Ocean acidification may directly harm fish: study

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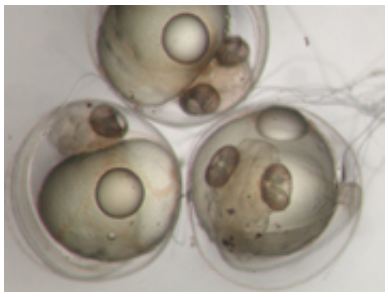

Silverside embryos shortly before hatch. Credit: Hannes Baumann

(PhysOrg.com) -- Fossil fuel combustion, and with it the release of heat-trapping carbon dioxide (CO_2), is still growing globally. Beyond climate change, this is also causing the world's "other CO_2 problem," ocean acidification, i.e., the formation of carbonic acid when CO_2 from the atmosphere enters seawater. Studies have already demonstrated a multitude of negative effects of elevated CO_2 conditions for many groups of marine organisms such as corals, plankton, shellfish and sea urchins. To date, scientists have assumed marine fish were immune to ocean acidification.

However, in a new article published in the December 11, 2011, online edition of the journal Nature Climate Change, researchers from Stony Brook University demonstrate that "the fish are okay" belief ignores an important knowledge gap – the possible effects of CO_2 during the early development of fish eggs and larvae. Co-authors of the study, Christopher Gobler and Hannes Baumann, are professors at the Stony Brook University School of Marine and Atmospheric Science (SoMAS) and represent one of several international teams working on closing this gap.

Their present study is the first to show that elevated CO_2 levels significantly decreased survival and growth rates in eggs and larvae of a fish. The researchers reared newly fertilized eggs of a common estuarine fish, the inland silverside (Menidia beryllina), under different CO_2 levels predicted for future oceans (current: ~400 ppm, mid-century: ~600 ppm, end-of-century: ~1,000 ppm) and found that egg and larval stages of these fish were highly sensitive to CO_2. On average, survival rates until one week post-hatch declined by over 70% under elevated (1,000 ppm) compared to current day CO_2 conditions. In addition, surviving larvae were 18% smaller in the high than in the low CO_2 group. The experiment was fully replicated and repeated five separate times, each revealing the same pattern.

"We knew from the study of other ocean animals, such as scallops and clams, that earliest life stages such as larvae are most sensitive to CO_2 and thus targeted the same life stage during our investigation of fish," said Professor Gobler. The study thus joins a growing body of evidence, suggesting that fish will both directly and indirectly be affected by ocean acidification, which also includes the potential for decreasingly productive commercial fish stocks. Brad Warren, Science Director of Sustainable Fisheries Partnerships stated: "This study is a shot across the bow and shows that some important fish stocks may be eroded by high CO_2 levels. And keep in mind, as estuarine fish, inland silversides are likely to be adapted to higher levels of CO_2 than many fish found in the open ocean, where chemistry is much more stable. This suggests that many commercially harvested marine fish stocks may be vulnerable too. Pelagic spawners, such as albacore, bigeye, yellowfin, and bluefin tuna, whose larvae are not adapted to acidified waters, could be particularly vulnerable."

However, the authors also caution that our understanding is still too limited for generalizations, since fish are a highly diverse group of animals, and species will likely react differently to increasing

CO2 levels.

Dr. Baumann stated, “In light of the broad implications of our findings, we believe that now is the time to comprehensively investigate fish early-life CO2 sensitivity, not just in one but in a wide range of species. We also have to address the general potential of marine organisms to adapt to the CO2 levels projected for future oceans.”

More information: Baumann, H., et al. Reduced early-life growth and survival in a fish in direct response to increased carbon dioxide. *Nature Climate Change*. DOI: 10.1038/CLIMATE 1291

Provided by Stony Brook University