US Army Corps of Engineers
Waterways Experiment Station

Zebra Mussel Research Technical Notes

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Components of Vessels and Dredges Susceptible to Zebra Mussel Infestations

Background

Since its accidental introduction into waters of the United States, the zebra mussel has spread rapidly throughout most of the Great Lakes and has now (mid-1992) been found in much of the inland waterway system. Commercial vessels and dredges, such as lochs, dams, reservoirs, and water intakes, are susceptible to zebra mussel infestations. In January 1992 a working group meeting was held to develop strategies for zebra mussel control applicable to vessels and dredges. Attendees included representatives from Corps Divisions and Districts, the U.S. Army Engineer Marine Design Center, the U.S. Army Engineer Waterways Experiment Station (WES), the U.S. Coast Guard, and commercial ship and barge lines. Working group members described the nature of potential zebra mussel problems associated with various vessel and dredge components. In addition, they outlined prelimmary control methods as a first step in developing control strategies.

Additional information

Contact the author of this technical note, Dr. Michael Palermo, WES, (601) 634-3753, for additional information. Dr. Ed Theriot, WES, (601) 634-2478, is Manager of the Zebra Mussel Research Program.

Components of commercial vessels at risk

The major components of a vessel are illustrated in Figure 1. Each component or system and the nature of likely problems due to zebra mussels, is briefly described below:

Hulls

The large surface area of hulls is vulnerable to largescale infestations, especially if vessels are in dry-dock for extended periods. Zebra mussel problems related to hull infestations include reduction of fuel efficiency due to added weight and drag and reduction in cargo-carrying capacity due to added weight. The working group representing lake and inland carriers and barge lines identified these problems as potentially the most serious.

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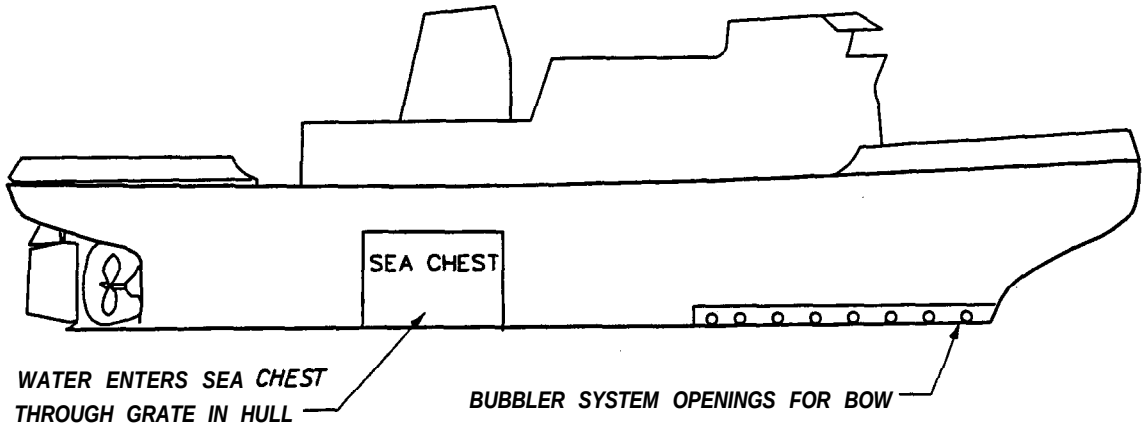

Figure l. Major components of a vessel

Ballast tanks/double hulls

Ballast tanks on vessels, interior compartments on dry-docks, and double-hull compartments for dry cargo barges are areas where raw water could enter and stay for varying periods of time.

Zebra mussel problems related to tanks and double hulls could be significant. If settlement occurs, the infestation would be difficult to remove. However, water in these compartments could become anoxic quickly, which could offset the potential for serious infestations.

Sea chests

A sea chest is a rectangular recess in the bottom of a vessel from which piping systems draw raw water for cooling or other uses. A sea chest acts in much the same way as a stilling basin or a stilling well, offsetting the effects of vessel speed and providing an intake reservoir. Sea chests are protected by grates and can contain baffle plates to further dampen the effects of vessel speed. The size of sea chests can vary from 1.5 sq ft for a small inland tug up to several square feet for a larger vessel.

The zebra mussel problems related to the sea chest include clogging the protective grate and individual water intakes within the sea chest. If such an infestation occurs without detection, the flow of water will be stopped with resulting damage to engines or other components that need cooling. Infestations of the valves would be dangerous if they could not be closed to prevent flooding.

Piping systems

Several different piping systems, each with separate intakes, can draw water from the sea chest. These provide water for engine cooling, fire protection, air conditioning, and refrigeration and to cool bearings. Pipes leading from intakes usually have a valve located near the sea chest that can be closed to prevent flooding.

Piping systems leading from the sea chest are subject to clogging from zebra mussels. However, zebra mussels have usually been detected in portions of pipes leading from the sea chest up to the first valve. Potentially, zebra mussels could cause extensive problems in vessel piping systems. For example, fire-fighting systems must operate on demand, yet they stand idle for long periods. These systems terminate

in nozzles subject to clogging from shell debris. Continuous high-flow systems present little problems because of low potential for settlement of immature zebra mussels.

Keel coolers

The term keel cooler refers to a system of pipes or channels located at the hull surface. Engine cooling water is circulated and cooled by ambient water in this area. Channel type coolers protrude from the huh, while recessed coolers are constructed from bundles of pipes placed in the hull recess.

Keel coolers could be encrusted and lose efficiency. The initial startup of a vessel engine after prolonged layup could be a critical problem. Also, these components are difficult to clean as compared to hull surfaces.

Dredging systems

Dredges and attendant floating plants are vulnerable since they all contain the above-described components. The dredging-specific systems, such as pumps and pipelines, or hoppers and pumpout equipment, were not thought to be at particular risk by the working group members.

Control strategies

The following strategies for various vessel and dredge components were identified by working group members:

Component	Control Strategy
Hulls	Antifoulant coatings Manual cleaning Frequent operation and monitoring
Double hulls/ballast tanks	Keeping hulls pumped dry Treatment Manual cleaning
Sea chests	Hot water backflush Antifoulant coatings Manual cleaning Redesign and retrofit Operation and monitoring strategies
Piping systems	Heat tape Hot water backflush Removal and cleaning or replacement Redesign and retrofit Treatment Frequent operation and monitoring
Keel coolers	Heat exchange Antifoulant coatings Manual cleaning Redesign and retrofit