Exotics in the Chesapeake

UNDERSTANDING SPECIES INVASIONS • FACT SHEET NUMBER THREE

Exotic Plants

Imagine that on Memorial Day you noticed in the creek near your home a plant growing that you had not seen before. Then by the Fourth of July the plant covered so much of the creek that special mowers were necessary to open channels to allow boats through, and several weeks after Labor day, as the dense growth began to decay, the oxygen levels in the creek dropped dramatically, causing fish to die and forcing crabs to crawl out of the water.

Scenes such as this — or very similar — have in fact occurred in many waterways around the world. In the Chesapeake Bay region in the late 1950s and early 1960s an exotic plant called Eurasian watermilfoil grew so thick that mowers did have to clear channels for boats. The spread of such plants can be rapid. In the northern Bay, for example, on the Susquehanna Flats, sample sites went from zero coverage of milfoil in 1957, to 1 percent in 1958, to 47 percent in 1959, to 94 percent in 1960. More recently, on the Potomac River, mowers have been used to open channels through hydrilla (*Hydrilla verticillata*), an exotic plant which quickly took hold after it was accidentally planted there.

Are exotic plants necessarily a threat to the Chesapeake Bay or its watershed? Do non-native plants crowd out native plant species and reduce biodiversity? Can they provide the same quality of food and habitat as native plants for wildlife in the Chesapeake region?

These are a few of the fundamental environmental questions people are asking about exotic plant species in the Chesapeake watershed. As is often the case with environmental problems, answers will likely be complex. Some non-native plants, like hydrilla for example, may be a mixed blessing. Although an unwelcome invader in tributaries of the Potomac and spreading steadily throughout the watershed, hydrilla consumes nutrients, produces oxygen and provides habitat that many argue has played a critical role in the restoration of important gamefish in the Potomac River. Others argue that hydrilla displaces or prevents reestablishment of native aquatic plants, such as wild celery or widgeongrass, thereby reducing biodiversity both through the loss of the plants themselves and through loss of the animals that depend on them. There may be other impacts as well, such as interference with the spawning areas of some fish.

Exotic Plants and Ecology

Aquatic plants play a critical role in coastal ecosystems like the Chesapeake Bay, providing food, oxygen and cover for organisms that have co-evolved with them. There is often a critical balance between aquatic plants and their environment, so that disruptions caused by excess nutrients, toxicants or even competition from exotic species may eliminate native forms and open up “niche space,” the physical space and other resources required to support a particular species. When native forms are stressed in this way, exotic plants may take their place, just as on land a cleared lot may fill with weeds, which are capable of rapid growth, high seed production and many ways of spreading.

Why should we be concerned when one species replaces another? After all, all plants produce oxygen, consume carbon dioxide, use nutrients and provide cover. The answer has to do with what we want from our environment. For example, many exotic plants grow profusely, but some provide little food for native animals or plants. In some cases, as with yellow iris (*Iris pseudacorus*, abundant in some Potomac marshes), the invaders may even be toxic to grazing animals.

Exotic Plants and the Chesapeake

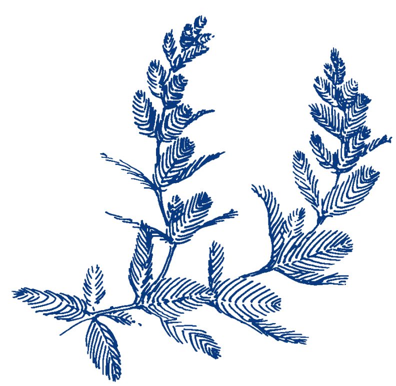
When colonists settled along the rivers of the Chesapeake they brought Old World customs and habits with them — and Old World plants.

According to John Smith, by 1629 colonists already had "gardens wherein doth grow all manner of herbs and roots we have in England." As in the case of imported diseases that spread among the Bay region's native human populations, there was no natural environmental "resistance" to these new plants. The environmental mechanisms that normally control a species — including predation, disease and competition — were not present, so these invaders reproduced and spread more-or-less unchecked. The problem of exotic species introduction into the Chesapeake and other regions is not simply a historical one. Introduction of exotic plants and animals is an ongoing problem, and the presence of species introduced early in the colonization of America — like dandelion, Queen Anne's lace and chicory — remains a reminder of the long-term consequences of exotic species introductions.

