Study mapping lobster genome could hold keys to strengthening species

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Fraser Clark, a molecular immunologist in Dalhousie's Department of Animal Science and Aquaculture, worked with researchers from Johns Hopkins University, University of Florida, University of Prince Edward Island, Tufts University and Harvard University. Credit: Dalhousie University

Researchers from Dalhousie University and several U.S. institutes have published the first complete genome sequence for the American lobster,

yielding critical insight into the species that can both improve sustainability and help predict how it responds to climate change.

The genome sequence—the complete list of nucleotides that make up all the chromosomes of a species—will serve as a valuable resource for fisheries, ecology and biomedical research, especially in understanding susceptibility to disease and the ability to cope with environmental change.

The findings will also provide important information on the biology of aging, immunity and the sense of smell in a creature that's estimated to have a natural lifespan of 50 or even 100 years and whose nervous system is a valuable model for human neural networks.

Fraser Clark, a molecular immunologist in Dalhousie's Department of Animal Science and Aquaculture, worked with researchers from Johns Hopkins University, University of Florida, University of Prince Edward Island, Tufts University and Harvard University. Their findings on the Homarus Americanus were published recently in *Science Advances*.

The team hopes it will help identify threats to and ultimately protect the American lobster, a species that supports one of the largest shellfish fisheries in the world that spans the Eastern seaboard from the Canadian waters off Labrador to about New Jersey.

"The lobster genome is almost like an encyclopedia of all the things that we could possibly be looking at in terms of how the lobster responds," says Dr. Clark.

"So, we can now get a much clearer idea of how a lobster will respond to different kinds of hardship that they will face normally or that could be happening with ocean acidification and climate change, for example. It's all about whether we can predict what might happen and help the

industry get ahead of a lot of these things."

Stress tests

The team did stress tests on the lobsters and then took RNA samples from them, producing a vast amount of data that could be analyzed to reveal how the lobsters respond to the tests. In one trial, researchers looked at how they reacted to being stored in a simulated holding facility for various periods of time up to four months.

They also shipped them to evaluate the stress associated with transportation, which has been linked to the development of holes in their shell. They are safe to eat, but might not be as marketable.

"The goal of using this tool is to make sure we have long-term viability and sustainability of the industry because it really is so important to so many small communities," says Dr. Clark, adding that the landed value for lobster could be close to $2 billion in Nova Scotia this year.

"We just want to give the industry as much information as possible because they have a vested interest in being able to fish lobster for the next 100 years."

They are trying to determine what effect stress might have on the animals, which can reach a length of more than 92 centimeters and weigh as much as 18 kilograms. A lobster under stress might put less energy into reproduction or use up a lot of its fat reserves, which could mean it might not be able to handle time in storage.

Detecting disease

Dr. Clark says the team was also interested in trying to learn more about

diseases that affect the species, particularly one that has beset the population south of Boston. Shell disease can cause deep lesions on the lobster's shell making it look rusty, something that began appearing in the 1990s off New England and has devastated the lucrative industry.

Scientists only know that it is linked to bacteria, but it's not clear if bacteria are causing the problem or if the lobster is stressed for some other reason.

"We're holding them in some conditions where we know they have the possibility of developing the shell disease," he said. "And we're examining those that get the disease and those that don't in much more detail to try to figure out why some get it and some don't."

The research, led by the Gloucester Marine Genomics Institute in Massachusetts, also found that the lobster has a robust immune system and a high fidelity of the genome since cancer-like diseases have rarely been reported in the American lobster.

More information: Jennifer M. Polinski et al, The American lobster genome reveals insights on longevity, neural, and immune adaptations, *Science Advances* (2021). DOI: 10.1126/sciadv.abe8290

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