

Canada Advances Solutions for Global Aquaculture Productivity

Aquaculture is the world's fastest-growing animal food-producing sector, supplying some 64 million tons of high quality seafood per year at an average annual growth rate of 8.8 per cent. With depleted wild fish stocks, aquaculture production is meeting the increasing demand for nutritious food and animal protein, with the increasing production of salmon, tilapia and catfish, along with the cultivation of new farmed species including halibut, cod, sea bass, and sea bream.

The Food and Agriculture Organization of the United Nations (FAO) indicates that 70% of the world's wild fisheries are now either fished to the maximum sustainable yield or are being over-fished. The future rising demand for fish as food will have to be met by increasing aquaculture production.

Like the revolution in the application of new technologies to land-based food production over the past century, technology innovation is fuelling the growth of the global aquaculture industry. In Prince Edward Island, a small eastern Canadian jurisdiction, researchers are providing leading-edge support and innovative solutions to the challenges facing the global aquaculture industry. From improved fish feeds to fish health diagnostics, to genetics and brood stock development, to the evaluation of new species, local and global aquaculture and fish health companies can access some of the most innovative thinking available anywhere. There are more than 30 organisations involved in aquaculture research and development across Atlantic Canada, and several leading companies that are part of the Prince Edward Island Bioscience Cluster are making some serious waves.

The Centre for Aquaculture Technologies Canada (CATC), an independent contract research organisation for aquaculture and related industries, recently expanded its operation in Souris, Prince Edward Island, Canada – providing services in the areas of genomics, drug approvals, vaccine testing, and evaluation of novel feed ingredients.

In the fall of 2015, the company moved into a new 21,000-square-foot facility that once housed a fish plant operation. The recent state-of-the-art renovation provides access to advanced technologies that improve aquaculture productivity. A wholly-owned subsidiary of the Center for Aquaculture Technologies headquartered in San Diego, California, CATC focuses on R&D and commercialisation activities involving cold-water aquatic species, while providing independent contract research services related to fish health, nutrition and genomics.

Debbie Plouffe is CATC's Vice President of Research and oversees the new facility in Prince Edward Island. "It's a good repurpose of an existing structure. We worked with

the community and the Harbour Authority, plus we had a third-party environmental impact assessment leading to federal certification. Our goal is to create a one-stop shop for global aquaculture research right here in Souris. There are European competitors, but no other direct private facilities on this continent."

CATC researchers excel in study design. Trials are customised to client-specific needs ranging from performance and efficacy evaluations, to safety, side-effect and residue testing. Research divisions include genomics and breeding; diagnostics and genotyping; molecular biology; and fish health and nutrition. R&D is based on a thorough understanding of regulatory approval pathways for biotech products for aquaculture. Areas of expertise include development of in vivo models and testing services; molecular applications in aquaculture; characterisation of new products; GxP-compliant research, and collaborative and contract research.

Studying Canadian fish health and water conditions using high-quality data sets that regulators can easily audit creates a distinct advantage when developing new products for fish health and nutrition. "There's a huge market opportunity for Canada to develop innovative health and nutrition products for the industry and produce more fish globally," says Plouffe. "Aquaculture will be a key contributor to feed a world population of 9 billion people by 2050."

The company maintains vital research partnerships with the Atlantic Veterinary College at the University of Prince Edward Island where CATC staff conduct trials on-site. The Atlantic Veterinary College at UPEI is regarded around the world as "the fish vet school" because of its expertise in aquatic animal health, featuring a number of experts, including Dr Dave Speare, award-winning fish pathologist; Dr Sophie St-Hilaire, Canada Research Chair in Integrated Health Research for Sustainable Aquaculture; Dr Mark Fast, Elanco Research Chair in Fish Health; Dr Crawford Revie, Canada Research Chair in Epi-Informatics; and Dr Ian Gardner, Canada Excellence Research Chair in Aquatic Epidemiology.

Aquatic health research at AVC is a collaboration of many experts in aquatic health sciences research, field services, and education. As an academic centre of expertise in aquatic health research, AVC's overall goal is to expand the economic value created by aquatic food animal industries through epidemiology and disease intervention research activities. AVC provides globally recognised expertise in epidemiology and evidence-based research to support aquatic health policy decisions for both government and industry. AVC is a founding

partner in the World Organization for Animal Health (OIE) Collaborating Centre for Epidemiology and Risk Assessment of Aquatic Animal Diseases.

