

FISHERIES & AQUACULTURE

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This year, the start of the fishing season is taking place in an unprecedented context that calls for solutions that we would never have imagined previously. I am proud of Québec's fisheries and aquaculture sector. Every day it fulfills its commitment to our coastal communities as it embarks on a fishing season that will surely go down in history for the extraordinarily complex issues it imposes.

At this stage of the pandemic, the Government of Québec's main objective is to accompany and support the industry so that it remains strong and survives the global crisis caused by COVID-19. The key to achieving this, of course, is constant communication with the various players in the field. The last few weeks have been difficult: uncertainty in the markets in the short, medium and long term and the risks of spreading COVID-19 among workers and coastal communities complicate decision-making. During regular discussions with the minister of Fisheries, Oceans, and the Canadian Coast Guard, Bernadette Jordan, I have also made sure to explain Québec's issues and the expectations of fishers, plant workers, processors and aquaculturists. I highlighted the importance of implementing specific support measures for the commercial fishing and aquaculture industry and providing better financial support to the federal government.

For its part, the Government of Québec has announced a series of support programs from which companies in the sector can benefit. My team and I are working every day to ensure that industry stakeholders have the necessary support for decision-making, but also to ensure that their activities can take place in the best possible conditions this year, with as few adverse consequences as possible. These protocols were developed with the Institut national de santé publique du Québec to guide you in the measures to be implemented to protect the health of those who work in plants and on ships.

Now that we know the opening dates for fishing for all species, we must work even harder to ensure that the fishing season runs smoothly while remaining healthy. Complying with the protocols in the specific situations of each company, both in processing plants and aboard boats, is a significant challenge and is essential to ensure continued operations. The weeks and months to come will allow us to see what lessons can be learned from this crisis. In closing, I would like to acknowledge the speed with which the industry has responded to the COVID-19 crisis and the proactive and team spirit you have shown in seeking solutions over the past few weeks. We will emerge from this troubled time united, resilient and stronger.



Minister of Agriculture, Fisheries, and Food

ANDRÉ LAMONTAGNE

MARINE PROTECTED AREAS IN QUÉBEC: A STATUS REPORT

By Moez Khefifi,

from the Direction des analyses et des politiques des pêches et de l'aquaculture

Under the Strategic Plan for Biological Diversity 2011-2020 for the planet adopted in Aichi (Japan) in October 2010, Québec and Canada decided to protect 10% of their marine and coastal areas by the end of 2020. They intend to achieve this by designating marine protected areas (MPA) to preserve fragile or exceptional environments and the habitats of threatened or vulnerable species.

CURRENT STATUS

Québec already protects three marine territories that represent 1.3% of its marine areas, including the Saguenay-St. Lawrence Marine Park created in 1998, the Réserve aquatique de l'Estuaire-de-la-rivière-Bonaventure and the proposed Manicouagan aquatic reserve, which were designated in 2009 and 2013, respectively. Furthermore, the designation of a new joint marine area project is under way: the Banc-des-Américains aquatic reserve, which will add 0.6% to the marine areas already protected.

REGIONS OF INTEREST

Two new joint marine protected area projects are under study: one in the northern Gulf and the other in the St. Lawrence Estuary. They were the subject of two information sessions with stakeholders in June 2019. These two projects will enable Québec to reach its goal of protecting 10% of marine and coastal areas.

Project in the northern Gulf of St. Lawrence

Eight areas of ecological interest have been identified in the northern Gulf of St. Lawrence. These areas are already marine refuges established by the Government of Canada as of December 2017. It is prohibited to use fishing gear that comes into contact with the seabed (bottom trawl, dredger, bottom seine, basket trap, bottom longline and gillnet) in these areas, whether for commercial or recreational fishing or subsistence fishing. The designation of marine protected areas in these areas provides an opportunity to strengthen the protection of corals, cold-water sponges and the ecosystems that support them.

Project in the St. Lawrence Estuary

Seven areas of ecological interest have been identified in the St. Lawrence Estuary to establish a multi-site marine protected area. These sectors were defined following analyses of human activities, including fisheries and aquaculture, and biological data in these sectors. The designation of a marine protected area in the St. Lawrence Estuary will make it possible to protect at-risk marine mammals, their habitats and prey and fish that are in a precarious situation and their habitats.

