

Exotics in the Chesapeake

UNDERSTANDING SPECIES INVASIONS • FACT SHEET NUMBER ONE

An Introduction

What Are Exotic Species?



PHRAGMITES

Exotic species are plants, animals or microbes that have been transported from one geographic region to another. They may be brought intentionally or they may find their way from place to place by hiding with imported products — such as fruits and vegetables — or in the ballast water of large ships.

Of course plants and animals move throughout the world as part of a natural dynamic, the very means by which species — including human beings — have spread around the globe. But prior to modern times, mechanisms for moving from continent to continent were few, and slow. Now organisms can move from Asia to Europe, from Europe to America, in a matter of days on a fast ship, or in a matter of hours by plane.

This means that organisms can move out of their natural ecological fabric — where eons of evolution have established a balance, for example, between predator and prey — to an area where they may have no natural competitors or other controls, and may therefore reproduce unchecked.

According to a report by the U.S. Office of Technology Assessment (OTA), “Harmful Nonindigenous Species in the United States,” harmful introductions result about equally from intentional and unintentional means. This emphasizes the substantial risks associated with introduction of foreign plants and animals, whether for agriculture, the aquarium industry, recreational fisheries, or other uses.

In the United States a number of exotic species have become established, in some instances caus-

ing ecological disruptions. According to one report, at least 4,500 species have established free-living populations in the U.S. About 15 percent of these cause significant harm. One estimate places losses caused by exotic species between 1906 and 1991 at nearly \$100 billion. An increased rate of exotic introductions could mean as much as \$134 billion in future losses — or more. Despite this threat, the pace of introductions has not slowed. In the U.S. about 205 new exotic species have been detected since 1980, and 59 of these — or 1 in every 3 or 4 — are expected to cause economic or environmental harm.

Clearly, exotic species can be a mixed blessing. Some — like the Gypsy moth — have become serious pests and can cause real economic and ecological problems. Others — like the honey bee — are considered valuable natural resources. In fact, American agriculture boasts a long list of species brought from other continents, including soybeans from Asia; beef cattle and dairy cows from Europe; and many plants, including weeping willow, chicory and Queen Anne’s Lace brought by European colonists, and honeysuckle from Japan. Some plants, like Kudzu, were introduced for management reasons (to control soil erosion), and then took off, growing wildly beyond our expectations.

The same is true of many aquatic species. Americans have introduced some aquatic plants and animals intentionally, like the brown trout, while other species, like the sea lamprey, have come by accident and caused serious trouble.



ZEBRA MUSSEL

Of the most recent aquatic invaders, the zebra mussel is perhaps the most infamous, causing considerable economic loss and environmental impact. A native of the Caspian Sea in Eastern Europe, the zebra mus-

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sel has been heading our way for decades. Having colonized the canals of Europe for years, the zebra mussel has hitch-hiked on barges and ridden slow-moving currents to extend its range. When it reached Western Europe, this striped mussel suddenly got a boost — it traveled thousands of miles in a single trip, most likely in the ballast water of a freighter bound for the Great Lakes. The result? In the mid-1980s zebra mussels suddenly turned up in Lake St. Clair, near Detroit. Within a few years the prolific mussel had reproduced and spread throughout many of the Great Lakes and down the Mississippi River to New Orleans, transported by currents but also by attaching to river barges and other boats.

The spread of zebra mussels has been astounding. The mussels have clogged filters and intake pipes, and even caused the water company of Monroe, Michigan to temporarily shut down. Electrical utilities and others have spent large sums of money cleaning their intakes, and industry is looking at new materials and new ways of preventing biofouling by zebra mussels. In the Great Lakes region alone, clean-up costs have been estimated in the billions of dollars.