Elanco is the largest fish health company in Prince Edward Island. The Elanco Aqua Health facility employs 120 staff at its Victoria PEI research facility and Charlottetown vaccine manufacturing and distribution plant. The company is unique in hosting the complete spectrum of its aqua health activities in one location, including R&D, production, quality assurance and control, supply, and logistics.

A powerhouse within the tight-knit ranks of global aquaculture, Elanco's aquaculture facility is an international innovator, creating vaccines and pharmaceuticals to prevent viral and bacterial fish diseases and control sea lice.

It was the first in the world to license vaccines for the hematopoietic necrosis and infectious salmon anaemia viruses — essential to the recovery of the Chilean Atlantic salmon industry.

The company understands the positive economic impact aquaculture can have on coastal communities and is proud of its work identifying emerging pathogens and creating preventive vaccines.

Elanco supplies hundreds of millions of doses each year, predominantly for salmon and trout, and with enormous global growth potential, especially in Asia — it is working to make a major contribution toward closing the world's protein gap by 2050.

Also in Victoria is Halibut PEI — a 20,000-square-foot land-based halibut production facility, producing 70 metric tonnes of halibut annually. This company is working to meet a growing market demand for its product.

Company leaders were keen to see if they could create an innovative and sustainable way to operate a halibut aquaculture industry on land, rather than at sea, using high-quality saltwater drawn from wells for its water supply. They began a pilot project in 2008, purchasing halibut juveniles and developing growing regimes in tanks at their facility.

The results of the pilot project significantly exceeded expectations. Mortalities were minimal and growth rates were exceptional, and no antibiotics were needed because the water was pure. The nature of the water provides optimal conditions and results in a low environmental footprint. Since the fish are land-based, concerns about fish escaping into the wild are non-existent.

Another company committed to the future of sustainable seafood through land-based production is AquaBounty — located in eastern Prince Edward Island. By raising its disease-free, antibiotic-free salmon away

from the ocean, it too is eliminating the risk of escapes impacting native fish populations and the risk of pollutants or contaminants harming marine ecosystems. Housed inside specially-designed buildings, the AquaAdvantage salmon are being raised in optimised conditions. Total control of the water coming in and going out allows for removal of wastes (sludge) and recycling of greater than 95% of the water used, and water discharges that can be used by other enterprises such as hydroponic produce farmers. In 1993, AquaBounty's CEO had the idea of pairing the two revolutionary technologies. The innovative and faster-growing AquaAdvantage Salmon, which would shorten production cycles by half and drastically reduce feed costs, could finally make land-based fish farming economically viable.

The second innovation driving AquaBounty's vision is the development of land-based recirculating aquaculture systems (RAS). While farming salmon in sea cages is less expensive and less technologically complex than a land-based farm, land-based salmon farming eliminates many of the environmental problems with net-pen farms. Sea cages are susceptible to a number of hazards such as violent storms, predators, harmful algal blooms, jellyfish, and the transmission of pathogens and parasites from wild fish populations passing close to the sea cages. All of these hazards can cause significant fish losses over the course of the 32-36-month production cycle.

Salmon farmers have used RAS technology to raise their fish from eggs to the time when they can go into the sea, normally about a year. The salmon grow to market size in the sea cages for another two years. Higher costs prevented salmon farmers from growing-out their salmon to market size in the RAS facilities. AquaBounty's innovative AquaAdvantage Salmon, with its fast growth rate, shortens the production cycle from 32-36 months to 16-18 months, making land-based salmon farming economically possible.

Innovative thinking, industry-relevant research, and high-quality infrastructure have established Prince Edward Island, and indeed all of Atlantic Canada, as a global centre of excellence in fish health, making an important contribution to the advancement of an industry that is demonstrating its importance as a highly-efficient, low-footprint means of feeding a growing world population.



Rory Francis, Executive Director

Mr. Francis has led the formation, growth and development of the Prince Edward Island BioAlliance since 2005. Under his leadership, the PEI Bioscience Cluster has more than tripled the number of companies, tripled private sector revenues and more than doubled private sector employment. He is a member of the Canadian BioAccord, the Canadian Agri- Food Policy Institute, the Vineland Research and Innovation Centre, Food Island Partnership, and is President of the Eastern Canada Oilseeds Development Alliance. Email: rory@peibioalliance.com