A feasibility study for the protection of marine environments in the Îles-de-la-Madeleine was relaunched in June 2019 in addition to these two projects. The creation of a marine protected area (MPA) in the Îles-de-la-Madeleine would eventually be taken into account in future MPA objectives for the year 2025 or even 2030.

Project in the Îles-de-la-Madeleine

The geographical extent considered for the creation of a possible marine area in the Îles-de-la-Madeleine covers an area of approximately 17,000 kilometres. The coastal waters are home to many invertebrate species (lobster, rock crab and various mollusks), while the deeper habitats are important for spider crab and snow crab in particular.

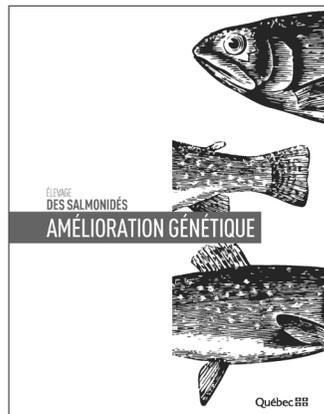
The feasibility study for the protection of the marine environments of the Îles-de-la-Madeleine will extend for several years. The study should make it possible to define the advantages and constraints related to the designation of a future marine protected area, the favourable sectors, the conservation measures and the possible management methods adapted to the reality of the environment.

Next steps

The COVID-19 pandemic has disrupted the schedule of consultation sessions with stakeholders of MPA projects in the northern Gulf and St. Lawrence Estuary. Nevertheless, the Canada-Québec Bilateral Group on Marine Protected Areas (BGMPA), which was set up in 2007 as part of a provincial-federal collaborative effort and which includes MAPAQ, continues to work on the conservation measures to be implemented in cooperation with Indigenous groups and stakeholders. MAPAQ will continue to exercise its role as a collaborator within BGMPA to protect the interests of fishers and aquaculturists in a sustainable environment.

A MODERNIZED SALMONID FARMING REFERENCE DOCUMENT!

By **Nathalie Moisan**,
from the Direction régionale de l'estuaire
et des eaux intérieures



Those with an interest in fish farming will be pleased to know that the *Amélioration génétique* booklet in the *Élevage des salmonidés* series has been updated with the latest science and that new chapters have been added to the previous version.

Readers will be able to learn about the following topics, among others:

- The basics of fish genetics;
- Genetic selection for one or more traits to improve certain characteristics of farmed fish;
- Ways to avoid inbreeding problems when breeding;
- The advantages and disadvantages of hybrid production.

New topics on recent advances in genetics, such as marker-assisted selection and genomic selection, as well as explanations on transgenesis, enrich this new edition.

You can find the paper and digital versions on the [website](#) of the ministère de l'Agriculture, des Pêcheries et de l'Alimentation.

OVERVIEW OF QUÉBEC'S FISH AND SEAFOOD EXPORTS IN 2019

By **Michel Bélanger**,
from the Direction des analyses et des
politiques des pêches et de l'aquaculture

The value of Québec's exports increased in 2019 compared to 2018. It rose from \$408.6 million to \$426.8 million. In 2019, various crab, lobster and shrimp products accounted for 90% of fish and seafood exports to other countries around the world. Québec's fish and seafood imports totalled \$577.5 million in 2019 and came, in order of importance, from Chile (16.8%), China (14%), the United States (11.6%), Vietnam (10.9%) and Thailand (8.7%). Shrimp and salmon are the two main products imported by Québec. Note that this analysis does not include interprovincial imports and exports.

