

THE ZEBRA MUSSEL—ANOTHER BIOLOGICAL INVASION

About one hundred years ago, a bird fancier released a few starlings in New York City's Central Park. Today, the starling is the most common bird in the United States. In 1866, the gypsy moth was transported from Europe to the New England states. It proliferated at the expense of North American forests. Today, these European invaders are joined by another exotic species, the zebra mussel (*Dreissena polymorpha*). The invasion of the zebra mussel, like the others before it, has been costly, both economically and ecologically for much of North America.

The zebra mussel is actually one of about 130 exotic invaders of the Great Lakes. The invasion began in 1985 or 1986, when larval mussels were picked up in freshwater ports of Europe as cargo ships filled their ballast tanks with freshwater. The larvae were released when ballast tanks were emptied into the Great Lakes. Within 3 or 4 years, the mussel spread into Lakes Erie, Ontario, Huron, and southern Lake Michigan. By June 1991, the mussels were reported in the Illinois River, and the mussel today threatens much of the Mississippi River drainage basin.

Many of the problems associated with zebra mussels are a result of their high reproductive potential. A single female may release 40,000 eggs. Their veliger larval stages may drift in the plankton for up to 5 weeks and be carried long distances by water currents. When larvae settle on a hard substrate, they attach by tough byssal threads. They grow to a length of about 2 cm, and densities of 200 individuals/m² are common.

Economic problems associated with zebra mussels result from their settling on, and clogging, water intake pipes. Detroit Edison officials reported 700,000 mussels/m² on a single water intake screen. In December 1988, mussels and ice shards blocked water intake to

the Detroit Edison plant, which resulted in power outages throughout Detroit. It cost the company \$250,000 to restore electricity to the city. Detroit Edison officials spent \$6 million on a new intake system that they hope will reduce the fouling problems. Throughout the Great Lakes, an estimated \$2 billion will be spent cleaning and refitting pipes in Great Lakes port cities through the 1990s.

Zebra mussels also threaten the ecology of freshwater ecosystems. They are very efficient filter feeders and are expected to disrupt freshwater food webs. As larvae settle and encrust hard substrates, they may disrupt the spawning ground of game fish such as walleye. The Mississippi River drainage basin is a particular concern. The Mississippi River and its tributaries contain the highest diversity of clams in the world. Some of these clams are endangered species. The valves of a native clam make an excellent substrate for zebra mussel attachment. The native clam can be so densely covered that feeding is impossible.

While research efforts are underway to monitor the spread of the zebra mussel and to search for its "Achilles' heel," a larger question looms in the background: "Are more invaders on the way?" One study of the ballast water of 55 cargo ships revealed that 17 species of animals were still alive in each ship by the time the ships arrived in North American freshwaters. Estimates of the number of individuals alive per species ranged between 10,000 and 8 billion! A relatively simple, partial solution to the problem of ballast-water invaders is to require ships to dump ballast water from foreign, freshwater ports into the open ocean and replace it with seawater. Seawater kills most freshwater organisms, and freshwater kills most marine organisms.