Because colonists were busy with surviving in a new environment, botanical studies were not a high priority. The first known plant collections in the region occurred in Maryland in 1698, but until the early 19th century information about the plants around the Bay remained sporadic. Many species were probably brought in very early, often in the stones and sand used by ships as ballast, before there were botanists to record them. Centuries later, we are unsure whether many of these plants are introduced or native, and so we use the term "cryptogenic" to indicate their uncertain origin. The most prominent example may be the common reed (*Phragmites australis*), which has been aggressively invading wetlands all along the East Coast in the last few decades. Common reed is known to have been in North America before the arrival of Europeans, but many scientists suspect that the recent rapid spread of this plant is due to the arrival of a new variety of unknown origin. Common reed has invaded many wetlands around the Bay in the last few decades, rapidly replacing native plants, especially in disturbed areas. These invasions are widely believed to adversely affect fish, birds and other wildlife, but more study is needed to determine the effects of this wide-ranging marsh plant.

PHRAGMITES

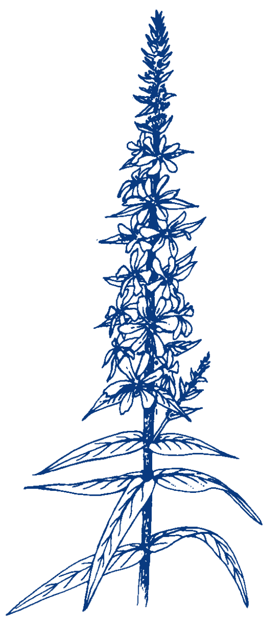
Over time, then, there has been a succession of introductions of exotic plants into the Chesapeake region. One, alluted to earlier, that has had widespread consequences in the Bay itself is Eurasian watermilfoil (*Myriophyllum spicatum*), an aquatic perennial that was introduced in the U.S. in the 1940s from Eurasia, either from aquariums (where it is commonly used) or from international shipping. Milfoil favors fresh or brackish water in ponds, lakes, streams and rivers. It is highly competitive with native species and may dominate aquatic vegetation just years after introduction. Because of its capacity to form dense growths, it interferes with many uses of aquatic systems, often with little benefit to fish or wildlife.



WATER MILFOIL

Following its introduction to the U.S., Eurasian milfoil spread rapidly and now occurs in over 30 states east of the Mississippi. A pollution-tolerant species, it can thrive in disturbed areas where native species may already be stressed or reduced. Eurasian milfoil, like other plants introduced in areas that have lost many of their native species, may have a short-term benefit in habitat improvement (by providing at least some form of vegetation). It is becoming increasingly evident, however, that long-term consequences may often outweigh short-term benefits.

Another Eurasian species to become problematic in the U.S. is purple loosestrife (*Lythrum salicaria*), seen in the wild in New England in 1830 and first recorded in the Chesapeake region in 1896. In contrast with Eurasian milfoil, purple loosestrife does not grow submersed in water but in shallow water or moist soil. With its reddish purple flowers, purple loosestrife is a perennial herb that may reach two meters in height under favorable conditions. Although the mechanism of introduction is uncertain, we know that purple loosestrife was introduced into the eastern U.S. almost 200 years ago, perhaps through ship ballast or maybe in livestock feeds. The fact that purple loosestrife was an important medicinal herb and ornamental suggests it may have been introduced intentionally. Purple loosestrife's successful spread is probably due to a lack of predators in North America and its high reproductive capacity — up to 300,000 seeds may be produced from a single stalk.



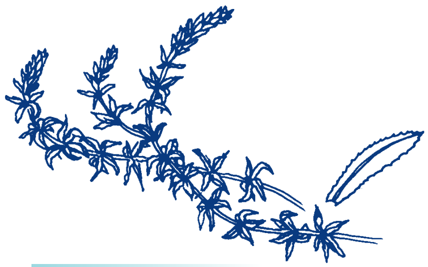
PURPLE LOOSESTRIFE

Because purple loosestrife can out compete native wetland species, it can change the character and ecological function of a marsh. This is a serious threat when we consider the overall loss of wetland areas and the important role wetlands play in preserving water quality in the Chesapeake. Many Bay wildlife species depend on wetlands and their native plants.

