GenomeAtlantic

A pearl of a project for Eastern Canada's oyster industry

The Eastern Canadian oyster industry could get an important and timely boost thanks to a recently announced $3.8 million research project to develop the first Canadian production-ready strain of Eastern Oyster.

There is a lot riding on this project. The east coast industry is currently enjoying a big surge in consumer demand that wild-caught oyster larvae, or spat, won't be able to fuel long term, if the current growth pattern continues. Industry revenue for 2017 jumped 25 per cent from the previous year to $31 million. Optimally, the projected new oyster strain will grow faster, produce better quality flesh, and show more disease resistance compared to current strains. For east coast oyster farms, those traits add up to greater profitability.

Managed by Genome Atlantic, in partnership with Génome Québec, the project brings together, L'Étang Ruisseau Bar Ltée (ERB) in Shippagan, N.B., the biggest oyster hatchery seed supplier in the Maritimes, and scientists from Université Laval, Quebec City, Que. and the University of Chile, Santiago, Chile. The project is enabled through Genome Canada's Genomic Applications Partnership Program (GAPP) with additional funding provided by ERB; Génome Québec; Atlantic Fisheries Fund; University of Chile; and Mitacs.

To get a better picture of this undertaking from the standpoints of the industry and the science involved, Genome Atlantic contacted the co-leads of the project, Dr. Martin Mallet from ERB, and Dr. Louis Bernatchez at Université Laval, for the Q&A interviews that follow.

Q&A with *Dr. Louis Bernatchez, a professor of genetics in Laval's Department of Biology who holds the Canada Research Chair in Genomics and Conservation of Aquatic Resources.*

Genome Atlantic: How did you and your colleagues at the Université Laval become engaged in this project?
Martin Mallet and I met through a common acquaintance and felt right away we could work together. So we did, first through an initial "small scale project" which led to the publication of the most important scientific publication to date on the genetic diversity of the Eastern oyster in Canada. It was then natural for us to team together on a much larger scale project.

GA: Why have scientists from the University of Chile become involved?
I collaborated with Dr. José Manuel Yáñez, an expert in genomics and qualitative and molecular genetics at the University of Chile in another project on salmon, which has been very successful. Dr. Yáñez leads a large research group in Chile, and I consider him to be one of the top aquatic quantitative geneticists in the world. So, together, we can bring all the necessary expertise to complement that of both Drs. Mallet *[André Mallet, marine biologist and president, and Martin Mallet, evolutionary biologist and co-owner]* from L'Étang Ruisseau Bar to bring this project to a successful completion.

GA: In layman's terms, can you outline the genomic techniques you will use to create the prospective breeding program that will attempt to select for traits such as improved growth, better flesh quality and disease resistance?

In order to use genomics to assist in and improve selective breeding, we first need to develop a tool that will allow us to look for genetic variation across the oyster's entire genome. To this end, we will build what is called a "DNA SNP chip" that will allow screening of the genetic variation at 200,000 positions across the whole genome of thousands of oysters. Then, we will search for associations among the variations at those 200,000 positions in the genome and the variation in phenotypic traits (e.g. growth rate, flesh quality) among those thousands of oysters. In this way, we identify those regions of the oyster's genome that underlie variation in those traits. Finally, we can then screen for variation of those precise regions in order to literally predict the phenotype of adult oysters' progeny and in this way speed up and improve the selective breeding program.

Are there any obstacles presented by the eastern oyster*, Cassostrea virginica,* or the east coast environment that make this a particularly challenging project?
There is always the unexpected that can happen of course, but honestly, we have planned this project very carefully and in the most realistic way possible in order to successfully reach our goals.

Could the genomics tools you are developing here for the eastern oyster have any applicability for other farmed molluscs such as mussels?
Not really in the sense that the genomic tools are species specific. But it could certainly be used elsewhere, for instance by any producers in Canada or in the U.S., depending on their needs. However, our project can certainly set the stage for a "know how" that could serve as a model for the development of similar tools in other species.

Q&A with Dr. Martin Mallet, a co-owner of L'Étang Ruisseau Bar Ltée and an evolutionary biologist focused on the genetics of wild oyster populations. He manages the company's hatchery and its research and development program in oyster genetics.

Genome Atlantic: What factors drew L'Étang Ruisseau Bar Ltée into this project?
With the success of our commercial shellfish hatchery, we viewed the implementation of a rigorous breeding program as a necessity. While incorporating genomic tools was initially more of a long-term goal, the opportunity to work with Louis Bernatchez and the support of Genome Atlantic played a large part in our decision to incorporate cutting-edge breeding tools into our efforts from the start.

GA: Why, in your view, have genomic tools to improve aquaculture production been slow to develop for the Eastern oyster compared with other oyster species used in aquaculture?
I think that the main reason is the age of the industry. Until recently and compared with other oyster species, eastern oyster aquaculture has been practiced in a manner more resembling ranching than farming. We're only at the point now where there is a critical mass of growers to support commercial shellfish hatcheries, let alone one carrying out a genomically-enabled breeding program.

GA: What part will the company play in this newly funded project?
We're taking a very active role in this project. While Drs. Bernatchez and Yáñez are undoubtedly the genomics experts, oysters are our world. We will be carrying out the experimental and fieldwork at our facilities, as well as being intimately involved in the breeding decisions. At the end of the day, these oysters represent the future of our farm.

How interested are other Eastern Canadian oyster farmers in what your company and the university scientists from Laval and Chile are trying to achieve?
Based on the conversations I've had, there is tremendous interest in our work. Not only will we be breeding an oyster that performs better for aquaculture, but we are also gathering important information about wild oyster populations. That's proving to be important in my conversations; growers want access to a better performing strain, but they also want to know where it fits into the bigger picture.

What potential benefits do you see arising from this collaboration between academic science and industry, apart from the obvious one of providing a better and more plentiful oyster product to meet growing consumer demand?
One of the biggest benefits to the broader community will be the creation of a high-resolution DNA SNP chip, which will serve as a catalogue of genetic variation in our oyster populations. I'm hopeful that the availability of this tool will stimulate a new wave of research into our oyster populations, as it can be used not only for breeding work but for a whole array of fundamental and applied research questions. I'm hopeful this project will serve as an example of successful academic-industry collaboration, for the benefit of both communities.

GenomeAtlantic