

Cultural Resources and Ocean Acidification

Preserving History along the Mid-Atlantic Coast

By McKenna Litynski and the Maryland Historical Trust



Shipwreck in Dry Tortugas National Park near the Florida Keys. Photo Credit: National Park Service.

Shipwrecks and other underwater archaeological sites are a part of our history and culture and contribute to healthy underwater ecosystems by acting as artificial reefs, providing nurseries for recreational and commercial fish stocks, and providing recreational opportunities for scuba divers. Approximately 5,000 shipwrecks are found within the Maryland region, 4,000 shipwrecks within Virginia waters, 4,800 shipwrecks off New Jersey's shores, and approximately 200 wrecks are known in Delaware. These estimates are based on newspaper accounts, insurance records, and the U.S. Life Saving Service/U.S. Coast Guard prior to 1960.

Unfortunately, these important elements of our past are at risk of vanishing at the hands of climate change, or the long-term change in



Shipworm, *Teredo navalis* L.
Photo Credit: Alchetron

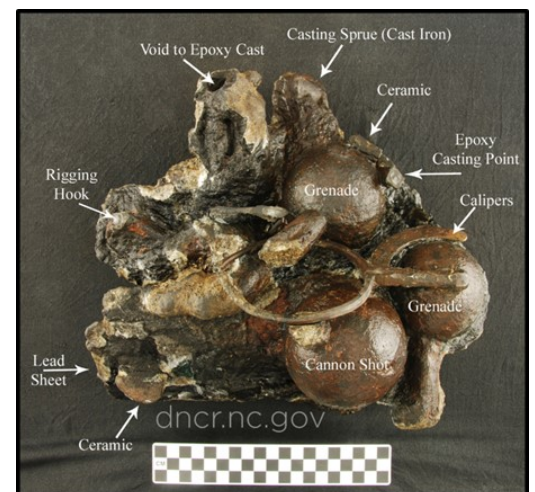
global or regional climate patterns. Warmer ocean temperatures are encouraging the survival and reproduction of species of shellfish called shipworms, which devour wooden shipwrecks and artifacts. The wind and currents associated with stronger and more frequent storms can result in the movement, breakage, and exposure of shipwrecks and their related artifacts and ecofacts. Sea level rise and increased erosion will submerge and damage both prehistoric and historical terrestrial sites in the near future. Increased acidification of ocean and fresh water is also a great concern to underwater cultural resources.

Ocean acidification (OA) is an aspect of climate change that can be defined as a long-term increase in acidity of the ocean. Carbon dioxide plays an important role in this shift. As fossil fuels are burned, carbon dioxide is released into the air and absorbed by the ocean waters. When it mixes with seawater, carbon dioxide undergoes a chemical reaction and forms a weak acid, called carbonic acid. As a result, seawater becomes more acidic.

Globally, our oceans have become 30% more acidic and have absorbed about 90% of the heat resulting from anthropogenic (human-caused) global change in the last 150 years. It is important to consider the impacts ocean acidification and the other effects of climate change have not only on the world's ocean ecosystems and wildlife, but also on the Mid-Atlantic's cultural resources and archaeological sites.

Impacts of Ocean Acidification

Ocean acidification affects underwater cultural resources in several ways. On shipwrecks, a protective layer, which archaeologists call "**concretion**", forms when rust interacts with saltwater, organic material, and/or microscopic organisms. More acidic waters strip away the protective layer surrounding historical shipwrecks and their hulls, as well as the artifacts on and surrounding these wrecks. If enough concretion erodes away, metal fasteners will disintegrate, causing a loss of integrity in wooden shipwrecks. Additionally, those shipwrecks with metal hulls will crumble and lose their ecological value as artificial reef habitat.