TABLE 1 – VALUE AND DESTINATION OF QUÉBEC'S FISH AND SEAFOOD EXPORTS IN 2019

	PARTNER COUNTRIES	VALUE OF EXPORTS (CA\$)	PROPORTION (%)
1	United States	348,616,083	81.68
2	China*	17,251,275	4.04
3	Denmark	17,069,620	4.00
4	Japan	14,114,661	3.31
5	South Korea	6,001,800	1.41
6	Spain	3,825,929	0.90
7	Italy	2,096,188	0.49
8	France	1,373,242	0.32
9	Saint Lucia	1,320,056	0.31
10	Dominica	1,229,608	0.29
	Other	13,934,807	3.26
	Globally	426,833,269	

* including Hong Kong

Sources: Global Trade Tracker, code SH (03)(1604)(1605)

TABLE 2 – VALUE OF THE MAIN SPECIES OF FISH AND SEAFOOD EXPORTED BY QUÉBEC IN 2019

SPECIES	VALUE OF EXPORTS (CA\$)	PROPORTION (%)
Crab	237,364,867	55.61
Lobster	118,356,094	27.73
Shrimp	31,078,828	7.28
Fish (e.g. halibut, herring, salmon, cod, etc.)	32,922,781	7.71
Other (e.g. sea cucumber, sea urchin, mollusks, etc.)	7,110,699	1.67

Sources: Global Trade Tracker, code SH (03)(1604)(1605)

MIGUASHA'S COMMERCIAL RAINBOW SMELT FISHING

By **Thierry Marcoux**,
from the Direction régionale de la Gaspésie



Rainbow smelt is a well-known fish in Québec's maritime communities and is fished recreationally in various estuaries when frozen by Québec's very cold winters. Few people are aware, however, that it is also fished commercially in Québec and that the majority of harvests are made each winter in the Miguasha sector, more specifically in the Restigouche River estuary opposite the municipalities of Escuminac and Nouvelle. This type of fishing is distinguished by its heritage, its artisanal practice and the quality of the catch. It has been practiced since the 19th century and has been handed down over generations by the families that occupy this territory.

Fishermen take advantage of the ice pack that forms in the bay to set their fishing gear. They travel to the middle of the bay by snowmobile, then create openings in the ice to place several wooden poles to set nets up to 40 metres long under the ice pack. Called bag nets or box nets, these devices operate with the rising tide, which guides the fish to their openings. When the tide is out, fishermen can then retrieve their catch by hauling the end of their nets up to the surface of the pack ice through a hole that is kept open. The fish is then frozen directly on the ice, which causes the secretion of an antifreeze that gives the fish a sweet almond taste. It is this traditional freezing process that distinguishes Miguasha smelt from competing products from elsewhere.

Today, only a handful of fishers still practice this activity. Difficult working conditions, aggravated by icy winter winds on a flat ice floe, and highly variable tide times contribute to the lack of new fishers. Climate change is also threatening the fishery, as the period during which the pack ice is stable enough to fish is getting shorter and the freezing of harvested fish on the ice is taking longer. Nevertheless, fishers have caught between 40,000 and 50,000 pounds of smelt each winter in recent years.

Despite these challenges, a company in the sector continues to evolve to preserve this territory's flagship activity. Indeed, Les Éperlans de Miguasha Inc. is currently working on designing a refrigerated warehouse with an ice floor so that it can continue to freeze fish on ice even during the increasingly warm months of March. It is also working to develop fish sorting, packaging and identification equipment to better position Miguasha smelt in the region and elsewhere in Québec. Currently, this equipment is only available in Gaspésie during the winter months.

The ministère de l'Agriculture, des Pêcheries et de l'Alimentation is proud to guide and financially support the company in the implementation of this developmental project for the commercial rainbow smelt fishery.

SAFETY ABOARD LOBSTER BOATS

By Julie Boyer,
from the Direction de l'innovation

Luckily, the largest gathering of fishers and industry support and guidance organizations was held in February, before the social distancing measures to slow the spread of COVID-19! And fortunately, Coronavirus, the masked Roman chariot racer, the enemy of Asterix and Obelix in the *Asterix and the Chariot Race*, did not travel through Rimouski. Rather, it was Merinov who visited Rimouski with their demonstrator mounted on a trailer.

The annual meeting of the Comité permanent sur la sécurité des bateaux de pêche du Québec is an opportunity to learn about developments to improve the safety of fishers, who practice a trade classified as one of the most dangerous in Canada.