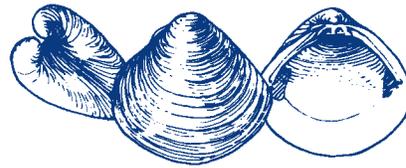
The mussels have caused environmental damage as well, out-competing native species for space and for food. In some areas the mussels are so abundant that they have cleared the water of algae. This may be good on one level, but it may also mean that zebra mussels are removing, through their filter-feeding, plankton normally consumed by other fish and shellfish. This shift in how food is apportioned among species could obviously have serious effects on local food webs. In addition, dense populations of zebra mussels have led to increased nutrients as a result of their excreting waste into the water. This can lead to greater availability of phosphorus and greater numbers of organisms that thrive under these conditions, such as noxious blue-green algae.

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The Chesapeake Bay has not yet seen impacts as dramatic as those of the zebra mussel or the sea lamprey in the Great Lakes — though there has been speculation that devastating oyster diseases such as “MSX” (*Haplosporidium nelsoni*) or “Dermo”

(*Perkinsus marinus*) may have arrived with oysters brought to the Bay from other regions. Other exotics include plants like watermilfoil and hydrilla, and fish like the common carp, which was introduced into the United States by the U.S. Fish and Wildlife Service (FWS) in 1876 and is still abundant in many of our creeks and rivers.

Other non-native species that have come to the Bay include the Asiatic clam (*Corbicula*), which occupies space that could be habitat for native species. This thumb-sized clam is, like the zebra



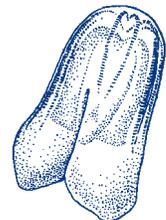
CORBICULA

mussel, a fouler of power plant pipes. Also invading the Chesapeake's rivers is the brackish water clam (*Rangia*) and, in higher

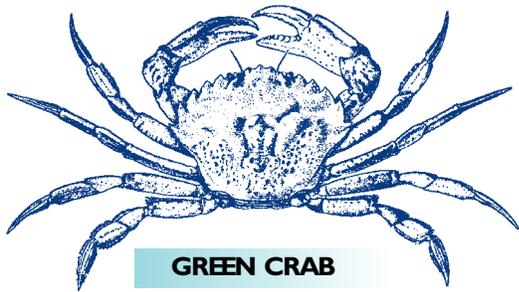
salinity areas, the Japanese shore crab and, newly discovered in the southern Bay, the Rapa whelk. In freshwater streams that feed the Bay's rivers, introduced brown trout often out-compete brook trout, a native species in the Bay watershed.

The Chesapeake Bay is not only on the receiving end — this region also sends marine species to other areas, for example, through ballast water. Bay species that have traveled elsewhere include the blue-backed herring, which has invaded the Great Lakes, and the comb jelly, which has invaded the Black Sea and had a serious impact on the anchovy fishery there, by competing with anchovy for planktonic food sources.

The effects of invasions by non-native species are not always predictable. Impacts range from extinctions of individual native species to changes in whole ecosystems. If, for example, it were shown that the oyster parasites MSX or Dermo were introduced as exotics to the Chesapeake Bay, one could argue that the estuary's entire oyster population has been affected. This effect includes not only a decimated oyster fishery with direct economic losses — but also the degradation of the Bay ecosystem, because of the oyster's essential role in removing algae from the water.



COMB JELLY



Such connections remain difficult to prove, though we do know that in other areas of the East Coast non-native species have established a strong foothold and created havoc. Along the shores of New England, for example, the green crab — a native of the Baltic Sea and familiar to Scandinavians — has long established a free-living population, and occurs in such high numbers that in the northeast commercial fishers worry that the crab may be eating young scallops and other valuable seafood. In Martha's Vineyard, one town offers a bounty for green crabs (reminiscent of the "penny a head" bounty on starlings earlier this century) in an effort to rid them from their local waters. Though more rare, the green crab now ranges as far south as the lower Chesapeake Bay.

Responding to the Problem

In the Bay region, concern over exotic species has mounted, leading to the development by the Chesapeake Bay Program of a Baywide strategy for managing nonindigenous introductions ("Chesapeake Bay Policy for the Introduction of Nonindigenous Aquatic Species"), a coordinated effort with its state and Federal partners. The Chesapeake Bay Commission has focused on this concern, and is working with the federal government toward the development of national legislation to regulate ballast water discharge.

