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Will Shark Skin Dissolve Under High CO₂?

Sharks are not able to survive chronic exposure to excess CO₂ and acidic environments; their scales may disintegrate by 2300 if decreases in oceanic pH are not abated.

SOURCE: Scientific Reports

By *Emily Witt* 1 April 2020

Climate change alters the natural environment. One of these changes, ocean acidification, is caused by anthropogenic CO₂ emissions. Marine organisms are often forced to change their biology, distribution, morphology, behavior, and physiology to survive in more acidic pH levels than they are accustomed to. Unlike some marine organisms, sharks evolve slowly and may not be able to adapt at a fast-enough rate to survive rapid pH changes.

Some of the largest impacts of ocean acidification include a reduction in the ability of calcifying reef invertebrates like clams, lobsters, corals, and plankton to build new calcium carbonate shells. Similarly, a lower ocean pH due to high CO₂ may have a detrimental effect on shark skin. Shark skin is covered by small structures called denticles, which are similar to fish scales. Denticles maintain skin protection and inhibit parasite attachment. Denticles also facilitate sharks in swimming by decreasing drag and turbulence, helping in their hunting ability by allowing them to swim more quietly. Without denticles, the way sharks hunt and their ability to survive may be compromised.

An increase in oceanic pH can cause also excess CO₂ in the shark's blood stream due to improper respiration. This can lead to suffocation and mortality. Sharks are vital to ecosystems as apex predators, but without their denticles, and if they are unable to breathe, they might not be able to survive as the oceanic pH changes.

To test if sharks can survive chronic exposure to increased levels of CO₂, and if their denticles will dissolve in a more acidic pH, puffadder shy sharks (*H. edawrsii*) were placed in environments with varying pH. *H. edawrsii* inhabit shallow water kelp beds and sand-inundated reefs, and were used as the test species because they are exposed to regular pH fluctuations in these environments. Throughout the shark's exposure to high CO₂, blood samples were taken from the caudal vein to measure internal CO₂ levels. Changes in denticle structures were observed throughout the study using scanning electron microscopy.

Dziergwa and coauthors found that continual exposure to elevated CO₂ leads to denticle erosion in *H. edawrsii*. Denticle surfaces appeared to be corroded, less sharp, and damaged, similar to how soda erodes teeth in humans. Elevated levels of CO₂ were found in the blood samples, as well. Even though this shark species is accustomed to exposure to fluctuating pH, it is likely not successful in maintaining its normal body functions during times of chronic exposure. Presumably, sharks that do not inhabit an environment with regular pH fluctuations will not be able to survive any change in their environmental pH.

Sharks are facing increasing threats from humans and climate change. They are subject to overfishing, the barbaric practice of finning, a lack of food availability, and are now at risk physiologically due to changes in seawater chemistry. This study highlights that sharks may be unable to adapt to climate change, impacting their future fitness and survival. Likely, sharks will not be able to adapt to ocean acidification at a fast-enough rate, which will compromise their denticle structure and their ability to breathe. Any further loss of sharks will be felt throughout marine ecosystems, leading to changes in food webs and potential widespread ecosystem collapse.

Citation: Dziergwa, J., Singh, S., Bridges, C., Kerwath, S., Enax, J. and Auerswald, L., 2019. Acid-base adjustments and first evidence of denticle corrosion caused by ocean acidification conditions in a demersal shark species. *Scientific Reports*, 9(1), doi: 10.1038/s41598-019-54795-7. Published on 18 December 2019.