Francis Coulombe, biologist, and Michel Tremblay, a fishing technician at Merinov, presented the innovative equipment and devices developed by Merinov for improving the ergonomics and safety of the «winch» (or «hauler») workstation, which is used to haul in the trap line, and the «trap support» workstation, where the traps are placed to retrieve the catch and baited again before they are released back into the water. This equipment and devices were installed on a trailer that simulated the deck of a lobster boat equipped with a low hauler on the starboard aft side, a model common in the Îles-de-la-Madeleine, and a high hauler on the port side, a model used in Gaspésie.

The improved hauler allows more of the trap to be carried aboard. As a result, the fisher has less need to bend over to retrieve the trap, which reduces the risk of falling overboard. An increase in freeboard height also reduces this risk. The improved hauler also reduces heavy-duty work and therefore improves the ergonomics of the workstation. The addition of a rope-receiving slab and a divider panel, which considerably reduces the amount of rope on the deck, makes the «trap support» station safer. As a result, there is less risk of operators getting their feet entangled in the rope and being dragged overboard.

In designing the demonstrator, Merinov's fisheries experts were assisted by Tamara Provencher, intern, and Charles-André Fraser, engineer. Both are attached to the design engineering chair headed by Professor Jean Brousseau of the Université du Québec à Rimouski. Junior engineer at Merinov, Colin Gauthier-Barrette, also contributed to the project.

Around thirty fishers and partners handled the devices and understood how they work. Merinov also plans to tour fishing harbours in Québec to allow more fishers to test these innovations, which could be installed in approximately 80% of the fleet in Gaspésie and Îles-de-la-Madeleine. The organization's staff will be able to advise fishers and machine shop personnel who wish to have this type of innovation designed and installed aboard their vessels.

This project is funded by the ministère de l'Agriculture, des Pêcheries et de l'Alimentation, the ministère de l'Économie et de l'Innovation and Mitacs, an organization that offers research and training scholarships in fields related to industrial and social innovation.

For more information contact Mr. Michel Tremblay by e-mail at michel.tremblay@merinov.ca.

PROMISING DEVELOPMENTS FOR FISH HEALTH

By Julie Boyer,
from the Direction de l'innovation

The development and profitability of Québec fish farming companies depend on the health of the fish. The best practices adopted by Québec fish farming companies help prevent disease, but bacterial infections still occur, as they do in all farms. Between 25% and 40% of the salmonid infections reported annually are attributable to furunculosis, a disease caused by the bacterium *Aeromonas salmonicida*. Approved treatments for this disease are becoming increasingly scarce. In Québec, fish farmers can rely on antibiotics administered by veterinarians, but antibiotic resistance is now frequent and limiting. There is, therefore, an urgent need to develop effective and ethical alternatives to deal with furunculosis.

Professors Steve Charette, Nicolas Derome, Sylvain Moineau and Michel Frenette of the Université Laval are studying the situation. They are exploring various innovative alternative approaches, both to prevent the onset of the disease and to cure infected animals. Their research teams are conducting three promising research and development projects, with the support of staff from Université Laval's Laboratoire aquatique de recherche en sciences environnementales et médicales, the Centre de transfert et de sélection des salmonidés and four Québec companies.

DEVELOPMENT OF AN EFFECTIVE AND LONG-LASTING PROBIOTIC TREATMENT

The microbial flora, also known as microbiota, that colonize the body surfaces of animals contribute to the host's immunity and inhibit pathogens. However, stress factors related to farming can disrupt the composition and activity of this microbiota. Changes in the beneficial properties of this microbiota for fish promote opportunistic and pathogenic bacteria. Researchers are relying on administering bacteria that are present in healthy fish and play a key role in host physiology, i.e. endogenous probiotics, to prevent and treat opportunistic infections such as furunculosis.

Professor Nicolas Derome and his colleagues have identified probiotic strains that inhibit the growth of several *Aeromonas salmonicida* strains from different geographical sources and have demonstrated their safety as well as beneficial effects on growth (20% to 30% weight gain) and immune response. In an initial experiment in a treatment context, fish that received probiotics saw their mortality rate drop by 50% within 35 days after infection. These probiotics, therefore, demonstrated strong potential as ethical and long-lasting therapeutic tools against furunculosis in farmed brook trout, as well as a beneficial effect on growth and immune response.

