Natural-born Killers

BENEATH THE WAVES

Environmental Protection

Anti-fouling coating systems and their mixed effects on the marine environment.

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Like so many issues related to environmental protection, balancing the benefits of a particular protective measure against the potential harm is a prime consideration. For example, anti-fouling hull coating systems can provide substantial environmental benefits, but an effective coating system can also have an unfortunate negative impact on the marine environment. There are very good reasons to keep a ship's hull free from bio-fouling, but the methods employed may cause severe damage to the environment. In other words, what happens when the natural-born killers are too good at killing?

At present, there are regional, national, and international regimes in place to control the detrimental effects of anti-fouling coating systems. This is because there is a compelling need to minimize the environmental harm caused by the biocides employed. In particular, the harm caused by organotins, or more specifically Tributyltin (also known as TBT), is well documented.[1]

Positive Effects of Anti-fouling Coating Systems

As a ship's hull becomes fouled with biological matter, the resulting surface friction causes a significant increase in the power required to maintain a desired speed.

The additional power output results in increased fuel consumption, which adds cost. As power output increases, the air pollution emissions from a shipboard propulsion system also increase. Components of this air pollution include nitrogen oxides, sulphur oxides, particulate matter, and greenhouse gases. Therefore, using anti-fouling coating systems can increase fuel efficiency, decrease air pollution emissions, increase operating speeds, and minimize the spread of aquatic invasive species.

Possible Environmental Harm

Among the environmental harm caused by TBT/organotin anti-fouling coating systems are documented mutations in invertebrate species, long-term heavy metal deposition, effects on marine mammals, and dangers to human health and welfare.[2]

There are well-documented concentrations of organotin biocides in areas such as Puget Sound, San Diego Harbor, and Hampton Roads.[3] The concentrations of these substances tend to be highest where ships remain stationary for extended periods of time.

SLIP

A fouled hull results in a reduction in vessel speed for any fixed power output. The increased hull friction will cause a diminished speed through the water for a fixed number of turns, which can be quantified by a metric known as "slip."

Slip is typically measured on a daily basis by comparing the theoretical distance a ship should have traveled—based upon a total number of turns made over a 24-hour period—against the actual distance traveled through the water during that same period.

There is some evidence that organotin has detrimental effects upon marine mammals. Some studies have found elevated concentrations of these biocides in the livers of stranded mammals.[4] Although more research remains to be done, there is a growing belief that the top of the food chain, including these mammal vertebrate species, is substantially affected by exposure to organotin biocides.

There is also a well-founded concern among the scientific community that human health and welfare is at risk due to organotin and other biocides. This is largely due to exposure related to the application and removal of anti-fouling coating systems, as well as human consumption of species where the biocides are concentrated.

At present, the principal substitutes for TBT are copper-based coating systems. Copper is far from a perfect solution because it is also associated with negative environmental effects, though not believed to be as serious as those related to TBT. Until a viable alternative can be identified for copper-based coating systems, it seems unlikely that there will be a move to ban (or largely limit) them.

Although there are some less toxic alternative biocides under consideration, some of the most promising alternatives may be those that approach the problem by inhibiting adherence of the species to the hull rather than killing the species directly.

Regulations

The key regulations in place include the U.S. Organotin Antifouling Paint Control Act of 1988 (OAPCA), the IMO anti-fouling system (AFS) convention, and the European Union regulation EC/782/2003.

In 1988, the United States acted unilaterally through the OAPCA of 1988. This legislation imposed controls on the supply chain and focused on banning use of organotin on recreational vessels. Whereas the existing unilateral regime focused on the domestic supply chain and recreational vessels, the AFS convention sought to regulate the entire supply chain and applications upon all types of vessels.

In 2003, the IMO adopted the AFS convention. Having met the minimum thresholds following ratification by Panama in 2007, the convention entered into force on September 17, 2008. At present, the annex to the convention only controls organotin, but it will likely be amended at some point in the future to include other biocides.

Although framed as regional or national measures, the practical effect of the EU regulation is to implement the IMO AFS convention in its entirety. This regulation supplemented a prior EU directive (2002/62), promulgated in 2002, which was primarily focused on cutting off the supply chain of organotin compounds within the community.

Ongoing Initiatives

The United States is presently signatory to the AFS convention, pending ratification. In early 2008, the president transmitted the convention to the Senate for advice and consent, together with proposed implementing legislation. The administration's proposed implementing legislation takes the form of amendments to the OAPCA of 1988. It principally provides for the U.S. Coast Guard to have primary responsibility for shipboard enforcement and for the EPA to have primary responsibility for shoreside enforcement. Congress has yet to act on the president's proposal.

The IMO Marine Environment Protection committee is addressing measures to minimize the translocation of invasive aquatic species through the bio-fouling of ships. At present, a correspondence group has begun work on the topic, under the leadership of New Zealand.

Domestically, the U.S. Coast Guard already has authority and a congressional mandate to prevent the introduction and spread of aquatic invasive species via means that include hull fouling. This authority is granted by the NANPCA of 1996, which amended the National Invasive Species Act of 1990. The U.S. Coast Guard has exercised this authority by requiring the regular cleaning of vessel hulls, via promulgation of regulations at 33 CFR 151.2035.

At the present time Congress is considering a variety of legislative proposals that may alter the U.S. Coast Guard's authority to regulate invasive species. The administration has expressed its concern that the U.S. Coast Guard's authority to regulate hull fouling as a vector for the introduction and spread of aquatic invasive species should not be compromised by legislative action. This vector is frequently overshadowed by the threat posed via ships' ballast water effluent, but is nonetheless quite important.

About the author:

Mr. Darr is a civilian Coast Guard attorney who advises the marine safety, security, and environmental stewardship programs. He has served on a wide range of IMO delegations at the assembly, committee, subcommittee, and working group levels. He graduated from the U.S. Merchant Marine Academy in 1993, cum laude, and from The George Washington University Law School in 2001, with high honors. He is a retired Coast Guard marine inspector, investigating officer, and law specialist.

Endnotes:

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