Concern has spread through many regions of the country and resulted in the passage of the Nonindigenous Species Act (NISA). NISA builds on the Lacey Act (1900), the primary federal vehicle for excluding harmful imports. Under the Lacey Act, the U.S. Fish and Wildlife Service restricts importation into the country of fish or wildlife that pose a threat "to humans, agriculture, horticulture, forestry, or to wildlife or the wildlife resource of the United States." The National Environmental Pro-

tection Act (NEPA) does not address nonindigenous species directly but has been used in at least one case to address nonindigenous species through an environmental impact statement (for predicting the effects of introducing Chinook salmon into Delaware Bay). And an Executive Order concerning exotic species was issued by President Jimmy Carter in 1977 (see below).

Passage of the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 created the interagency Aquatic Nuisance Species Task Force, charged with development of programs for the prevention, monitoring and control of unintentional introductions. This 1990 legislation authorized the Fish and Wildlife Service and the National Oceanic and Atmospheric Administration (NOAA) to issue regulations related to the prevention of unintentional introductions of aquatic nuisance species, like the zebra mussel. Although no such rules have been issued to date, eventual regulations under the Act could impose additional restrictions on the importation of harmful aquatic nonindigenous species. At present, according to the OTA, tens of thousands of new species could potentially be legally imported into the U.S.

Most recently, President Clinton has issued the "Invasive Species Executive Order" (1999), which replaces the 1977 order and establishes a special council to oversee efforts to control unwanted exotic species. This Invasive Species Council will be co-chaired by the Secretary of the Interior, the Secretary of Agriculture and the Secretary of Commerce. The Council will also include the Secretaries of State, Treasury, Transportation, and the Administrator of the Environmental Protection Agency. At least at one level the U.S. appears to be taking potential economic and ecological threats posed by exotic species very seriously.

Still, much remains to be learned. At research laboratories around the country, scientists are confronting difficult questions. How far into saline waters will zebra mussels spread? Why do some aquatic plant populations explode and then decline? What plants and animals — including microbes — are being brought to the U.S. by shipping and other means, and which of these were introduced by our forebears so long ago that to us they seem part of the natural coastal ecosystems?

Only through detailed analysis and creative thinking will we begin to understand the true impact of modern transportation on the movement of species from one part of the world to another. And only through such understanding can we assure that all our efforts to restore important native species in the Chesapeake Bay are not thwarted by the invasion of unwanted animals or plants, including toxic algae, dinoflagellates or other microscopic pests.

References

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For Further Information

This publication is one of a series of fact sheets on exotic species in the Chesapeake Bay produced for the Chesapeake Bay Program by the Maryland Sea Grant College and the Smithsonian Environmental Research Center. Printed copies of these fact sheets are available at the offices listed below; they are also available on the Maryland Sea Grant web site.

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Smithsonian Environmental Research Center
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Edgewater, Maryland 21037
www.serc.si.edu/invasions/index.htm

Chesapeake Bay Program Office
410 Severn Avenue, Suite 109
Annapolis, Maryland 21403
www.chesapeakebay.net

Selected Web Sites

Aquatic Nuisance Species Task Force:

<http://www.ANSTaskForce.gov/>

Sea Grant Nonindigenous Species:

<http://www.ansc.purdue.edu/sgnis/>

Invasive Plants of Virginia:

<http://www.state.va.us/~dcr/dnh/invlist.htm>

<http://www.hort.vt.edu/vnps/invasive.html>

Rapa Whelk Research:

<http://www.vims.edu/fish/oyreef/rapven.html>

National Biological Information Infrastructure:

<http://nbii.gov/index/html>

Nonindigenous Aquatic Species:

www.nas.er.usgs.gov

Zebra Mussel Clearinghouse:

<http://cce.cornell.edu/seagrant/nansc/Products.htm>

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