The addition of prebiotics, i.e. dietary fibres that stimulate microbiota microorganism growth and activity, can enhance these benefits. Researchers are now working to optimize the formulation of treatment for furunculosis based on probiotics and prebiotics and to test its effectiveness in different aquaculture settings.

DEVELOPMENT OF LIVE NATURALLY ATTENUATED VACCINES

A preventive approach such as effective vaccination would be an interesting option. Typically, the dead vaccine strain is injected into the peritoneal cavity of the fish to force the immune system to develop a protective immune response. From a cost-effectiveness and efficiency perspective, a vaccine that can be administered orally by immersing young fish in water containing this vaccine is a better option. Furthermore, it is known that vaccination is most effective when the vaccine strain is alive but has lost its virulence naturally.

Professor Steve Charette and his colleagues compared the genomes of susceptible and refractory strains to loss of virulence using heat treatment. They documented the mechanisms related to the loss of virulence of the bacterium, in particular by discovering an element in their genome that inhibits this loss. These results indicate that it is currently impossible to produce vaccine strains specific to each fish farm in Québec or all regions of Québec since known strains from certain regions carry this element of their genome and therefore remain virulent. This has led researchers to focus on a single vaccine strain that would work for all Québec fish farms and provide specific vaccine strains to fish farms in regions infected with *Aeromonas salmonicida* strains that are capable of losing their virulence.

Researchers now plan to test a vaccine strain that has the potential to effectively immunize fish throughout Québec on salmonids. They also want to confirm the safety and effectiveness of this approach, not only in their laboratory but also in two fish farming companies.

DEVELOPMENT OF BACTERIOPHAGIC COCKTAILS TARGETING FURUNCULOSIS

Bacterial viruses, also called phages, are viruses that specifically attack bacteria by infecting and killing them. Health Canada has approved of the use of phages in certain agri-food commodities to kill bacteria. For the treatment of furunculosis, researchers are aiming to develop optimized cocktails (mixtures of different viruses) of phages that would be easily used by fish farmers.

To date, researchers have characterized phages in the laboratory that are effective against a wide range of strains of the bacteria that cause furunculosis. The analysis of these phages has identified several important parameters that must be met in making phage cocktails, such as phage specificity for *Aeromonas salmonicida*. The teams are continuing to develop these bacteriophagic cocktails, this time addressing their effectiveness in vivo, i.e. by carrying out real tests with fish infected by the bacteria.

These projects are financially supported by the Innovamer program of the ministère de l'Agriculture, des Pêcheries et de l'Alimentation and by Ressources Aquatiques Québec, which is the inter-institutional research group for the sustainable development of the aquaculture and fisheries industry in Québec. They are also supported by the Association des aquaculteurs du Québec and the Table filière de l'aquaculture en eau douce du Québec.

For more information,
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and Mr. Nicolas Derome at nicolas.derome@bio.ulaval.ca.

MEETING WITH PARTNERS ON THE STATUS OF THE MINISTERIAL 2018-2025 ACTION PLAN FOR THE COMMERCIAL FISHING AND AQUACULTURE INDUSTRY IN QUÉBEC

By Moez Khefifi and Rabia Sow, from the Direction des analyses et des politiques des pêches et de l'aquaculture

Québec's fishing and aquaculture industry partners held a meeting on March 11 in the City of Québec. Organized by the ministère de l'Agriculture, des Pêcheries et de l'Alimentation (MAPAQ), the purpose of the event was to take stock of the two years of implementation of the ministerial Action Plan 2018-2025 action plan for the commercial fishing and aquaculture industry in Québec and to define the industry's issues and priorities for the coming year.

This plan was announced in April 2018. Developed under the guidelines of the Québec Bio-Food Policy, it includes 20 actions that were determined following discussions with partners on the industry's main issues.

