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As ocean temperatures rise, so too will vibrio outbreaks

5 September 2016

By Clare Leschin-Hoar

Shellfish farmers unsurprised by study on virulent bacteria



At Norm Bloom & Son Cops Island Oysters in Connecticut, workers haul farmed oysters from cages. For New England shellfish farmers, the emergence in recent years of a highly virulent non-native strain of VP known as 04:K12 is troubling. Photos by Peter Massini.

Gloomy news for oyster growers: Scientists say they now have compelling evidence that climate change and warming sea surface temperatures are strongly associated with the presence and spread of vibrio bacteria.

Published in the current issue of the *Proceedings of the National Academy of Sciences*, **the study** (<http://www.pnas.org/content/113/34/E5062.abstract>) looked at plankton samples taken over a 53-year period and tested those samples for vibrio. Researchers found that as water temperatures warmed, vibrio abundance increased, and that those changes correlated to data showing an increase in human illness outbreaks.

Certain strains of vibrio, including *Vibrio parahaemolyticus* (VP) and *Vibrio vulnificus* can be fatal to humans who eat contaminated shellfish. Its growing presence is a concern for shellfish growers across the nation – even in northern regions like New England or Alaska where vibrio was once rarely found. But where increases in sea temperatures have been recorded, such as the Gulf of Maine, the bacteria's presence has seemingly become more common.

The new study now establishes the direct link between climate change and an increased presence of vibrio.

“We provide evidence, for the first time to our knowledge, of the important role ocean warming plays in promoting the spread of vibrio within an extensive area of the North Atlantic,” the study's authors write.

The news came as no surprise to third-generation oyster grower Jimmy Bloom of Norm Bloom & Son Cops Island Oysters, one of Connecticut's oldest shellfish companies. For New England shellfish farmers like him, the emergence in recent years of a highly virulent non-native strain of VP known as

04:K12 is especially troubling.

Indeed, Bloom says they've had to drastically change the way they harvest oysters after a **2013 vibrio outbreak** (<http://www.cdc.gov/vibrio/investigations/index.html>) of the 04:K12 strain that sickened 104 people across 13 states was linked to shellfish harvested by the company.

"That strain is much more virulent than anything we have dealt with before," said Bob Rheault, executive director of the East Coast Shellfish Growers Association.

That outbreak spurred concerns the 04:K12 strain was possibly **becoming endemic** (http://www.ct.gov/dph/lib/dph/infectious_diseases/ctepinews/vol34no4.pdf) on the Atlantic coast, and prompted new state requirements on how oysters were to be handled post-harvest.



After a vibrio outbreak in 2013, Norm Bloom & Son Copsps Island Oysters started using an icing slurry, dropping the oysters into the chilled water immediately after harvest, bringing the meat temperature below 50 degrees-F in 15 minutes.

“We used to shuttle oysters off the deck two to three times a day, but it wasn’t enough,” says Bloom. He says they’ve had to change harvest methods and have invested nearly \$500,000 on new equipment including a heavier crane, stainless steel cages, an ice machine, refrigeration and more.

“After the 2013 outbreak, we started using an icing slurry. We drop the oysters straight into the chilled water, which brings the meat temperature down below 50 degrees in 15 minutes,” he says.

Fifty degrees Fahrenheit is the threshold at which the bacteria stop multiplying. The oysters are then placed inside foam coolers, and quickly moved to a climate-controlled processing facility. But Bloom’s job no longer ends there. To ensure his oysters remain safe until slurping, they’ve had to spend a lot of time educating the wholesalers and distributors that purchase from them.

“We don’t want to do this work for nothing if it’s not taken care of when it leaves our doors,” he said.

They’re not the only shellfish growers altering harvesting methods in an effort to stem any future vibrio outbreaks. During warm summer months, growers on Martha’s Vineyard, off the coast of Massachusetts, **are moving cages** (<https://vineyardgazette.com/news/2016/08/25/vineyard-oyster-farmers-get-creative-keep-vibrio-bay>) to the island’s outer harbor where water temperatures remain cool, hoping to inhibit vibrio growth. Growers now call it “summer pasturing.”

