

Climate change a threat to even the most tolerant oysters

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Climate change-associated severe weather events may cause flooding that threatens the survival of the Olympia oyster, new research suggests. The findings will be presented today at the American Physiological Society's (APS) Comparative Physiology: Complexity and Integration conference in New Orleans.

Oceans around the world typically have a salt content ([salinity](#)) of around 3.5 percent, but the percentage varies more in shallow coastal waters affected by rainfall. Researchers studied three groups of Olympia oyster from different areas of the California coast where the influence of rainfall on [seawater salinity](#) varies. One group was native to a large estuary—a body of seawater near the mouth of a river—that was routinely exposed to freshwater flooding from extreme precipitation, which decreased the salinity of the oysters' surroundings. A second group lived in a small estuary that received much less freshwater exposure, and a third group lived far away from the large estuary where salinity was also higher and more stable.

All organisms, including oysters, show higher expressions of genes that are involved with DNA damage and protein unfolding in response to extreme stress. Protein unfolding is a process in which proteins lose their structure and become unstable, which, if not repaired, will eventually lead to the animal's death. Researchers study the Olympia oyster because they are a "foundation species," meaning the presence of oysters provides habitat for a large number of other smaller species and creates a much healthier ecosystem. If the oysters die out, all of the associated

species will too. Because of the vital role oysters play in coastal ecosystems, researchers want to know if oysters living in certain areas are more tolerant of low salinity and therefore better equipped to survive climate change.

The research team exposed all three groups of oysters and their offspring to low-salinity seawater (around 0.5 percent salt) and measured their gene expression patterns. They found that the oysters living closest to the large estuary were more tolerant of a five-day exposure to low-salinity seawater. "More frequent exposure to freshwater in this region likely forced oysters to evolve new ways of surviving in low salinity," explained Tyler Evans, Ph.D., from California State University East Bay, and first author of the study.

This group expressed considerably higher levels of mRNA—genetic material that tells cells what new proteins to make—than the less-tolerant oysters that were accustomed to higher salinities. Proteins encoded by the mRNA control the activity of the oyster's cilia (hair-like structures on the gills that move back and forth to circulate fluid inside the [oyster](#) shell). The researchers predict this added cilia movement increases survival by allowing oysters to keep their shells closed (and the low-salinity seawater out) for longer amounts of time. However, climate change is a concern for the survival of even the most tolerant group of Olympia oysters due to the expected increase in the severity of extreme-precipitation events that would expose the oysters to even longer periods of low salinity. "Even oysters having garnered greater low-salinity tolerance via natural selection will be vulnerable to future freshwater flooding events," the research team wrote.

More information: Tyler Evans, PhD, of California State University East Bay, will present "Transcriptomic responses to low salinity among locally adapted populations of Olympia oysters, an estuarine foundation species" as part of the session "Omic responses to stress" on Saturday,

October 27, at the Astor Crowne Plaza-New Orleans French Quarter.

Provided by American Physiological Society

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