

Ballast Water and Hull Fouling: Two Vectors for Aquatic Invasive Species to Invade California

What is ballast water and how does it relate to aquatic invasive species (AIS)?

Carried by ships to provide stability and adjust a vessel's trim for optimal steering and propulsion, ballast water may be the most important mechanism for the introduction and spread of aquatic invasive species (AIS) into the U.S.¹ Not only are AIS concentrations high within the ballast water, enormous volumes of ballast water enter domestic water: every hour an average of more than 2 million gallons of ballast water (equivalent to three Olympic-sized swimming pools) are released in U.S. waters. That is 555 gallons per second.

Ships often take up ballast water in ports and coastal regions, where the ecosystems have a rich diversity of life. These biologically diverse waters, and their underlying sediments, including many forms of viruses, bacteria, plankton, plants and animals, are sucked into vessels' ballast tanks. Ballast water is then released during various stages of the ship's journey, including at sea, along coastlines, and in various ports. As a result, a diverse mix of organisms is transported and released around the world. Over 3,000 marine species travel around the world in ships' ballast water on a daily basis.²

What is hull fouling and how does it relate to AIS?

Aquatic nuisance species are carried across the seas not only inside ships but also attached to the outside. This is known as hull fouling, vessel fouling, or biofouling. Organisms like barnacles, mussels, sponges, algae and sea squirts attach themselves to the hulls of ships, fouling these wetted hull surface areas (WSA), or live within the matrix of the fouling community and protected nooks and crannies such as sea chests. These organisms then colonize the hull and "hitch a ride" from one port or bioregion to the next. Invasions can occur when these fouling organisms come in contact with structures in a new port or release their larvae into its waters, possibly establishing themselves in the new port and spreading to nearby areas within that bioregion. Hull fouling is a serious problem, especially considering:



Fouling species can be spread easily, even during cleaning.

Courtesy of Triton Diving Services Ltd.

- The WSA that arrives into the U.S. annually is equivalent to 2.5 times the area of Washington, D.C. (438 sq km).³
- 67% percent of this WSA comes from outside the U.S.³
- 70% of Australia's 250 AIS⁷ and 74% of Hawaii's AIS⁸ arrived via biofouling.
- Vessels may contain large amounts biofouling – up to 90 tons.
- Simply cleaning the ship is not enough, as live organisms are often released into the water during this process.

Effects of AIS

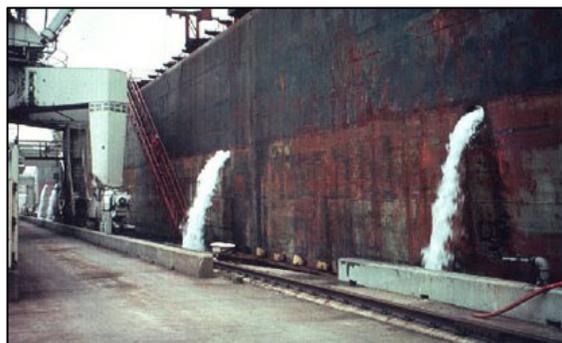
Associated damages and costs of controlling aquatic invaders in the United States are estimated to be \$9 billion annually. In addition, ballast water can carry organisms that endanger public health, including toxic dinoflagellates (red tides) and cholera bacteria.⁴ In addition, ecological effects abound. Over 234 invasive species have taken root in the Bay-Delta ecosystem. In the bay's benthic community - its sediment dwellers - invasive organisms account for between 40 percent and 100 percent of the common species, up to 97% of the total number of organisms, and up to 99% of the biomass.⁵

What is being done about this problem?

In order to stop an invasion, organisms (1) must not be discharged from ballast tanks; and (2) must not be carried on hulls. The first action can be achieved by not taking organisms into ballast tanks, killing organisms during the voyage, or not discharging organisms when ballast water is released; the second action can be achieved by reducing the amount of organisms present on vessel hulls through regular cleaning and maintenance.

Existing California Ballast Water Legislation

- SB 497 (2006) This bill requires the State Lands Commission to adopt regulations on ballast water performance standards on or before January 1, 2008.
- AB 433 (2004) California's Marine Invasive Species Act requires all vessels arriving at California ports to perform mid-ocean ballast exchange or qualifying vessels must retain all ballast water onboard.



Without regulations, ballast water is often released in port. Courtesy of L. David Smith

Existing Hull Fouling Legislation

Australia is the only legal body that has implemented hull fouling measures (in the process of becoming mandatory), which apply to vessels under 25m in length. These measures include: (1) Cleaning the vessel's hull within one month prior to arrival; or (2) Applying antifouling paint within one year prior to arrival; or (3) Booking the vessel to be hauled out and cleaned within one week after arrival.

Upcoming California Hull Fouling Legislation

AB 740 (in Assembly) This bill would define the term "vessel fouling," require removal and recordkeeping of vessel fouling organisms from hull, piping, propellers, sea chests, and other submerged portions of qualifying vessels at least every 60 months, and require in-water cleaning of the submerged portion of a vessel while in state waters, to be conducted using specified procedures. Additionally, the bill would require the CA State Lands Commission, by January 1, 2010, to develop and adopt regulations governing the management of vessel fouling on those vessels arriving at a California port or place, to protect state waters.⁶

1. James T. Carlton, *Endangered Species Update* Vol.12, 1995.
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4. Pimentel, D., Lach, L., Zuniga, R., Morrison, D. (2000) Environmental and Economic Costs of Nonindigenous Species in the United States. *BioScience*, 50(1): 53-65
5. Cohen, A.N. and J.T. Carlton. 1998. Accelerating invasion rate in a highly invaded estuary. *Science*, 279: 555-558.
6. California State Senate website: [http://info.sen.ca.gov/pub/bill/asm/ab_0701-0750/ab_740_bill_20070222_introduced.html](http://info.sen.ca.gov/pub/bill/asm/ab_0701-0750/ab_0701-0750/ab_740_bill_20070222_introduced.html)
7. Australian Quarantine and Inspection Service. 2005. AQIS Fact Sheet.
8. Godwin, L Scott (2003). Hull Fouling of Maritime Vessels as a Pathway for Marine Species Invasions to the Hawaiian Islands. *Biofouling*, 19 (1), 0892-7014.