Gone are the days of 10-hour windows from harvest to refrigeration. Like Connecticut, Massachusetts developed a robust **Vibrio Control Plan** (<http://www.mass.gov/eea/docs/dfg/dmf/programsandprojects/2016-ma-vibrio-control-plan.pdf>), that now mandates growers ice shellfish within one hour of harvest.

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According to the Centers for Disease Control and Prevention (CDC), vibrio causes an estimated 80,000 illnesses and 100 deaths in the United States every year. Most cases of *Vibrio parahaemolyticus* (VP) and *Vibrio vulnificus* are caused by consumption of raw oysters. But *Vibrio vulnificus* can also **cause illness in swimmers** (<http://gcri.usm.edu/microbiology/vibrio.vulnificus.threat.via.wounds.php>) who enter the water with an opened wound – especially in coastal waters between Florida and Texas. And health officials believe the numbers could be even higher, as many cases of vibrio infections go unreported.

All public health laboratories are now asked to forward every isolate of vibrio species they receive to the **CDC** (<https://www.cdc.gov/vibrio/>), **where they're tested** (<https://www.cdc.gov/narms/pdf/2014-annual-report-narms-508c.pdf>) to for antimicrobial resistance.



New harvesting protocols for many oyster harvesters include immediately reducing the shellfish body temperature to below 50 degrees-F.

But outbreaks still happen. In Florida, there have been five confirmed deaths, and 24 reported infections so far this year. Health officials there keep track of the data (<http://www.floridahealth.gov/%5C/diseases-and-conditions/vibrio-infections/vibrio-vulnificus/index.html>), on their website, and have created a public service announcement in an effort to educate residents and visitors, according to Brad Dalton, spokesperson for the Florida Department of Health.

“There are many factors that could be contributing to more cases in any given year – more people in the water, more people with chronic disease, etc. As awareness of the disease increases, we see more diagnosis as well,” said Dalton.

Rheault added that while the new study proves there's a direct link between warming ocean temperatures and an increase in vibrio, it's not the only driver impacting infections.

"There are many plausible factors influencing illness rates: temperature rise, consumption trends and a more virulent strain," he said. "We've seen a dramatic increase in oyster consumption during the summer months. Oyster sales have doubled on the East Coast in the past five years."

Indeed, in an effort to meet growing consumer demand for year-round local oysters, lawmakers in South Carolina are now trying to pass legislation that would allow for summer harvesting (<http://www.postandcourier.com/20160726/160729544/local-oysters-might-be-served-in-summer>) – a practice that is currently banned.

"At the same time, there has been a shocking lack of research dollars spent to address the threat," said Rheault. "We don't have good or affordable measurement tools, and the FDA spent a paltry \$75,000 on vibrio research for shellfish last year."

Better funding would make researchers like Steve Jones, research professor at the Northeast Center for Vibrio Disease and Ecology at University of New Hampshire happier.

"You can do the studies, but you have to really scarp for funding," said Jones.

Jones and other colleagues, including molecular biologist Cheryl Whistler, have been working on **whole genome comparisons** (<http://www.ncbi.nlm.nih.gov/pubmed/25832299>) of *Vibrio parahaemolyticus*, and in 2015 **announced a breakthrough** (<https://colsa.unh.edu/nhaes/article/vibriopatent>), in the ability to provide a rapid test for specific strains of vibrio, including O4:K12.

"We're using it intensively in Massachusetts this summer," said Jones.

The industry may have a promising new tool in being able to test and identify vibrio in shellfish, but there's still plenty about the bacteria that they don't understand.

"What we're really interested in is the ecology," said Jones. "In what conditions do these pathogenic strains emerge? They're not there to infect humans, they're in the ecosystem because there's an advantage to them, and we're interested in finding out what that is."

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Author



CLARE LESCHIN-HOAR

California-based journalist Clare Leschin-Hoar covers food policy and seafood. Her work has appeared in The Guardian, NPR, Scientific American, EatingWell and many more. Follow her on Twitter @c_leshin

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