In the Anacostia River watershed, for example, purple loosestrife invaded a newly restored wetland in Kenilworth Aquatic Gardens, Washington, D.C., threatening to change the ecological character of the marsh. Here, and in much of the U.S. and Canada, a biological control program is underway, involving the release of three European beetles which feed almost exclusively on this plant. Biologists hope that carefully researched introductions will reduce by ninety percent the overall density of purple loosestrife in North America.

In the early 1980s another exotic plant, hydrilla, appeared in the Potomac River, planted there accidentally by resource specialists who mistook it for the aquatic plant elodea. Hydrilla was already present in a number of ponds and marshes in the Potomac watershed, so its appearance may well have been inevitable. The new introduction soon took off and began to form large mats on the river. Hydrilla has been described as "the perfect aquatic weed" because its specialized patterns of growth, physiological features and reproductive strategies make it highly adapted for life in aquatic environments.

A native of southeast Asia, hydrilla was first found in the United States in Florida in the 1960s. Since then it has spread rapidly and is now found in all states of the Gulf Coast and up to Connecticut along the Atlantic Coast and in western states including Arizona, California and Washington. One of the greatest concerns caused by hydrilla infestation is the loss of native species of aquatic plants. Hydrilla is a highly effective competitor, in part due to its rapid growth (a rate of elongation up to an inch per day) which enables it to create mats near the surface, intercepting light otherwise available to support native plants. In addition, hydrilla effectively uses low light — as low as 1% of available sunlight — which enables it to grow at considerable depths, often 30 feet or more. Hydrilla has a high reproductive capacity, using four distinct reproductive mechanisms: fragmentation, or the establishment of new plants from pieces of hydrilla that might be broken off by boating or other human activity; turions, which are compact buds that are released from the plant at maturity and grow into new plants; tubers, a type of turion produced in the sediments on rhizomes; and seeds, which are not as significant as the other methods.



HYDRILLA

There are a number of negative consequences of hydrilla infestation, including reduction of flow in irrigation systems and canals, interference with navigation, and ecological disruption through interference with native plants and fish populations. In the Chesapeake region, hydrilla has spread rapidly, causing problems in cooling ponds of a VEPCO power-generating utility company in Lake Anna, Virginia, interfering with boating and recreational fishing in the Potomac River, and invading lakes and ponds, including areas used by the developing aquaculture industry.

ELODEA

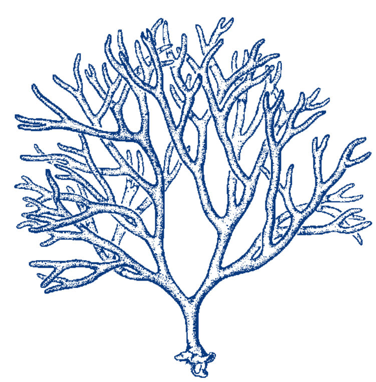
Not all exotic plants are easy to see with the naked eye. In the Chesapeake Bay and the nearby ocean, tiny algae also arrive on the hulls or in the ballast tanks of ships. Shipping, as well as fishing activities, have brought not only several species of exotic seaweeds, but also microscopic plants (called phytoplankton). Scientists are still trying to determine which of these may be exotic — a difficult task — and they have identified at least two single-celled plants (in this case, diatoms) that have come to the Chesapeake and the Atlantic from the Pacific Ocean. One of these (*Coscinodiscus wailessii*) caused "blooms" in the Atlantic off Maryland in 1978. Slimy mucus from this diatom coated fishnets, making them difficult to handle. Scientists have also documented the transport of dinoflagellates (another type of single-celled algae) from Japan to Australia, but whether similar species of microscopic plants have come to the Chesapeake Bay in ballast water and become established here remains unknown.

Exotics Roulette

One of the fundamental requirements for a plant or animal species to be successful is the ability to move or be transported from one place to another. This movement is called dispersal, and anyone who has ever watched the wind scatter dandelion seeds or seen the seed pod of the touch-me-not pop open or pulled a cocklebur from a sock has seen how nature accomplishes its need for dispersal. Like so many things that contribute to ecological balance, the transport of an organism within its natural range contributes to the health of a population and the ecosystem it inhabits, while transport out of that range may lead to unforseen changes.

