Ancient clams preserve evidence of parasite increase in higher seas

March 12 2018, by Cheryl Dybas

Lesina Lagoon, Italy, where scientists are studying living, dead and fossil clams and parasites. Credit: John Huntley

How will sea-level rise influence the prevalence of infectious diseases? The best way to answer that question, says paleoecologist John Huntley of the University of Missouri, may be to look to the distant past.

Huntley and colleagues found that as sea level rose during the Holocene

(the geologic epoch from 11,700 years ago to the present), disease-causing parasites in clams increased dramatically. Higher and warmer waters, the researchers discovered, are the likely culprits.

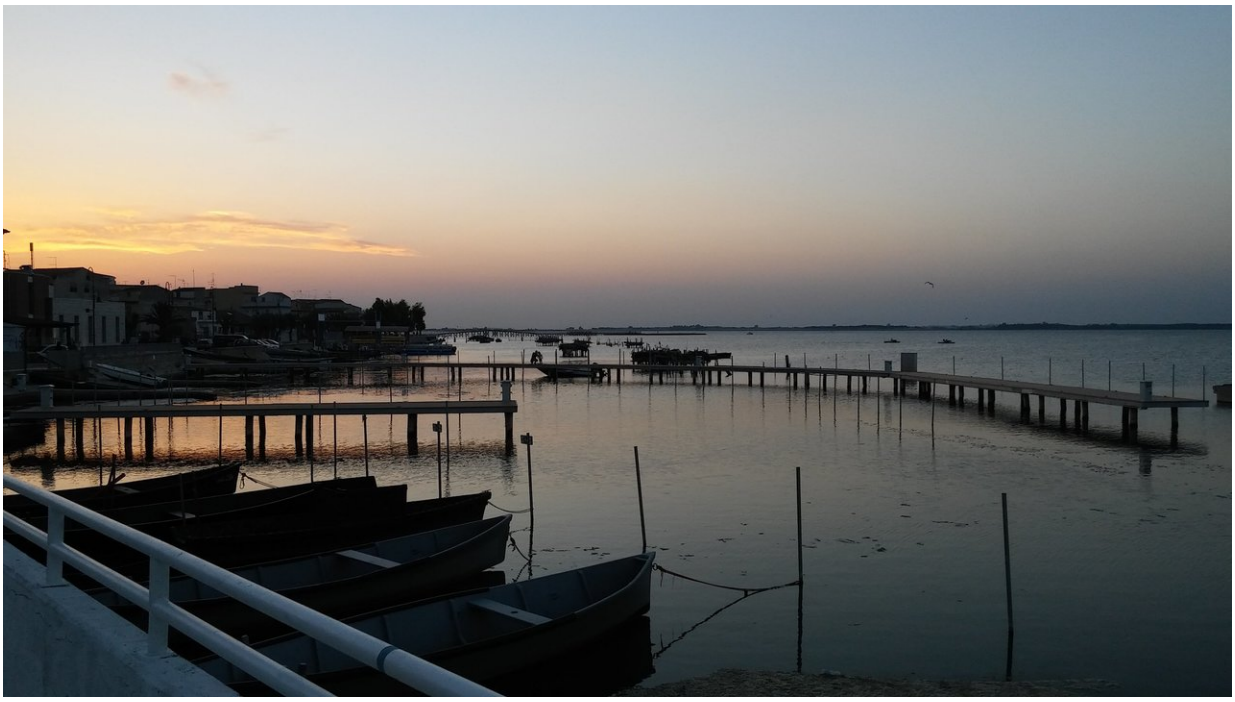
Sea level is expected to rise significantly by the end of the 21st century, Huntley says, "and many studies have suggested that parasites will expand their range and become more severe as a result. However, such studies often lack a perspective from geologic time."

Questions in Italian muck

The knowledge is hard-won: Huntley recently traversed a muddy lagoon in Italy "on all fours," as he explains, looking for clues.

