



Aliens in Our Midst *Chesapeake Bay is highly invaded*

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Our trawler *Bright Pleiades* is moored within a green curve of forest and marsh at the head of the Rhode River. The springtime anchorage, surrounded by the preserve of the Smithsonian Environmental Research Center, appears as pristine as any on Chesapeake Bay. But beneath the mirror of water and along the shore, a silent biological invasion has been underway since Europeans arrived.

Elegant but ecologically destructive mute swans paddle past the boat. They were introduced to the Bay in 1962. Another Bay invader is the nutria, a voracious, big brown rodent brought from South America.

Invaders alter ecosystems and may outcompete native species.

We can't see some of the most destructive lifeforms such as the tiny protozoa — one-celled organisms — that cause MSX and dermo, diseases that have helped to push the Bay's native oyster to 0.2 percent of its historic levels.

“The Chesapeake Bay is highly invaded,” says Smithsonian biologist Greg Ruiz, who heads a laboratory a mile uphill from shore. His team has compiled a database

of 160 confirmed Bay invaders and more than 40 other probable candidates. This is the first broad look at biological invasions at a coastal Atlantic site in the U.S.

Alien Transport

Many aliens from coastal ecosystems arrive on ships from foreign ports. In the past, invaders often hitchhiked by attaching to a ship's hull. This process, known as fouling, is less prevalent today thanks to metal hulls, anti-fouling paints, shorter port stays and faster ships.

The now favored means of invasion of the Bay — indeed, for coastal waters worldwide — is ballast water dumped from ships. Big ships fill ballast tanks at overseas ports and use the water to keep stable at sea. The water is taken from and discharged in coastal waters, all home to a rich plankton soup of tiny animals and plants.

Some ships flush ballast water as they come up the Bay. Until recently, a ship arriving at Baltimore from the Mediterranean might have discharged hundreds of species into the harbor. Most would not have survived.

Since 2005, the law has required ships coming to the United States to exchange coastal ballast water for mid-



Invasive Phragmites at West Point, Virginia.



Chesapeake
Winter

ocean water, whose species are less likely to thrive in port. But the practice is not foolproof. Bad weather can prevent a ship from carrying out a safe exchange on the high seas. Also, not all alien babies are flushed out with the bathwater; some coastal organisms remain in the tank.

As ballast technology has changed, so have the species that travel along. Before 1880, wooden ships carried sand, stone and brick ballast. Part of Old Otterbein Methodist Church in downtown Baltimore, dating from 1785, was built with ballast bricks tossed from ships into the harbor.

Counting the Aliens

“A big wave of plants” came in with dry ballast, Ruiz says. In the mid-20th century, as water ballast took over, marine invertebrates dominated as invaders.

Knowing what lurks in ballast tanks is a step to preventing invasion. Smithsonian and fellow researchers have studied what lives in the tanks of more than 200 ships arriving in the Chesapeake from foreign ports. Bacteria and viruses abound. Larger oddities have included a mullet about a foot long that arrived in Baltimore in 1995, and, in another tank, an entire school of fish. Many species reproduce well in the lab.

Today’s Chesapeake Bay is the unfortunate recipient of more foreign ballast water than any other port system on the U.S. Atlantic and Pacific coasts except New Orleans. Even domestic arrivals may contain residual water from foreign ports.



Ballast water on freighters can transport hitchhiking life all over the world.

The type of ship, where it set out from and how long it took all influence which hitchhikers survive and thrive, the researchers have learned. Bulk carriers — which visit the Chesapeake in abundance — discharge more ballast water than do container ships. Most overseas traffic comes to the Bay from Northern Europe, the Black Sea (home of the zebra mussel) and the Mediterranean. The longer a voyage, the less chance an invader usually has of making it.

Not long ago, Smithsonian researchers reported the first case of a native predator — the Bay’s own blue crab — keeping out a marine invader, the green crab, which has spread worldwide by various means, possibly including ballast water. From Maine to Virginia, wherever blue crabs abound, greens do not; the blues eat them up.

Seeking the Cure

At another laboratory on Solomons Island, scientists are working on new methods to treat ballast water. David Wright of the Chesapeake Biological Laboratory has tested biocides from plants. Toxic to life in a dark tank, they break down quickly when exposed to light. He has also tested ultraviolet light and a filter method aboard the Coral Princess cruise ship. The UV light killed many types of plankton.

Colleague Mario Tamburri has worked on another technique: bubbling nitrogen through ballast water to reduce oxygen. This method not only kills many species but also cuts down on tank corrosion and uses machinery already on ships, so it has proved popular with ship owners and crews. Tamburri is now testing an oxygen-removal device on commercial ships.

Such efforts can’t bear fruit too soon. Aquatic invaders are burgeoning in places of international commerce, changing ecosystems around the globe. On any day throughout the world, the Smithsonian team says, thousands of species are swimming in ballast water en route to new locales. Marine invaders cost the United States an estimated \$10 billion each year.

Scientists now have a better picture of how ballast and its hitchhikers come to harbors of the Chesapeake than for any other port in the world, Ruiz says. That’s an initial foundation for fortifying against further invasion.