RESEARCH RESULTS

Answers from the 2010 Baird Symposium on lobster shell disease

seagrant.gso.uri.edu/baird/2010_diseases.html

The ninth annual Ronald C. Baird Sea Grant Science Symposium, "New Approaches to Understanding Emerging Marine Diseases: From Science to Management" (August 10–11, 2010) focused on lobster shell disease. Results presented by the scientists on their collaborative research—funded by the New England Lobster Research Initiative—show that there are significant differences between lobsters with shell disease and those with no symptoms of the disease.

Experts in a variety of fields—crustacean endocrinology, genetics, veterinary medicine, behavior, microbiology, lobster biology, chemistry, environmental science, and epidemiology—worked together with fishermen and fisheries managers. They studied lobsters from every possible approach—looking at the animals and what is happening in their shells, in their internal tissues, and in their environments.

The Culprit: Bacteria

Some researchers discovered that the microbes that live on the shells of all lobsters differ somewhat between healthy and diseased shells. While the same bacteria exist on both, diseased lobsters showed more of one species—*Aquimarina homaria*—than healthy lobsters did. This species is relatively new to local waters, though it has been known to be present in the Pacific for many years. *A. homaria* is believed to be responsible for causing the first entry into the shell. Lesions are quickly invaded by the other bacteria in the environment.

The Shell

Other researchers looked at chemicals in the environment and how they affect the hardening of the shell. One researcher looked at alkylphenols, which are found in differing amounts in sediments of many sites where shell disease occurs. He discovered that alkylphenols in the lobsters' environment were taken up by the lobsters and were present in the shells. These chemicals lengthened the time it took for the shells to harden and delayed molting (shedding of the shell). Alkylphenols are also toxic to lobster larvae. Concentrations of trace metals were also higher in lobsters with shell disease—particularly chromium, copper and mercury. (Those concerned with consuming alkylphenols or metals should avoid eating the tamale, or hepatopancreas, where these were most present; the meat is safe to eat.)

One researcher discovered that a type of chitin, a compound that makes up part of the outer portion of the lobster shell, was most present in the pores of the shell, presumably offering more protection to an area that might otherwise be a weak spot in allowing bacteria to enter the lobster. The area around the pores, protected by this chitin, appeared to be the least affected in shell diseased lobsters. However, there are concerns that changes in pH of the oceans caused by acidification will weaken these shell areas. Also, shells that were breached in some way in laboratory testing—abraded by sandpaper for instance—were subject to shell disease, while shells that were not abraded were not susceptible (barring other contributing factors, such as malnutrition). Lobsters with bands around their claws showed no signs of disease underneath the bands.

Other Tissue

Researchers discovered that lobsters with shell disease had compromised immune systems and a decrease in a hormone found in muscle tissue, indicating lobsters may be energetically compromised. Shell disease also affected other hormones in lobsters disrupting their growth and reproduction.

Stress

Other researchers found that stressors—such as poor nutrition or temperatures warmer than ideal for lobsters (but below temperatures that would kill the bacteria) contributed to lobsters coming down with shell disease. Shell diseased lobsters are also subject to higher mortality rates than non-symptomatic lobsters.

New Population Structure

Genetic and morphometric information reveals a complex population structure of lobsters in Rhode Island waters. Several "tribes" of lobster exist that recognize their own kind and prefer to spend time with them. The tribe did not influence susceptibility to disease but further work is being done to explore these possibilities.

100 Lobster Project

Research continues to analyze the results of the RI 100—the approximately 100 lobsters that were each divided up among researchers. Each of these lobsters was dissected and pieces sent to researchers using a new approach to study the whole animal. This database will be available as a public resource to further understanding of the complex effects of a marine disease.

For Further Study

What the initiative was not able to determine was the issue of cause versus effect. In other words, did lobsters have all these changes as a result of shell disease? Or did they get shell disease because they were already compromised? The only way to clarify this is a longer term study where researchers induce shell disease in healthy lobsters and have before-and-after data. However, researchers pondered whether there were any lobsters that could be deemed "healthy" even if they did not show symptoms of the disease. It might not be valid to compare Maine (apparently healthy—lobsters there have a low incidence of shell disease) to Rhode Island lobsters since they are different genetically.

For more information about the results of the symposium, please see the "New Information on Shell Disease" fact sheet online at seagrant.gso.uri.edu/z_downloads/baird_2010_toolsandinfo.pdf.

ABOUT THE INITIATIVE: Congress appropriated $3 million to establish a cooperative research program—the New England Lobster Research Initiative—to study the causes and consequences of lobster shell disease. $300,000 of this was allocated for sea sampling in MA, NH and ME; $500,000 for ventless trap surveys in ME and RI. $2.1 million was used to fund research and outreach for the initiative. This funding was jointly managed by the National Oceanic and Atmospheric Administration's National Marine Fisheries Service, URI, and Rhode Island Sea Grant. The goal of this project was to describe the disease agent and how it works, and to determine the extent and severity of the disease in New England waters. The initiative tapped into expertise from two state agencies and over 35 scientists and graduate students from 16 institutions:

- Stony Brook University
- Boston University
- University of Louisiana
- Marine Biological Laboratory
- R.I. Department of Environmental Management
- George Mason University
- University of Massachusetts
- University of Connecticut
- University of Maine
- Virginia Institute of Marine Science
- New England Aquarium
- Roger Williams University
- Georgia Aquarium
- Woods Hole Oceanographic Institution
- Maine Department of Marine Resources
- New York Sea Grant
- Ludwig Maximillian University, Germany
- Carl von Ossietzky University of Oldenburg, Germany

For more information visit **seagrant.gso.uri.edu/lobster_initiative.**

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