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Zebra Mussel Research Technical Notes

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Update on Floating Plant Components Susceptible to Zebra Mussel Infestations

Background

In July 1992, the Zebra Mussel Research Program's floating plant working group published its assessment of components of vessels and dredges susceptible to zebra mussel infestation. Since that time, the working group has revised its assessment of the components at risk.

At meetings conducted in February 1993 and February 1994, working group representatives from Corps Divisions and Districts, the U.S. Army Waterways Experiment Station (WES), the U.S. Coast Guard, the Tennessee Valley Authority, and commercial ship and barge lines discussed floating plant components that have incurred zebra mussel- related problems. This technical note updates the list of floating plant components susceptible to zebra mussel infestation and the control strategies considered most effective for those components of concern.

Additional information

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Components of floating plant at risk

Technical Note ZMR-3-07 (Palermo 1992) identified hulls, ballast tanks/double hulls, sea chests, piping systems, keel coolers, and dredging systems as components susceptible to zebra mussel infestation. More recent information obtained by members of the working group indicates that the floating plant components most affected by zebra mussels include the sea chest, keel coolers, piping systems and, under certain conditions, hulls. Readers are referred to Technical Note ZMR-3-07 for a description of each of these components. Table 1 summarizes the recommended control strategies for the four susceptible components. The following discussion summarizes the experiences with each component and provides a summary description of the risks.

Hulls

It was speculated that the added weight of zebra mussel infestations on ship hulls would reduce cargo-carrying capacity and that the additional drag would reduce fuel efficiency. To date, zebra mussel infestations on hulls have not proven to be a serious problem. The St. Paul District's dredge *Thompson*, for

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Table 1. Control Strategies for Susceptible Components

Component	Control Strategies	
	Reactive	**Proactive**
Hulls	• Mechanical cleaning • Freezing/desiccation • Ice operation/grounding	• Antifoulant coatings
Sea chests	• Mechanical cleaning	• Antifoulant coatings • Engine coolant recirculation • Enlargement
Piping systems	• Component replacement	• Periodic operation • Copper piping
Keel coolers	• Mechanical cleaning • Replacement	• Antifoulant coatings

example, was dry docked in March 1994. Fewer than 100 zebra mussels were found attached to the hull, despite the fact that the dredge had operated in zebra mussel-infested waters for 3 years. No zebra mussels have been reported on Detroit District's *Towas Bay*, which was coated with a copper-based paint in 1992 (Miller and Freitag 1992).

Vessels that operate in waters with ice flows are probably not at risk, because of the abrasive action of the ice and the subsequent removal of zebra mussels. Vessels that do not operate during an ice season but are periodically grounded may achieve the same results. The primary means of control are periodic dry docking (every 3 to 6 years), mechanical cleaning of the hull surface, and resurfacing with a copper-or zinc-based paint that provides the requisite protective coating to the hull for normal operations as well as antifoulant benefits.

Ballast tanks/double hulls

No infestations or problems with ballast tanks or double hulls have been reported. No control strategies are suggested.

Sea chests

The hard steel surfaces of the sea chest, protective grates, and baffles combined with low water velocities created in this area provide a suitable environment for zebra mussel attachment. Zebra mussel infestations have been found to clog the individual intakes and gates of the various water piping systems, decreasing the availability of water for onboard operations. This could result in damage to engines and other components that require water for cooling. Therefore, sea chests are considered to be the component most susceptible to serious infestation. Control strategies include coating all surfaces with an antifoulant such as copper-based epoxy paint or hot-dipped galvanized. Periodic inspection and replacement of grates and screens also reduces the risk. Increasing the size of the sea chests 20 to 30 percent may delay the onset of serious problems that could force an engine shutdown. As a thermal control strategy, the U.S. Coast Guard recirculates engine-cooling water through the sea chests once a week for 2 hr, bringing the temperature to 100^{o} F. Although designed to keep the chests from clogging with ice, recirculation of hot water has proven extremely effective in controlling zebra mussels.

Piping systems

Piping systems that provide water for engine cooling, fire protection, air conditioning, and refrigeration usually draw from the sea chest and, thus, are susceptible to infestation from the same pathway. Most of the piping systems leading from the sea chest are operated continuously at velocities in excess of those required for settling and attachment, so only their system valves are subject to clogging. Some of these piping systems (for example, fire-fighting and air-conditioning systems) stand idle for long periods of time, allowing an opportunity for zebra mussels to settle. Although clogging of floating plant piping systems has not been reported, instances have occurred at other facilities. The threat and seriousness of this type of infestation warrants the exercise of control strategies which include periodic operation of all systems, valves, and nozzles. In some cases, it may be prudent to replace standard piping with copper pipe.

Keel coolers

The difficulty of cleaning the keel coolers and their large surface area makes this a highly susceptible floating plant component. Though keel coolers are no more susceptible than hulls, loss of efficiency of the coolers due to even "minimal" infestation could present a critical problem in operating a floating plant so equipped. Although no reports of major keel cooler infestation have been received, periodic inspection of these surfaces is recommended. Antifoulant coating of the keel coolers and the adjacent surfaces is recommended in all cases.

Dredging systems

No infestations or problems with dredging systems have been reported. Susceptibility of dredging vessels appears to be limited to the same components at risk on other vessels. No control strategies for dredging systems are proposed.

References

Miller, A. C., and Freitag, T. 1992. "Use of a Copper-Containing Epoxy Material to Protect a Bay Class Tug from Zebra Mussel Infestations," Technical Note ZMR-2-12, Zebra Mussel Research Program, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Palermo, M. R. 1992. "Components of Vessels and Dredges Susceptible to Zebra Mussel Infestations," Technical Note ZMR-3-07, Zebra Mussel Research Program, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.