High levels of carbon dioxide threaten oyster survival

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It has been widely reported that the build up of carbon dioxide (CO_2) in the air, which is caused by human behavior, will likely lead to climate change and have major implications for life on earth. But less focus has been given to global warming's evil twin, ocean acidification, which occurs when CO_2 lowers the pH of water bodies, thus making them more acidic. This lesser known phenomenon may have catastrophic effects on all sea life.

Oysters in Peril

Inna Sokolova, associate professor of biology at the University of North Carolina at Charlotte, studies the affect of high carbon dioxide on oyster survival, growth and shell hardness. The results of her research suggest that creatures once thought to be fairly adaptable to changes in the environment, may be in serious trouble.

Sokolova's research team includes Anna Ivanina and Ilya Kurochkin also from the University of North Carolina at Charlotte and Nicholas Lieb and Elia Beniash from the Department of Oral Biology at the University of Pittsburg. Their research findings will be reported by Sokolova at the Global Change and Global Science: Comparative Physiology in a Changing World conference from August 4-7, 2010 in Westminster, Colorado.

The research group monitored oysters that were kept in high CO_2

conditions. Juvenile oysters were affected the most by high CO_2 conditions. These young oysters grow at a faster rate than the adults and need to use more energy for survival. There was a higher chance that juvenile oysters would die if kept in high CO_2. They also had reduced growth of their shells and their soft bodies. The young oysters' shells were also more fragile and prone to breaking, potentially making them more susceptible to predators.

"Living in the high CO_2 world may increase the cost of living which cuts into other energy expending pathways," says Sokolova. "Everyday maintenance becomes harder making it harder to live."

The effects on growth were less pronounced in the adult oysters since they don't grow as fast and have slower metabolisms than the juveniles.

The fact that the early life stages are more affected by high CO_2, suggests that this may serve as a bottleneck for oyster decline. Sokolova says, "Expect to see huge effects on populations in the future."

The researchers found evidence that the oysters are sensing and trying to offset the affects of a high CO_2 environment. The oyster's soft body covering called the mantle had increased expression of carbonic anhydrase, an enzyme that regulates pH and helps make bicarbonate, which is used to make the shell. Sokolova believes that the increased levels of this enzyme show that the oysters are at least trying to compensate for the acidic conditions in response to CO_2, but it doesn't seem to be enough.

Oysters - Ecosystem Engineers of the Sea

Oysters live in estuaries - coastal water bodies that have fresh water rivers flowing into salt water - which are highly variable environments because of tides, waves and changes in salt concentration. The focus for

those scientists interested in ocean acidification/climate change research generally has been on organisms in stable situations that are thought to be more affected by small changes in the environment. "People feel that oysters are tough and will tough out the changing conditions so they haven't been a primary research focus, but oysters are vulnerable too," says Sokolova.

Sokolova describes oysters as "ecosystem engineers," that are responsible for preventing erosion, filtering the water, ridding the water of harmful algae, providing a habitats and nurseries for other species like crabs. In addition, they are the number one harvested mollusk, meaning their presence is important economically for the seafood industry.

"We are looking at the effects of a very real environmental stressor that oysters see even nowadays. Our research shows that even under the present conditions they may be stressed," says Sokolova. "Monitoring these guys will help us monitor the effects on the entire ecosystem as levels of CO_2 increase."

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