Since 2018, the Mi'gmaq Wolastoqey Indigenous Fisheries Management Association has had an aquaculture site dedicated to cultivating seaweed, mostly sugar kelp, and conducting trials on Atlantic wakame and dulse. It established the first Quebec site dedicated to commercial seaweed farming. It also collaborates on research projects with many partners, including Merinov, UQAR and Laval University.

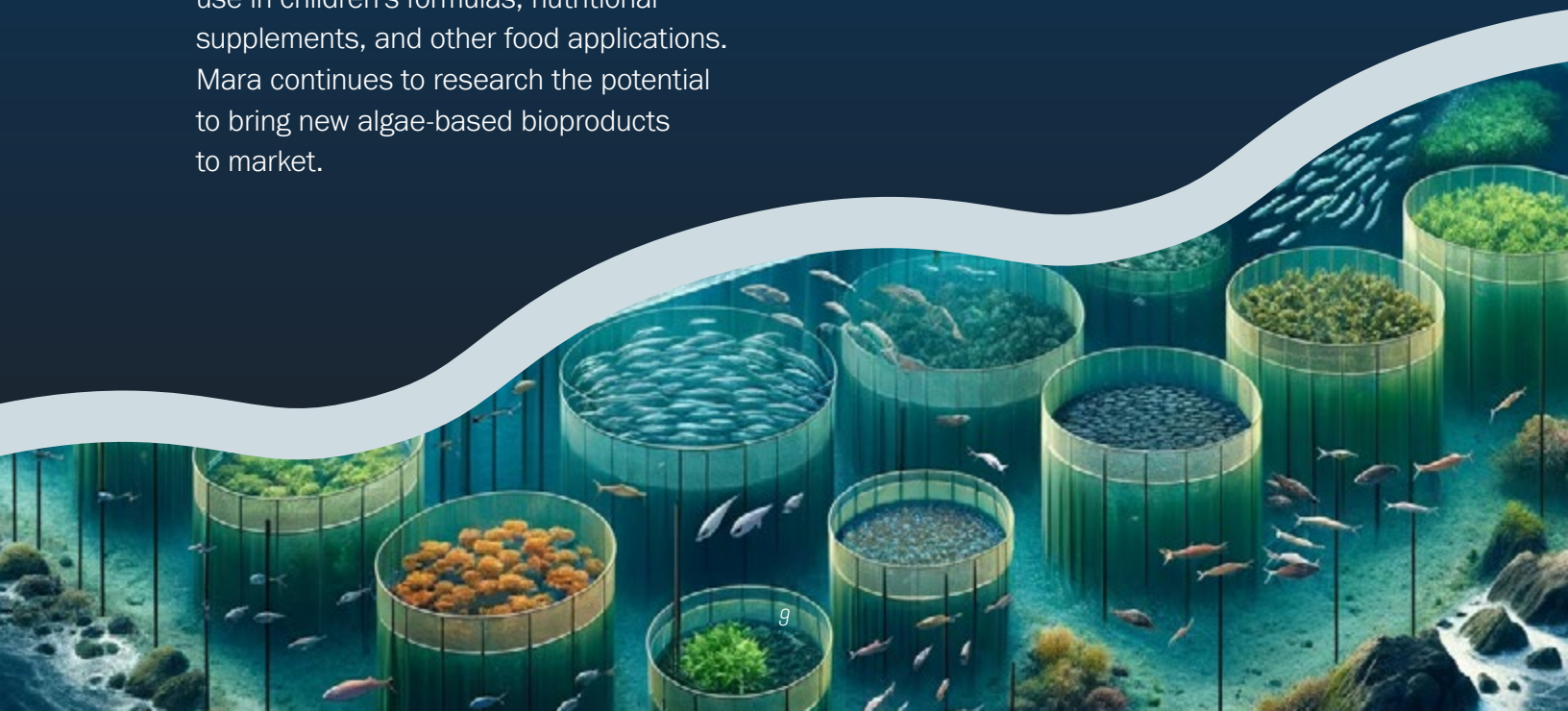
EMERGING SUBSECTORS

LARGE-SCALE MICROALGAE CULTIVATION

Microalgae are microscopic, photosynthetic organisms with great economic potential in Canada. They can be cultivated for applications ranging from biofuel production to pharmaceuticals to nutraceuticals, contributing to sustainable industries and economic growth.

