ICYESS2013-79-1
Interdisciplinary Conference of Young Earth System Scientists
Hamburg, Germany, 22 – 25 September 2013

Uncertainty in Marine Ecology – Understanding Ocean Acidification

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Ocean acidification is a global phenomenon created by the increase in anthropogenic carbon dioxide (CO_2) emissions that is threatening the health of our world's oceans. This process alters the water chemistry by lowering the pH, which lessens the organisms' ability to develop and grow, thus changing their capability to cope with outside stressors. An example of a stressor is the heavy metal copper (Cu). Copper is ubiquitous; it is found in copper pipes, on rooftops, and on boats. It is naturally occurring in sediment, yet in higher concentrations it is very toxic and potentially fatal. When copper is combined with acidic water (lower pH), the water chemistry changes, making the copper more toxic. These conditions vary based on human activity. As we anticipate more CO_2 to be absorbed by the oceans, it will become more acidic, and with more copper released into the ocean, the water becomes more toxic. When the oceans are in poor health, it affects the whole ecosystem, including fisheries and aquaculture. Without healthy oceans, we will have little fish and seafood to feed ourselves or the next generation.

Animals of major concern for acidity and toxic copper are calcifying organisms, i.e. corals, shrimp, lobsters, mussels, oysters, sea urchins and sea stars. In this study, the brittle star Amphiura filiformis (Echinodermata) was used as it regenerates quickly. A. filiformis was used to investigate if there is a multiplied or an added effect when acidic water (low pH) reacts to coppered water, thus affecting the water chemistry and perhaps altering the animals' ability to cope and grow. To investigate growth, two out of the five stars' arms were amputated creating new regenerating arms. Regeneration and differentiation growth rates, along with survival and self-amputation (a stress indicator) were analyzed to determine the effects of pH and copper. This research, as a part of a larger EU project, was conducted to understand how A. filiformis behaves in these conditions and predict how other calcifying organisms may as well. As we can only hypothesize how animals will react, it is essential for us to decrease the uncertainty of how copper may affect our acidic oceans in the future, by continuing to conduct relevant research.

With all scientific research there is a level of uncertainty. One is uncertain if the experiment will work, if the animals will fair well in the environment provided and if the experimental plan will provide significant results. With all of these uncertainties, it is crucial to modify ones ideas to the circumstances that arise. Therefore, one must continue to test out different scenarios, using the best tools available to correctly analyze the scientific data. Thereby, we can make more accurate predictions to affect policy makers and politicians to make the best decisions to regulate pollutants, creating a better environment for us all.

Although uncertainty will always be present, it fuels creativity, strength and tenacity.