The scientist conducted research in Italy's shallow Lesina Lagoon with colleague Daniele Scarponi of the University of Bologna. "The lagoon has a mucky bottom," says Huntley, "so even though the water is shallow, wading is out of the question because you'd sink past your knees in mud."

To obtain samples of modern parasite-infected clams to compare with fossil clams containing traces of unidentified parasites, the scientists made their way across the lagoon on hands and knees. Along the way, they encountered some unexpected lagoon residents.



Lesina Lagoon at sunset, its muck-covered bottom obscured in the dusk. Credit: John Huntley

"We were sorting through the mud for samples when I felt something brush across my leg," Huntley remembers. "The lagoon is known for its eel fishery and sure enough, it was an eel that had run into me—or the other way around—and was slithering through my clothes. I was yelling, swatting and trying to run through mud. I had eaten anguille carpaccio for dinner the night before, so maybe the eel was exacting a toll for dining on one of its relatives."

He survived what might be called the revenge of Lesina Lagoon, but didn't come up with an answer to the mystery fossil parasite. "As it stands, we don't know which parasites are producing the traces we're seeing in fossil clams in northern Italy." The same clam species is still alive today and is thriving in Italian coastal lagoons, Lesina included,

giving the scientists a leg up in their research.

"Parasites can be detrimental to mollusks like these clams," says Judy Skog, a program director in the National Science Foundation's Division of Earth Sciences, which supports Huntley's research. "Since mollusks are a food source for people, the factors that influence their parasites are of economic and human health importance."

Huntley's study, she says, "is looking across time to determine the effects of environmental change on parasites to find out how they, their hosts and their ecosystems are responding. Knowing more about these long-term processes will help predictions of future such changes."

A lagoon near Cervia, Italy, a field work site for the scientists' parasite research. Credit: Daniele Scarponi

Answers in Chinese sediments

In 2011, Huntley was working in China's Pearl River Delta. He noticed that fossil clams preserved in sediments deposited when sea level had risen had more traces of parasites than when sea level had fallen.

The fossil traces aren't the parasites themselves. They're markings the worms left behind: oval-shaped pits on the insides of the clam shells. "These traces are the clams' response to the flatworms that infected them," says Huntley. "Each trace is less than an inch across."

The scientists set out to identify modern environments that mimicked those of ancient sea-level rise and sea-level fall—barrier islands, for the former, and river deltas, for the latter. They collected samples of dead shells from beaches in these locales.