This economic subsector is in its earliest stages of development; some research and development are underway across the country, but only a handful of companies are in the market. Challenges include access to funding for early-stage research and development and regulatory and approval frameworks that have not evolved to address this newly emerging opportunity.

- Mara Renewables Corporation (Mara) is a leading biotechnology company that has created a nature-sourced marine microalgal strain to produce DHA-rich omega-3 fatty acids, approved for use in children's formulas, nutritional supplements, and other food applications. Mara continues to research the potential to bring new algae-based bioproducts to market.
- Industrial Plankton designs and manufactures turnkey bioreactors in Canada for clean, on-site, live algae production for aquaculture, research lab, and biotechnology uses. The result is trustworthy equipment capable of easily and reliably producing biosecure, high-density algae.
- Algae-C, based in Nova Scotia, creates designer algae that produce valuable plant-based ingredients for the pharmaceutical, nutraceutical, and therapeutics industries. Their single-step biomanufacturing platform reprograms the DNA of microalgae, enabling the production of a wide range of complex ingredients in a single reactor, simplifying the manufacturing process, and expanding capacity.



EMERGING SUBSECTORS

MARINE BIOTECHNOLOGY

The marine biotechnology subsector harnesses the ocean's genetic, biochemical and ecological resources to develop novel products, processes and solutions. With applications ranging from pharmaceuticals and bioenergy to aquaculture and environmental remediation, marine biotechnology holds immense potential for driving economic growth.

Across Canada, research and development is occurring within companies and incubator clusters. This subsector's greatest opportunity is to support continued research and innovation and the scaled production of products that will meet the growing demands of its users in the natural products and pharmaceutical industries.

- Nautilus Biosciences, recently acquired by Croda International, focuses on using marine microbial biodiversity to discover novel active ingredients and biochemicals. For example, Nautilus and Croda have worked to develop specific applications for skin care, hair care, and crop care.
- innoVactiv, located in Quebec, specializes in innovative nutraceutical ingredients to support formulators in the dietary supplement industry. The company's products, such as InSea2®, which helps maintain good glycemic health, and Cartidyss®, which promotes the densification of the dermis, are both sourced from marine biomass and transformed for use through innovation.
- LUX BIO – Based in British Columbia, Paigen Whitehead developed a proprietary enzyme-based lighting system that is inspired by bioluminescence. The enzymes are powerful and biodegradable themselves, which is a fundamental principle in Green Chemistry. The reaction is stable, long-lasting, and shelf-stable. Their technology is on par with chemiluminescence performance and has been tested with NASA, Stellantis, the BBC, and other early pilot partners across the globe. It is built to NATO standards.
- Smallfood – a Nova Scotia company has discovered a unique strain of microalgae that produces soluble protein with a complete amino acid profile. Their innovative processing systems deliver a high-quality plant-based protein in just days, compared to the many months required of pea and soy protein.
- GC Lipid Technologies, based in Montreal specializes in creating genetically modified microalgae for sustainable aquafeed. Leveraging its expertise in genetic engineering, the company rationally designs microalgae strains with desirable qualities to supply various industries.

EMERGING SUBSECTORS

CO-PRODUCT VALORIZATION

Ocean biomass co-product valorization is a cutting-edge approach to sustainable resource use. It harnesses the vast potential of marine biomass by transforming what was once considered ‘waste streams’ into valuable products. This innovative concept addresses environmental concerns and holds significant promise for economic growth. Industries can create new revenue streams while minimizing waste by maximizing the value of discarded or underused components from ocean biomass.

Numerous research initiatives in Canada have produced very interesting results; however, there are currently no industrial facilities that would collect, stabilize, and pre-treat sporadic volumes distributed across thousands of kilometres of shoreline and quickly degrading.

Integrating advanced technologies and strategic partnerships further amplifies the economic impact, positioning ocean biomass co-product valorization as a pivotal driver for sustainable economic development in coastal regions and beyond.