Reducing or eliminating the problem of exotic plant introductions requires that we prevent the transport of species from one region to another; or, if it is determined that a plant species should be intentionally introduced to a new region, making certain that this exotic species will not cause problems or become invasive. Preventing transport is a formidable problem because, as mentioned previously, dispersal mechanisms generally form part of a plant's natural traits. Plant species can be transported as seeds or tissue fragments or whole plants. Plants like *Codium*, a seaweed species introduced into the Northeastern U.S. from Europe, or hydrilla, as discussed above, may arrive as whole plants and then be rapidly dispersed through reproduction or fragmentation. Others, like dandelion, chicory, and purple loosestrife, may have been introduced via cultivation from seeds and now continue to be dispersed via natural reproduction and seed dispersal.

If dispersal is a natural and beneficial aspect of the biology of plants



CODIUM

and the structure and function of ecosystems, what is the concern? As with all exotic species the answer depends upon the value we place on natural intact ecosystems and organisms. Exotic species are ecologically out of place — and “place” in an ecological context includes the “natural framework” that not only supports a sustainable food web but that also limits the number and range of a species. This natural system of checks and balances includes resource competition, predation and disease.

Although dispersal of some plant species over considerable distances is a natural occurrence (e.g., the drifting of coconuts), the increasing frequency of rapid, long-distance travel by humans has increased risks for unwanted exotic plant introductions. We know that there are costs or consequences with exotic plant introductions — are there any benefits that justify the risks of introduction? In some cases many people would answer “yes.” Such industries as agriculture, aquaculture, the aquarium trade and home gardening employ the use of exotic plants often, and provide conduits for unplanned introductions. Some plant species we introduce become sources of major economic activity — soybeans, for example, were introduced from Asia and have become a major part of plant oil and protein production in the U.S. Introductions of species can be justified based on benefit, but should be carefully considered against risk. Fortunately soybeans are not invasive.

Taking Back Control

Once invasive exotic species have arrived, we must learn to deal with them. Managing unwanted aquatic vegetation can be accomplished using mechanical, biological or chemical techniques. Increasingly, following the lead of terrestrial experience, resource managers are using “integrated” approaches that employ combinations of techniques, with the goal of effective control and reduced chemical use. Mechanical control can prove as simple as removal with hand tools or as involved as the use of aquatic mowing devices such as those used to open areas of the Potomac choked with hydrilla.

Biological control methods for aquatic plants are limited compared with those for terrestrial weeds but are beginning to play more of a role. For example, officials have addressed hydrilla problems in the VEPCO cooling ponds of Lake Anna, Virginia by introducing triploid (presumably sterile) grass carp. Both hydrilla and water milfoil have been successfully treated using insects as control agents. The use of biological controls, although promising, can cause its own problems. In some documented cases, imported controls have in turn led to unwanted introductions. Both the grass carp and the insects noted above are themselves exotic species.

Chemical control methods are effective and used widely, although there are few products available and there is potential for environmental harm. Of the available herbicides, Glyphosate formulations (e.g., Rodeo) are widely used in management of emergent plants like common reed, while fluridone, endothall and diquat are frequently used for submersed species like hydrilla or water milfoil.

Many states, especially in the Great Lakes region, urge boaters to check their boats and trailers for entangled water plants, in order to minimize the spread of Eurasian watermilfoil and other invasive plants. Some seaweeds in the Chesapeake Bay, including the invasive *Codium*, may have come from the careless dumping of weeds used to pack bait, such as bloodworms. Natural resource agencies urge those who fish, or who own aquariums or fish ponds, not to dump aquatic plants into the Bay, or into the ponds, streams and creeks that drain its watershed.

As with exotic aquatic animals such as carp and brown trout, exotic aquatic plants must be evaluated for their benefits and for the problems they can cause. Careful thought and analysis before introductions take place is clearly the best policy. Once a species has taken hold, eradication or control can prove costly, or even impossible.

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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.

Fact sheets that describe the biology and control of aquatic weeds, whether exotic or not (*Aquatic Plant Fact Sheets*), are also available from Maryland Sea Grant Extension at the address below.

Maryland Sea Grant College
0112 Skinner Hall
University of Maryland
College Park, Maryland 20742
www.mdsg.umd.edu

Smithsonian Environmental Research Center
P.O. Box 28
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

National Biological Information Infrastructure:
http://nbii.gov/index/html

Nonindigenous Aquatic Species:
www.nas.er.usgs.gov

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