deionized water, then perhaps these chemicals would be a significant contributor to long-term corrosive action, but in lakes as they exist now, their contribution to enhanced corrosion is insignificant.

Many people believe that herbicides and algaecides have negative effects on their boat surfaces after they observe a chemical treatment taking place, become concerned about their boat, check the hull and find corrosion. It is likely that the corrosion was already there but went unnoticed until the boat owner checked the hull in response to seeing the weed management operation. If corrosion from herbicide and algaecide treatments were common, the boats used to apply the treatments would quickly corrode during the treatments, which is not what happens.

Examining Hydrilla verticillata, one of the world's worst weeds. Photo by Stephen Ausmus, USDA (public domain)

Galvanic corrosion is a common problem for modern boats, even in freshwater systems, and requires constant diligence and maintenance. The use of sacrificial anodes is critical to help protect the valuable metal parts of a boat such as the hull and propeller. Therefore, these anodes must be kept in the water, checked routinely, and constantly energized (if relevant), in order to be effective. Storing the boat slightly out of water such that the anode is not submersed is a common error that can lead to lack of corrosion protection.

Chemical control of aquatic plants and algae is a common and necessary activity, but is highly unlikely to contribute to corrosion of boats due to the rapid dilution and short-lived nature of these treatments. Diligent maintenance and routine inspections of the boat and the protective processes (i.e., sacrificial anodes) are the best tools to fight corrosion of boats.

For more in-depth reading on this topic see the following websites:

http://www.boatus.com/boattech/articles/marine-corrosion.asp

http://www.boatus.com/boattech/casey/sacrificial-zincs.asp

AERF
Aquatic Ecosystem Restoration Foundation
Restoration Regulatory Research
3272 Sherman Ridge Drive • Marietta GA 30064
www.aquatics.org

RUST WARS

The Galvanic Force Awakens

Rise of the Anodes

Corrosion or fouling of boat surfaces has been a problem for as long as boats have been used for travel or leisure. From wood decay and barnacle growth on ancient vessels to corrosion of metal on modern boats, there are a host of issues that can damage the integrity of a boat hull. It is not just seafaring vessels that have to contend with corrosion and fouling; many freshwater boats are also subjected to these forces. Particularly with the advent of newer materials and disparate metals used in modern boat manufacturing, the process of corrosion continues to be a major problem. Some have questioned whether the use of aquatic herbicides for invasive weed control contributes to accelerated corrosion.

Rusty anchor hull. Photograph by Gillfoto, distributed under a CC BY-SA 4.0 license.

Management of invasive aquatic species (particularly plants and algae) is both necessary and common for many waterbodies throughout the United States. This is often accomplished with the intervention of chemical control (herbicides and algaecides) to remediate these problematic invaders. However, this has led to the common misconception that these chemicals directly cause corrosion or pitting. Though it is possible for these chemicals to be involved in that process, this article will discuss why that is unlikely in most circumstances.

Modern boat hull and propeller construction involves the use of different types of metals that can act as either anodes or cathodes, with negative and positive charges, respectively. The basic formula for a working battery that electrons from an electrolyte solution (acid for batteries) flow from the anode to the cathode. For those who have seen the corrosion old batteries can cause, this is similar to the galvanization that can occur in boats. The hull of a boat is commonly aluminum, which carries a negative charge, whereas propellers and other boat parts are made of materials that carry positive charges. Water carries enough electrolytes (even freshwater) to create conditions for galvanic corrosion. Though saltwater is more commonly associated with this process, freshwater has enough dissolved minerals and particles with a charge to cause corrosion as well. Furthermore, stray current in the water, from powered boat docks or incorrect boat wiring, can further add to the corrosive forces acting on boats in freshwater.

A common way to minimize the corrosive effects on boats is to utilize sacrificial anodes made of zinc, aluminum or magnesium. These anodes preferentially absorb the charges and corrode first, which protects the more valuable metals such as the boat hull or propeller. This can either be passive or induced (with electricity), but the key piece is that these anodes MUST be in the water in order to work. A boat that is partially submerged in the water will not be effectively protected if the sacrificial anodes are out of the water. If an induced system is at work, then power must be provided, so anodes need a power source.

Sacrificial anode on a boat hull. Photograph by Zwergelstern, distributed under a CC BY-SA 3.0 license.

Alternatively, storing a boat completely out of the water will halt the corrosive process. The sacrificial anodes will wear out with time and need to be replaced. As with any system, proper maintenance and routine checks of the system will keep them functioning at their best. If caught early, damaging corrosion can likely be stopped.

This boat hull is in the early stages of corrosion and corrective action should be taken to prevent any further damage. Photo by Jim Donahoe, used with permission.

Sometimes aquatic plant and algae management is blamed for causing corrosion of boats in the area of treatments. Although it is true that in their undiluted form these chemicals can be corrosive, these chemicals are greatly diluted into a spray tank before being even further diluted into the lake water. Once in the treated water these chemicals are found at very low concentrations, as low as a few parts per billion and even at their highest only a few parts per million. Furthermore, these low concentrations are short lived in the environment due to rapid dilution away from treatment site and environmental breakdown/sequestration. This short-lived, low concentration introduction of charge particles to the water is very small compared to the conditions that exist naturally in the lake. If all lakes were pure