- Kenney & Ross Limited, in Nova Scotia, collects fish skins and produces value-added products such as gelatin and collagen and higher-grade products in pharmaceutical/nutraceutical and retail markets.
- Land and Sea Pets Inc. is working to develop shelf-stable canned pet food produced from locally sourced, sustainably harvested cod by-products.
- Izumi Aquaculture – An Ontario aquaculture company was sustainability set up in rehabilitated gravel pits. They have designed a floating raceway to allow solid fish waste collection to then turn into a resource. Izumi Aquaculture is creating a solid fertilizer and liquid fertilizer, which they tested on a large tomato garden and potato crops.

ESTABLISHED AND EVOLVING SUBSECTORS

FINFISH AND SHELLFISH AQUACULTURE

Canada's aquaculture industry involves cultivating fish, shellfish and aquatic plants in controlled water and land environments. In 2020, the industry generated an estimated \$3.86 billion in economic activity and \$1.39 billion in GDP, plus employed over 14,500 full-time workers.

Finfish is the most significant component of the farmed seafood sector in marine and freshwater environments, with a production value of \$954 million in 2020. Meanwhile, shellfish produced \$88 million in value during the same period. The industry has seen a decrease in production values of 25% and volume of 11% between 2017 and 2020.

There is extensive potential for aquaculture in Canada. In 2019, the Canadian Aquaculture Industry Alliance prepared an update to the sector's physical footprint, which showed that only 1% of the water area that could be used for farming seafood is in use, a considerably lower percentage than in most other countries. Canada produces about 2.3 tonnes per km of coastline. In contrast, Norway produces 52 tonnes per km of coastline (20 times more).

With an industry comprised of hundreds of predominantly small-scale farm operations, global demand and economic growth require investments in infrastructure, science-based regulations, and innovation to enable the industry to expand and allow large-scale plants to emerge.

WILD CAPTURE FISH AND SEAFOOD

Canadians have been supporting themselves by fishing for over 200 years, and Canadian seafood supports more than 90,000 jobs and contributes over \$9 billion to the national GDP annually. Canada is clearly a global leader in supplying sustainable, healthy and delicious seafood and envisions being one of the world's top three best-quality and sustainable seafood producers by 2040.

Climate change will continue to impact access, particularly regarding stock migration and marine conservation. With relatively stable wild capture fishery catches, economic growth will require full use of harvest and new high-value products, hinged on innovation in and evolution of the seafood industry in Canada as we know it.

The Fisheries Council of Canada's Innovation Storyboard describes transitioning to "Industry 5.0, which will include cobots, waste transformation, greener technologies and biorefineries and circular economies." This evolution will allow full use of the harvest that comes into the processing plant, resulting in by-products as diverse as fish oil, fish meal, pet food, minced products, novel food supplements, collagen and chitin. This full-value use of harvested resources holds the potential for economic, societal and environmental benefits.

BE A PART OF SHAPING THE FUTURE OF CANADA'S BLUE BIOECONOMY

JOIN US AS INDUSTRY LEADERS, RESEARCHERS, AND GOVERNMENT OFFICIALS COME TOGETHER TO IDENTIFY WAYS TO CREATE AN ECOSYSTEM THAT DRIVES INNOVATION AND ACHIEVES OUR ECONOMIC POTENTIAL IN THE BLUE BIOECONOMY.

Sessions will explore key questions for building a national strategy.

1. What are Canada's current assets and strengths that can be built upon?
2. What are the greatest opportunities for economic impact and growth?
3. What are the gaps and barriers to innovation and growth in the Canadian ecosystem?
4. How can a national strategy best support the blue bioeconomy to achieve its greatest potential?

To request an invitation to a session, please contact us at:

ellie.speck@oceansupercluster.ca

Victoria, BC

May 29, 2024

9:00 - 3:00

Halifax, NS

June 5, 2024

9:00 - 3:00

Rimouski, QC

June 11, 2024

TBC



Questions? Please contact:
contact@oceansupercluster.ca

www.oceansupercluster.ca

