Managing Hull-Borne Invasive Species on California's Coastal Boats

Coastal birds, wildlife, fish and shellfish depend on abundant food and living space. Aquatic invasive species (AIS) threaten coastal marine life and structures all over the world. Most AIS are carried across the ocean on ships, while boats help to spread them along the coast. Good hull husbandry can help to manage the threats posed by AIS.

When is fouling growth invasive?

Fouling occurs when marine microbes, plants, animals, their spores and larvae attach and grow on a vessel hull. If they survive the trip to a distant harbor, they may spawn, release spores, or be removed and discarded there. They may create problems, such as: out-compete local species for food; overgrow them and alter their habitat; damage shorelines and structures; cause new diseases for humans and marine life; and be expensive to control or eradicate. Pleasure and fishing boats may spread AIS by visiting commercial ports, attending events or fishing on grounds with boats from many areas, or cruising along the coast.

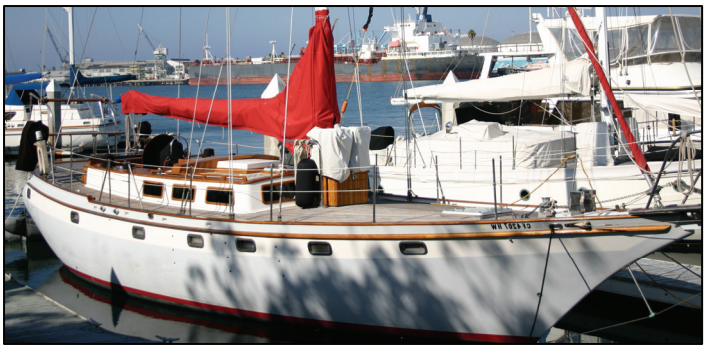
Common AIS that cause problems in California include Pacific shipworm (*Bankia setacea*), Atlantic shipworm (*Teredo navalis*), striped barnacle (*Balanus amphitrite*), European green crab (*Carcinus maenas*), Australasian isopod (*Sphaeroma quoyanum*), star sea squirt (*Botryllus schlosseri*), sea vase (*Ciona intestinalis*), club tunicate (*Styela clava*), "coral-like" serpulid tubeworms (*Hydroides* spp.), spotted jellyfish, spaghetti bryozoan (*Zoobotryon verticillatum*), and Asian kelp (*Undaria pinnatida*).

Scientists believe that 747 species have been introduced to California's coastal ecosystems. Most appear to have come from the northwest and northeast Atlantic and the northwest Pacific. California receives much ship traffic and aquaculture species from these regions. However, some species have come from warmer-water regions.

Why aquatic invasive species are a problem

Invasive species threaten biological diversity and ecological integrity worldwide. They can permanently reduce biodiversity by preying on, parasitizing, out-competing, causing or carrying diseases, or altering habitats of native species. Some cause or carry human diseases or foster other species that do. As their populations explode, invaders may transform entire ecosystems, pushing native species to the brink of extinction. Some scientists believe that the threat posed by invasive species is second only to that posed by habitat loss; others consider invasive species to be the greater threat. Hull-borne invasive species can cause severe economic and ecological damage, including damage to shorelines, man-made marine structures, equipment, and vessels, requiring costly repair or replacement.

Tubeworm and sea squirt fouling on the hull of a dinghy in San Diego Bay.



Recreational boats and commercial ships share port waterways.

One example in California is the European green crab. The green crab can adjust easily and quickly to new environments, outcompeting native species. It can exhaust available food supplies, threatening the survival of Dungeness and other native crabs, and feed upon seafood aquaculture species. Another example is the club tunicate, which can be a problem for shellfish aquaculture by competing with other species for space and food or by consuming their planktonic larvae.

Solutions to controlling invasive species

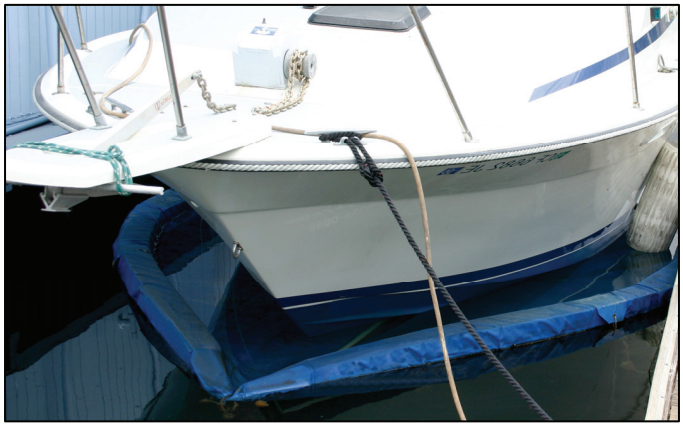
Toxic, antifouling paints are pesticides used to control fouling growth. They would seem to be the solution to controlling AIS on vessel hulls. However, they slow, rather than prevent, fouling and create a water quality problem by leaching metal. Also, science is finding that fouling AIS tolerate copper better than native species. Thus, antifouling paints cannot be expected to solve the problem of hull-borne, invasive species. Durable, nontoxic coatings are environmentally friendly alternatives that can

