APPENDIX 3: ZEBRA MUSSEL (DREISSENA POLYMORPHA) AND QUAGGA MUSSEL (DREISSENA BUGENSIS): THE DREISSENID MUSSEL CASE IN THE GREAT LAKES



### **THE DISCOVERY**

Zebra and quagga mussels are native to Eastern Europe, Ukraine and Russia respectively, and are both members of the family Dreissenidae. These invasive mussels grow to be about the size of a fingernail and form dense colonies on a variety of aquatic substrates. Zebra mussels were first discovered in the Great Lakes in June of 1988 in Lake St. Clair. Quagga mussels were first reported in Lake Erie the following year, but weren't recognized as a unique species until 1991. Both species are believed to have been introduced via ballast water from foreign ships (Ricciardi and MacIsaac 2000). In the years following the discovery, the mussels quickly expanded throughout the Great Lakes. By 1992 they had spread past the Great Lakes, into the Mississippi River, and into inland lakes across New York, Indiana, and Kentucky.

### THE DAMAGE

Dreissenid mussels affect the ecosystems they invade by forming dense populations and filter feeding plankton and other microscopic food particles—depleting the base of the food web and clearing up the water column. Clearing water increases the penetration of sunlight, triggering increased growth of algae and other plants. The mussels affect other important members of the ecosystem through the accumulation of environmental contaminants. The mussels have a direct impact on industry through the accumulation of shells on water intake structures like pipes and screens. These mussels alter recreational opportunities by colonizing docks, break walls, buoys, boats, and beaches.

Electricity generating companies and water treatment facilities on Lake Erie were among the first to experience the effects of the mussels. Rapid accumulation along intake pipes restricted water flow and prevented facilities from operating efficiently.

# THE POLICY RESPONSE

As the mussels spread throughout Great Lakes basin in the following years, extensive outreach was undertaken, including: public information sessions, industrial seminars, zebra mussel conferences; and creation of a zebra mussel clearinghouse to serve as a centralized hub of information. The media response included newsletters, bulletins, television broadcasts, and newspaper articles—but the threat was never fully conveyed or realized by media outlets or policy makers. This was, in part, due to the difficulty of conveying the risks of a species that does not look intimidating, and can take over a decade to begin to show negative environmental and economic impacts after initial invasion.

The primary federal response to dreissenid mussels was the passage of the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) in 1990. The act classified the zebra mussel as an injurious species under the Lacey Act, provided funding for zebra mussel education and research, required the Coast Guard to issue ballast water regulations, and established the Great Lakes Panel on Aquatic Nuisance Species. The passage of the NANPCA marked an important shift in the fight against invasive species in the United States, as it became the first piece of invasive species legislation that aimed at prevention by focusing on vectors of transmission, rather than mitigation of an already established species. Nevertheless, dreissenid mussels had already established at this point.

## **ACTION TAKEN**

Awareness campaigns from a range of agencies across the basin focus on recreational water users—emphasizing draining, drying, and cleaning of boats and equipment to prevent overland movement of dreissenids and other invasive species. Preliminary research using eDNA as an early detection and monitoring tool is underway (Gingera et al. 2017). The only control options developed thus far are restricted to small, confined, populations. Current control options include: chemical treatments of chlorine, potassium chloride, or copper based compounds; physical removal via SCUBA; exposure to UV light; and biological control.

### **CURRENT STATUS:**

Zebra mussels are widely dispersed throughout the Great Lakes Basin, the Mississippi River and its tributaries, and have rapidly spread west into California. Quagga mussels are fully established throughout the Great Lakes, with additional invasive populations detected across the continental U.S., including southern California.

### **REFERENCES:**

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**Ricciardi, A., and H. J. MacIsaac. 2000.** Recent mass invasion of the North American Great Lakes by Ponto–Caspian species. Trends in Ecology & Evolution **15:**62-65.



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