Scientists discover way to detect low-level exposure to seafood toxin in marine animals

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(Phys.org) -- NOAA scientists and their colleagues have discovered a biological marker in the blood of laboratory zebrafish and marine mammals that shows when they have been repeatedly exposed to low levels of domoic acid, which is potentially toxic at high levels.

While little is known about how low-level exposure to domoic acid affects marine animals or humans, high-level exposure through eating contaminated seafood can be toxic, and can lead to amnesic shellfish poisoning, with symptoms such as seizures, short-term memory loss, and, in rare cases, death. Domoic acid is produced by particular species of marine algae and accumulates in marine animals such as clams and mussels.

The findings were reported in a study published in Public Library of Science journal (PLoS ONE), a peer-reviewed scientific journal. Up until now, the absence of a marker for such chronic exposure has been a barrier to accurately assessing possible effects to humans.

“This study paves the way for creating reliable blood tests for low-level domoic acid exposure, which could help scientists assess the effects of chronic exposure to both wildlife and people who eat seafood,” said Kathi Lefebvre, Ph.D., a NOAA fisheries biologist and the lead author of the study. “We don’t know yet if the same antibody response we found in the laboratory in zebrafish and naturally exposed California sea lions also occurs in humans. Our next step is to team up with human-health experts to answer that question.”

In the NOAA study, scientists injected zebrafish two to four times a month over nine months with low levels of domoic acid in the laboratory. Although the zebrafish appeared healthy after 18 weeks, scientists detected an antibody response for domoic acid in blood samples. Scientists found a similar antibody response in blood samples taken from wild sea lions from central California, confirming that natural exposure to the toxin produces a similar response in marine mammals.

The researchers also found that long-term, low-level exposure to domoic acid does not build tolerance or resistance to it, but instead makes zebrafish more sensitive to the neurotoxin.

Domoic acid was first identified as a shellfish toxin in 1987, after more than 100 people were sickened from eating contaminated mussels harvested off the Canadian province of Prince Edward Island. In 1998, more than 400 California sea lions died on the U.S. west coast after consuming anchovies containing domoic acid.

Since the early 1990s, regular monitoring of shellfish has protected people from amnesic shellfish poisoning caused by high levels of domoic acid.

Lefebvre will continue to work with co-authors, John D. Hansen, Ph.D, an immunologist with the U.S. Geological Survey-Western Fisheries Research Center, Donald R. Smith, Ph.D., a toxicologist at the University of California at Santa Cruz, and David J. Marcinek, Ph.D., a physiologist at the University of Washington, to look for health consequences of low-level exposure to domoic acid using the antibody marker.

The study, “A Novel Antibody-Based Biomarker for Chronic Algal Toxin Exposure and Sub-Acute Neurotoxicity,” was conducted by

scientists with NOAA, the Marine Mammal Center, the U.S. Geological Survey-Western Fisheries Research Center, the University of Washington and the University of California Santa Cruz.

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