



Proceedings of the Aquatic Invaders of the Delaware Estuary Symposium, Malvern, Pennsylvania, May 20, 2003, pp. 3-5.

Economic and Ecological Costs Associated with Aquatic Invasive Species

Abstract: More than 50,000 non-indigenous species have invaded the United States and their ecological damages and control costs total more than \$137 billion/yr. The most serious aquatic invading species based on damages and control in terms of millions of dollars per year are fishes (\$5400); zebra and quagga mussels (\$500); others (\$3000). One of the most serious ecological costs of biological invading species is the extinction of native species caused by non-native species. Approximately 40% of the species forced to extinction in aquatic ecosystems are due to predation, parasitism, and competition from biological invaders.

A significant driving force to fuel the increased pace of invasive species introductions worldwide has been the dramatic increase in human population movements and foreign imports of food products. The United States population is growing by 3.3 million each year and the present population of 285 million is expected to double in the next 70 years. Most foodstuffs are introduced; the average American consumes 2,200 lbs/ yr. or about 3,600 cal/ day. Not all introduced species are invasive. For example, 99% of crops and 100% of livestock have been introduced to the United States. Ninety percent of world food, including the United States, relies on 15 plant and 8 livestock species.

However, a major effect of human driven invasive species introductions is a loss of biodiversity. It is estimated that exotic species have contributed to 40% of species extinctions in the United States. Florida alone now has 25,000 exotic plant species and only 2,500 native plant species. Nationwide there are about 18,000 native species while 50,000 exotic species are now established. Over 128 species of agricultural plants have become serious weeds including Johnson grass and purple loosestrife.

Over fifty thousand species have been introduced in the United States, causing \$137 billion in damages each year. Below is a breakdown of these introductions:

<u>Taxa</u>	<u>Number of Species Introduced</u>
Plants	25,000
Mammals	20
Birds	97
Mollusks	88
Arthropods	4,500
Microbes	20,000

The mongoose is a classic example of a biological control disaster. The mongoose was introduced in the West Indian Islands (including Puerto Rico) and Hawaii to control tree rats and Norway rats that were decimating sugar cane crops. Unfortunately, it only preyed on the Norway rat. As the Norway rat population declined, the tree rat populations flourished, and sugar cane crop damage continued. The mongoose itself has been responsible for the extinction of 12 species of birds and lizards in addition to harboring rabies and *Strongyloides* which both present a risk to human health.

About 4,500 species of exotic arthropods are present in the United States including gypsy moths and fire ants (that have attacked birds, snakes, chicks and killed 2 people in Mississippi). About 40% of our insect pests in the United States are exotic, costing \$14.5 billion annually in damage and pesticide applications. The United States applies 1 billion of the 5 billion lbs of pesticide sprayed yearly, which in turn, has significant ecological impacts.

Exotic microbes comprise the highest percentage (65%) of crop pathogens (e.g. Dutch elm, and American chestnut blight). Damage and control associated with these pathogens costs nearly \$23 billion/yr, discounting the environmental impact of associated pesticide applications.

Aquatic Invaders

Associated damages and costs of controlling aquatic invaders in the United States are estimated to be \$9 billion annually:

Fish	\$5.4 billion
Zebra and quagga mussels	\$1 billion
Asiatic clam	\$1 billion
West Nile Virus (WNV)	\$1 billion
Aquatic plants	\$500 million
(Cost of mechanical and chemical aquatic weed control ranges from \$2,000 to \$6,000/hectare/yr; one established, removal is very difficult.)	
Shipworm	\$205 million
Green Crab	\$100 million

Exotic diseases including those associated with waterborne vectors, such as West Nile Virus (WNV), which affects 4,200 people annually, are extremely hard to combat. Mosquito spraying for WNV costs \$15/ person/ yr in affected communities. Public education and screening programs for United States ports of entry can minimize exotic disease transmission. Better risk communication among federal agencies such as the USDA and health services is also needed. An example of an extremely invaded aquatic system is San Francisco Bay, host to 234 alien species. There, 90% of the species and 99% of the biomass are composed of introduced species. From 1851 to 1960, 117 new species were introduced to the Bay. From 1960 to 1995, an additional 117 species were introduced. The pace of introductions has accelerated, a national trend that is expected to continue.

Discussion Questions:

Q – What are your data sources?

A – Lots of places, for example, there are 63 million cats in the United States. How many birds does each cat kill? By looking at the literature we estimate about 13 birds/cat/yr, which totals 500 million birds. What's the value of a bird? Birders spend \$0.40/bird/year while hunters spend \$260/bird shot. Exxon paid \$800 to replace each bird that died in the Valdez oil spill. We used a figure of \$30/bird although some ornithologists were not happy with our figure. It's a difficult thing to determine, however, decision makers are more likely to listen to you if you speak numbers.

Q – The number of species coming in is daunting. Is there any hope?

A – We shouldn't give up, although I know of only 2 successful exterminations; the Mediterranean fruit fly and the citrus canker. Human and livestock diseases alone are major problems.

Q – What do you think about the intentional introduction of the Asian oyster in the Chesapeake?

A – I think we should proceed very, very cautiously. The problem is that once released, it cannot be taken back.

[View Entire Proceedings \(9.75 MB\)](#)

Contact: David Pimentel, College of Agriculture and Life Sciences, Cornell University, 5126 Comstock Hall, Ithaca, NY 14853, USA

Key Words: [Nonindigenous](#), [Zebra mussel](#), [Quagga mussels](#)

Product Type: [Publication](#), [Proceedings](#)

User Type: [General](#)