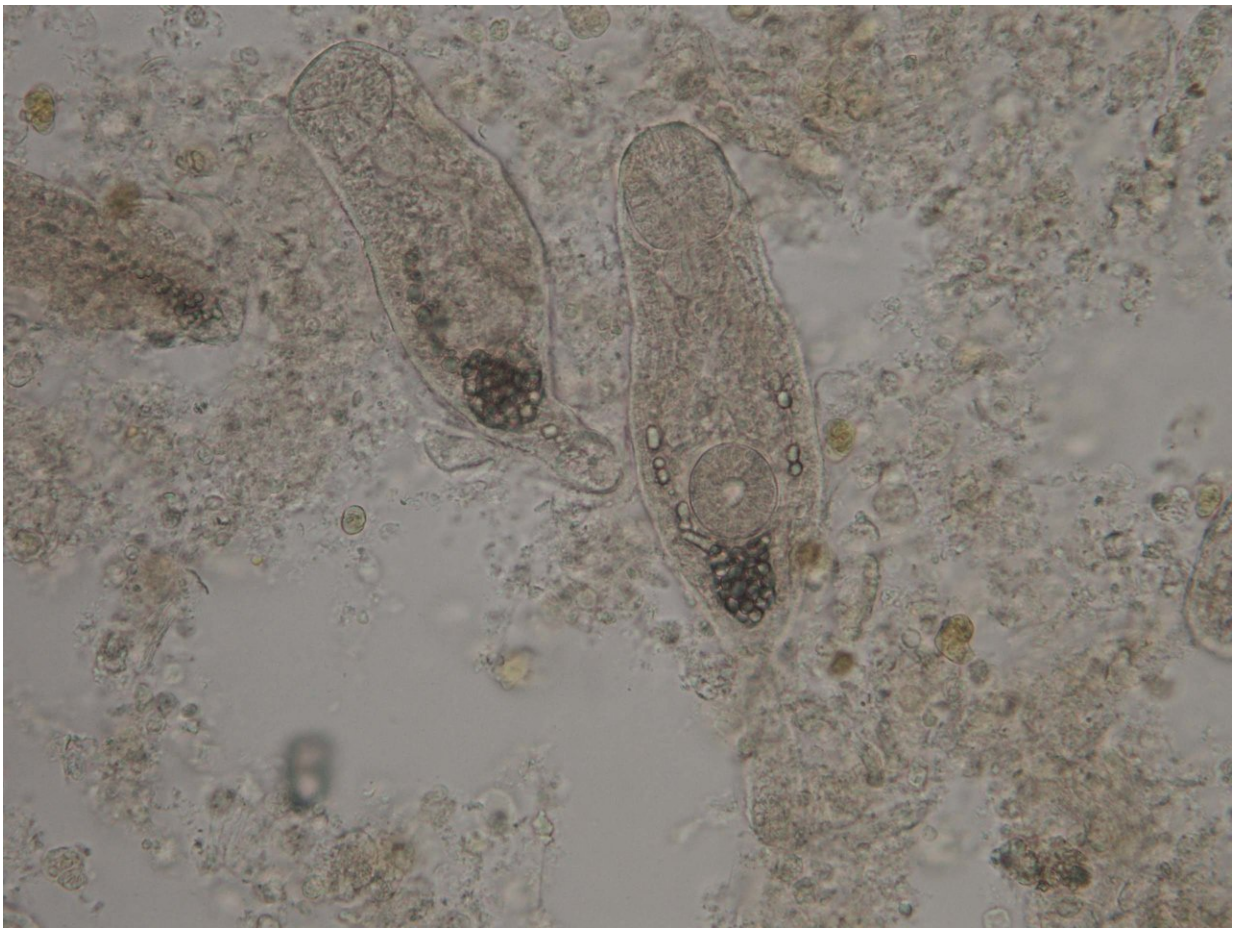
"As we suspected," says Huntley, "the prevalence of parasites was significantly higher in the sea-level-rise settings than in the sea-level-fall settings." Finding the reason for this pattern, he says, "necessitates unraveling several clues."

Paleoecologists collect live clams in a lagoon near Cervia, Italy. Credit: Michele Azzarone

He's now conducting analyses that will help reconstruct how temperature and nutrient availability changed over time in the Pearl River Delta, and may have contributed to an increase in parasites. "It's likely related to warming waters," says Huntley, "and possibly to increased nutrient availability."

Evidence from the past, concern for the future

Concern about how parasites will respond to climate change is growing. Results from subsequent work by Huntley and colleagues in Italy's Po River, published in the journal *Scientific Reports*, present the first analyses of parasite responses to climate change on both long and short time scales. A nearly 10,000-year-long record of clams and parasites from the Po River Delta shows significant spikes in parasites during times of sea-level rise.