THE REVIEW OF THE INTERVENTIONS

Almost two years after the implementation of the Action Plan, 19 of the 20 actions have been implemented or are in progress. The table below presents the results of the Action Plan's implementation concerning the established targets.

ACTION PLAN TARGETS		RESULTS FOR THE YEARS 2018 TO 2020
Investment	Invest \$200 M in the harvesting, aquaculture and processing sector, including an \$80 M contribution from the MAPAQ	Total investment: \$157.2 M MAPAQ contribution: — \$24.6 M (financial assistance available for projects in the sector since April 2018) — \$59.2 M in loan guarantees to fishing companies
Aquacultural production	Double production from 1,600 tonnes to 3,200 tonnes annually	— Fish farming: An additional 330 tonnes — Mariculture: An additional 110 tonnes
Environmental certification	Increase the share of Québec's environmentally certified aquatic products from 52% in 2015 to 70% in 2025	Fisheries in the process of certification: crab from the coastal areas of Québec and Greenland halibut
Québec content in fish and seafood*	Increase the value of Québec content in fish and seafood purchased in Québec by 20%	Growth of 10% to 13% in the value of distribution purchases from the Québec market in 2018 compared with 2017*
Exports of aquatic products from Québec	Increase the value of Québec's aquatic product exports by 20%	Increase of 4% in the value of exports in 2019 compared with 2018

* Data for the year 2019 is not yet available.

KEY INDUSTRY ISSUES FOR THE 2020-2021 PERIOD

Following the presentation of the Action Plan review and the results of its implementation over the past two years, the meeting participants were invited to discuss the industry issues to be prioritized for the coming year. This information will enable MAPAQ to guide its interventions in the sector for the 2019-2020 period. It is important to note that these issues were defined before the start of the pandemic and will need to be reviewed in the coming weeks and months.

The key issues that the industry has identified are as follows:

SECTORS	ISSUES FOR THE 2020-2021 PERIOD
Harvesting	<ul style="list-style-type: none"> Adapting fishing gear to address the problem of right whales and the Marine Mammal Protection Act. Continue work on improving safety on board boats. Develop effective and accessible alternative baits for fishers. Adapt boats and fishing gear for a possible opening of the redfish fishery. Maintain or increase environmentally certified species.
Processing	<ul style="list-style-type: none"> Develop the redfish processing capacity. Facilitate access to foreign labour. Reduce the volume of residual materials.
Aquaculture (fish farming)	<ul style="list-style-type: none"> Increase aquacultural production. Adapt the sector to climate change. Shorten the time frame for issuing authorizations.
Aquaculture (mariculture)	<ul style="list-style-type: none"> Facilitating access to funding for businesses.
Marketing	<ul style="list-style-type: none"> Addressing the impact of COVID-19 on markets for aquatic products. Identify Québec's aquatic products. Develop and diversify export markets.
Innovation	<ul style="list-style-type: none"> Develop new technologies to ensure growth in aquacultural production. Diversify aquacultural production.
Consultation	<ul style="list-style-type: none"> Continue the work of the redfish committee. Establish a consultation committee with industry representatives to work together.

COVID-19: TIPS TO HELP YOU!

How can you protect yourself in the workplace?

There is currently a climate of uncertainty not only across commercial fishing and aquaculture industry, but also in the bio-food industry overall. The COVID-19 situation is affecting everyone in one way or another and forces us to reflect on our ways of doing things. In order to clarify the situation, the National Institute of Public Health of Quebec has published recommendations on how to protect the health of employees and those who visit their workplace:

- [Recommendations for the Fishing Industry.](#)
- [Recommendations for the food processing industry.](#)

Government programs to support you!

In light of the challenges posed by the pandemic, the Sous-ministériat aux pêches et à l'aquaculture commerciales of the Ministère de l'Agriculture, des Pêcheries et de l'Alimentation (MAPAQ) has compiled an inventory of government support programs available to businesses and workers in the industry. For information about the programs and whether you can benefit from them, please consult the following resources:

- [Fishing companies](#)
- [Fish and seafood farmers](#)
- [Processing plants](#)
- [Fisher helpers, plant workers and aquaculture workers](#)