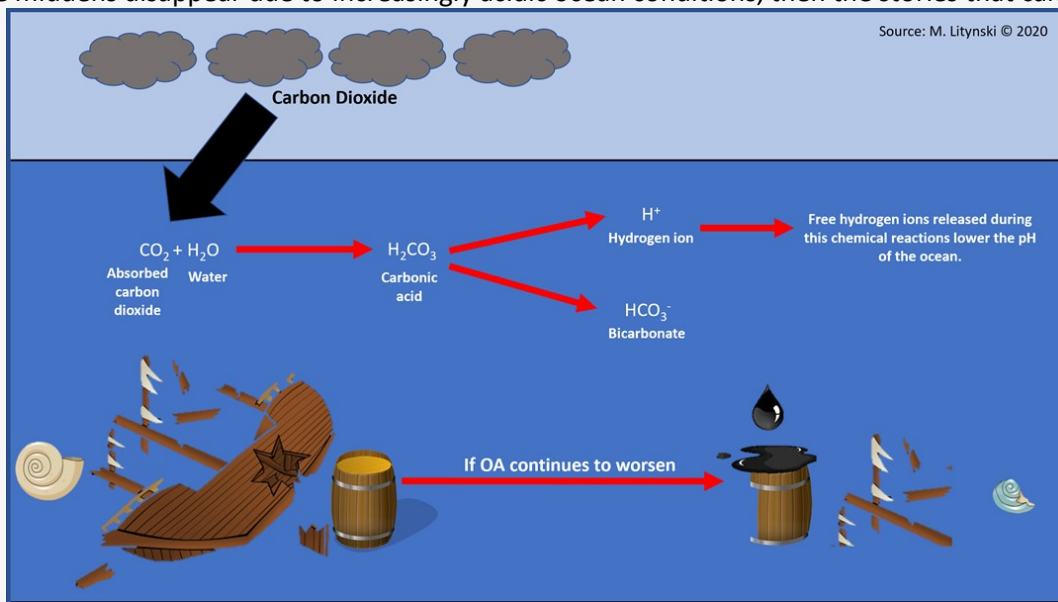


Archaeological objects recovered in a concreted state from the Queen Anne's Revenge Project.
Photo Credit: Natural and Cultural Resources

It is also important to consider artifacts that may be hazardous to the environment if they deteriorate due to ocean acidification. For example, some modern wrecks may still contain fuel, or metal containers full of oil or toxic chemicals. If OA accelerates the deterioration of these metal containers, the oil and toxic chemicals inside could leach out, causing an environmental disaster. In addition, sunken military vessels may contain ordnance that can become unstable under these conditions.

OA has the potential to destroy artifacts found at underwater archaeology sites, especially those composed of organic materials. For instance, carbonic acid can disintegrate archaeologically important oyster shell middens. These middens were formed over time as Native American tribes consumed clams and oysters as part of their healthy diet and left piles of shell behind. If these middens disappear due to increasingly acidic ocean conditions, then the stories that can be uncovered by studying them will never be learned.

Ceramics, another cultural artifact can also be affected by OA. The glazes, including lead and tin glazes, on the ceramics can deteriorate faster in more acidic waters. Finally, the faunal and human remains important to our understanding of the past and our culture will dissolve if left exposed in a more acidic environment.



What Can You Do to Help?

Shell middens, shipwrecks, and the artifacts associated with them are incredibly important to understanding the histories, cultures, and ways of life of people who lived in the past. The impacts of OA on cultural resources are already visible at shipwrecks in the Mid-Atlantic region. Unfortunately, there are no international laws relating to the effects of OA on underwater cultural resources. OA's impact on cultural resources often slips the mind of people due to limited site monitoring and a lack of international strategies for protection. Fortunately, there are many ways you can help to slow the pace of OA and save our important historical and cultural resources:



Reduce nutrient runoff (nitrogen and organic carbon). Use less fertilizer on your lawn or garden.



Reduce your use of energy and fossil fuels. Recycle waste and ride your bike, carpool, or use public transportation.



Volunteer to help with a community tree planting or seagrass restoration project. (Visit this website from Virginia Institute of Marine Science to learn more: <https://www.vims.edu/research/units/programs/sav1/restoration/index.php>).



Talk! The more we can educate each other about OA and its impact on cultural resources, the greater chance we have at combating this environmental, historical, and cultural issue.