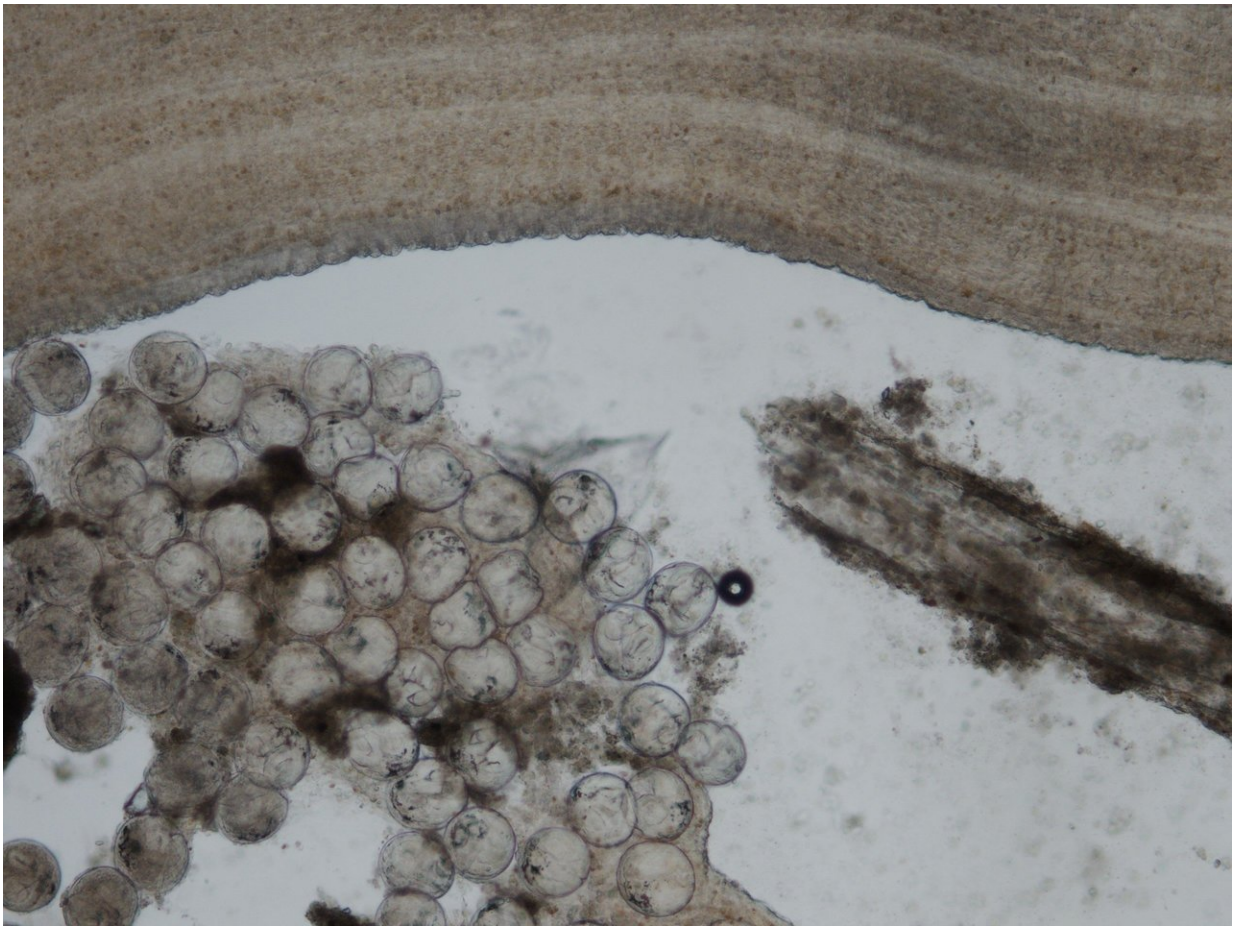


The larval stage of a parasite in its host clam, Abra segmentum. Credit: John Huntley

Next up: Huntley and Scarponi are studying sediments from river-bottom cores taken in Italy. "Warming waters may explain the parasite prevalence in marine and estuarine settings," says Huntley, "and could suggest a similar result for the freshwater parasites that infect humans and cause diseases like schistosomiasis."

In general, he says, "the results have stark implications for fisheries and human health in times of climate change."

Adds Skog, "Parasites and their hosts have responded to environmental change in the past. Now they're serving as signposts for what's likely to happen in the future—to them, and to us."



Encysted parasite larvae in their host clam, Abra segmentum. Credit: John Huntley

Provided by National Science Foundation

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