Leigh Taylor Johnson, Marine Advisor; Jamie Gonzalez and Amber Himes, Program Representatives
University of California Cooperative Extension – Sea Grant Extension Program
County of San Diego, MS O-18, 5555 Overland Ave. Suite 4101, San Diego, CA 92123
(858) 694-2845 http://seagrant.ucdavis.edu

UCSGEP-SD Fact Sheet 06-1 March 2006

last much longer than copper-based antifouling paints. Thus, they can be more cost-effective over time, despite costs to convert from copper-based paints and the twice-as-frequent hull cleaning needed to control fouling growth.

Many pleasure craft spend much time at the home slip, so their antifoulant coatings would contribute relatively more copper to marina waters and in-water hull cleaning would not increase the risk of introducing AIS. Such boats are good candidates for nontoxic hull coatings. Slip liners can reduce exposure to fouling species and so may help to reduce the need for antifoulant coatings and in-water hull cleaning. Boats that often take long trips may be better candidates for antifoulant coatings, because they would contribute less pollution to the marina and are more likely to encounter AIS.



A slip liner will help to prevent hull fouling.

Recommendations

The following may help reduce the risk of AIS transport:

- Prevention is more ecologically and cost effective than control, mitigation or eradication. Reducing fouling growth on boat hulls can help prevent AIS introductions.
- Boat owners and boating businesses can take immediate steps to prevent and control invasive species transport on hulls and underwater running gear. A first step would be to clean the hull before leaving to visit a distant region, island or event with boats from many regions. A slip liner will reduce exposure to fouling growth. Boats should be cleaned again before returning or moving to another region. Heavily fouled boats should be hauled and cleaned upon arrival.
- Education programs are most effective when developed and delivered in collaboration with boat owner and boating industry associations.

Underwater hull cleaner removes early fouling growth.

- Immediate, collaborative, education programs will raise boat owners' and boating businesses' awareness of the AIS problem, increase the effectiveness of management practices they can readily apply and increase adoption of the recommended practices.
- Programs to prevent and control invasive species transport will need to consider water quality, tolerances of invasive and native species to antifouling toxicants, changes in antifouling paint regulations, and costs of new products, practices and reporting requirements.
- Heavy vessel traffic on the North American Pacific coast means a coordinated approach by states, provinces and nations is needed to manage hull-borne AIS effectively. It should consider recreational, commercial and commercial-passenger fishing boats kept in saltwater, ships and trailered boats.
- Managers will need to communicate among each other and with policy makers, boat owners, boating, fishing and hull-coating businesses, scientists and educators to develop effective and sustainable policies.
- Research will more clearly define the types of invasive species likely to be transported on boat hulls, their expected ecological and socio-economic impacts on recipient regions, and how to prevent and control them.
- Sea Grant Extension Program will continue to conduct research and education on fouling control, water quality and hull-borne, invasive species. For more information contact the authors or visit: http://seagrant.ucdavis.edu
- For recommendations on controlling AIS on trailered boats, visit: http://protectyourwaters.net

Acknowledgements

This publication was supported in part by the California Department of Boating and Waterways Project No. 04-106-111, the California Policy Research Center Project No.EEN03A, the Pacific States Marine Fisheries Commission Project No. 05-73, the Western Regional Panel of the Aquatic Nuisance Species Task Force, Renewable Resources Extension Act, U.S. Fish and Wildlife Service, the California State Lands Commission, National Sea Grant College Program of the U.S. Department of Commerce's National Oceanic and Atmospheric Administration under NOAA Grant #NA04OAR4170038, project number A/E-1, through the California Sea Grant College Program, and in part by the California State Resources Agency, the University of California Sea Grant Extension Program, Regents of University of California, the University of California Agriculture and Natural Resources and Cooperative Extension, and the County of San Diego. The views expressed herein do not necessarily reflect the view of any of those organizations.

Photographs taken by Cesar J. Alvarez, Program Representative