

Case Study 1

The Need for Prevention – A Zebra and Quagga Mussel Case Study

Zebra and quagga mussels are native to the Black and Caspian Seas. Both species of mussel can wreak havoc when introduced to a new environment by disrupting the natural food chain and crowding out native species. They are prolific and range in size from microscopic to the size of a fingernail, attaching themselves to hard and soft surfaces. They were introduced to North America's Great Lakes in ballast water from Russia in the late 1980s.

Soon after introduction, the invasive mussels spread throughout the Great Lakes region, resulting in hundreds of millions of dollars in damage to water delivery systems in the east.

They were first detected in the western United States in January 2007 in the Lake Mead National Recreation Area. They have since spread throughout the Colorado River system and are now found in several other western states.

Although the mussels are not established in Idaho's lakes and reservoirs, most waters of the state are vulnerable to future invasion. Calcium and temperature levels are suitable for them to establish in Idaho. As these mussels are transported primarily by watercraft, state resource managers have developed programs to ensure that the invasive mussels are not introduced to Idaho's waters via mussel-fouled boats that have been in mussel-infested waters of other states. Idaho's watercraft inspection station program focuses on boats from impacted states as they cross the state line.

In addition to devastating environmental impacts, zebra and quagga mussels pose an economic threat to Idaho. The mussels can colonize on hulls, engines, and steering



components of boats, other recreational equipment, and can damage boat motors and restrict cooling. The invasive species also attach to aquatic plants and submerged sediment and surfaces such as piers, pilings, water intakes, and fish screens. The mussels frequently settle in massive colonies that can block water intake and threaten municipal water supply, agricultural irrigation, and power plant operations.

From 1993 to 1999, congressional researchers estimated that an infestation of zebra mussel in the Great Lakes cost the power industry alone \$3.1 billion with a total economic impact to industries, businesses, and communities of more than \$5 billion. Given the well-documented impacts these species have had in the Great Lakes, many western states are on high alert to contain, control, and prevent their spread. The states of Nevada, California, Arizona, Colorado, and Utah each have detected these species in critical water supply systems, and are attempting to minimize impacts. Quagga mussel veligers (the immature stage of the mussels) have been found in a Utah waterbody that is 130 miles from the Idaho state line.

Zebra and quagga mussels have not been found in Idaho waters to date. In order to understand the potential impacts of these species to

Idaho, ISDA examined existing databases and published research to generate estimates on comparable occurrences in Idaho. The results reflect an estimated cost of direct and indirect impacts on infrastructure and facilities that use surface water. Most of the published data examined does not report annual costs; however, annual maintenance costs would be expected to increase for all of the categories examined. In some cases, economic impacts could not be estimated. For example, no comparable economic data exists for mussel impacts on irrigation systems; therefore they are excluded from the potential cost estimates. These estimates are considered conservative and for the most part are reported in 1997 dollars, not adjusted for inflation.

Hydropower

These estimates were based on a Bonneville Power Administration (BPA)-commissioned study that examined the estimated hydropower maintenance costs associated with zebra mussel by examining the Bonneville Dam First Powerhouse, costs associated with Asian clam control at Bonneville, and a survey of zebra mussel mitigation costs at other hydropower generation facilities in North America. The study estimated the costs for installing sodium hypochlorite systems and applying antifouling paint to 13 federal hydroelectric projects in the Columbia River Basin. The Idaho estimate was based on the BPA average cost per project (\$1.8 million) for the 26 hydropower dams in Idaho (Phillips et al. 2005).

Other Dams

Other dams include water impoundment structures not associated with power generation. These structures will incur maintenance costs associated with mussel fouling of pipes and structures. Estimate based on figures from O'Neil (1997) for navigational lock structures (\$1,700 per structure) applied to 86 structures in the state.

Drinking Water Intakes

The drinking water facilities included in this analysis are facilities that draw surface water for municipal or public drinking water use. Mussels foul intake piping and water processing infrastructure, increasing maintenance costs and degrading water flavor due to mussel

waste and decomposition in water lines. Private single family home water intakes for drinking and irrigation are not included in this estimate. Estimates based on O'Neill (1997) figures from water treatment facilities (\$42,000 per facility) applied to 100 facilities in Idaho.

Golf Courses

Golf courses are at risk for additional maintenance costs for irrigation systems. Fouling of pipes and pumps and clogged sprinklers are projected to increase operating expenses. Estimates based on O'Neill (1997) costs from golf courses (\$150 per facility) applied to 114 Idaho courses.

Boating Facilities

Boating facilities include marinas, docks, and boat launches. Increased cost estimates are based on maintenance associated with dock and boat launch fouling. Estimates based on O'Neill (1997) figures from marinas (\$750 per facility) applied to 380 Idaho facilities.

Fish Hatcheries and Aquaculture

Hatcheries and aquaculture facilities are vulnerable to zebra/quagga mussel fouling. Pipes, pumps, and raceway structures are all subject to increased operations and maintenance costs. Estimates based on O'Neill (1997) figures for hatcheries and aquaculture impacts (\$5,800 per facility) applied to 163 facilities in Idaho.

Boater Costs

More than 90,000 motorized boats were registered in the state of Idaho in 2007. Potential increases in boater costs are based on estimates for anti-fouling paints and increased per-boat maintenance costs. Estimates based on Vilaplana et al. (1994) for increases in boater maintenance costs (\$265 per boat).

Fishing Use

Recreational fishing is a \$430 million industry in Idaho. Research on impacts of mussels on fisheries is limited but reductions of fish numbers are likely. Vilaplana et al. (1994) found a 4% decrease

in boater recreation because of mussel introduction. Estimate based on a 4% reduction of use applied to 2,917,972 Idaho fishing trips a year averaging \$150 per trip (IDFG 2003).

Irrigation

56,175 points of diversion (POD) were identified in Idaho by the Idaho Department of Water Resources. Multiple points of use (POU) may be associated with each POD. Each POD and POU could be affected by the introduction of zebra or quagga mussels. These mussels can grow up to 0.5mm / day under ideal conditions and could impact water conveyances that are seasonally dry. Fouling from mussel establishment is cumulative and increased fouling and flow reduction would occur in ditches, pipes, pumps, fish screens, and diversion structures over time. Published research on mussel-related flow reduction in irrigation systems is minimal, but mussel establishment in pipes and pumps is well documented. The true impacts of zebra and quagga mussel introduction on irrigated agriculture in Idaho are uncertain, but there is a high likelihood that these mussels will increase maintenance costs for operations that rely on surface water for irrigation.

Facility	Number	Estimated Cost Per Unit	Estimated
State-Wide Cost			
Hydro Power	26	\$1,817,000	\$47,242,000
Other Dams	86	\$1,730	\$148,700
Drinking Water	100	\$42,870	\$4,287,000
Golf Courses	114	\$150	\$17,100
Boat Facilities	380	\$750	\$285,000
Hatcheries/ Aquaculture	194	\$5,860	\$1,136,800
Boat Maintenance	90,000	\$265	\$23,850,000.
Angler Days (4% reduction)	2,917,927	\$150	\$17,507,500
Irrigation POD	56,175		
TOTAL ESTIMATE			\$94,474,000

