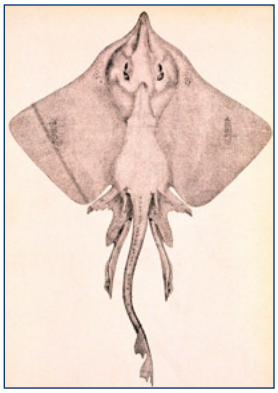
Swim for the River

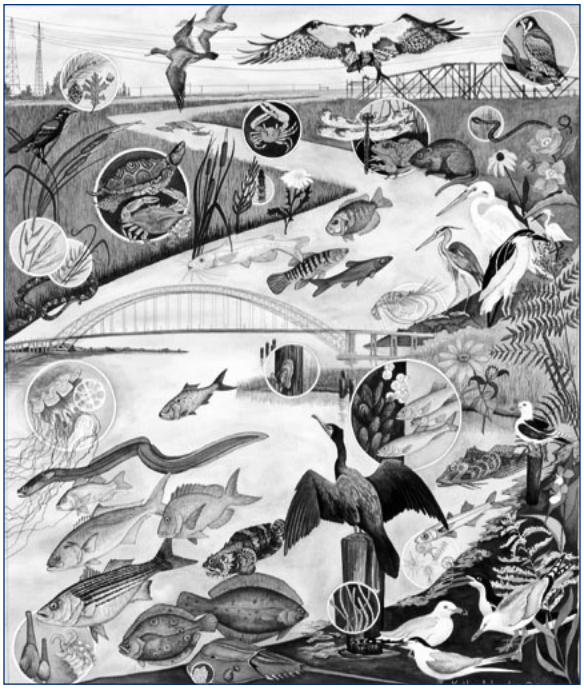
The Estuary

Biodiversity and alien species
(Environmental Science)



Barndoor skate

If you visit the Hudson River exhibit in the state museum in Albany, you can see a preserved sea creature called a barndoor skate. The really odd thing about this ocean fish is that it was caught near Albany, 150 miles inland. Other saltwater animals, notably ***dolphins and porpoises***, were seen in the central Hudson in the 19th century. Blue claw crabs are still found near Albany. How can saltwater species survive so far from the ocean? Because the lower Hudson is a saltwater estuary.



Estuaries are home to diverse species

Estuaries are bays, harbors, river deltas or marshes in which fresh-water from rivers mixes with salt water from the ocean. Protected from the big waves of coastal storms, estuaries are an ideal home for fish, crabs, plants and other aquatic organisms. Estuaries are often important fish nurseries or spawning grounds.

Being long and narrow, the Hudson estuary is different from other big estuaries like Boston Harbor, ***Puget Sound***, or ***Chesapeake Bay***. Geologists sometimes refer to the Hudson as a "drowned river." Visualize it as a long narrow valley that was inundated 14,000 years ago when the oceans rose at the end of the last Ice Age. The sea flooded the valley bottom, creating a long fjord or finger of ocean reaching far inland.

Fresh water draining from the Adirondack Mountains and the surrounding watershed mixes with salt water. Ocean tides reverse the flow of the river every six hours, all the way to Troy, which is 153 miles inland but only two feet above sea level.

Plankton are microscopic organisms

The widest point of the Hudson estuary, about three and half miles across, is at Haverstraw Bay. Striped bass, American shad, white perch, tomcod, and Atlantic sturgeon can be found there, 45 miles from the ocean. The bay is large and shallow. It is a major producer of ***plankton***,

which forms the base of the food chain. Blue claw crab and a variety of clams also make their home in the bay. Atlantic fisheries are supplied by stocks that spawn and grow there.

In the mid-twentieth century the Hudson River was seriously compromised by industrial pollution. Then in 1972 the ***Clean Water Act*** mandated a cleanup. Over time species that had almost disappeared from the bay returned. In 1987, the New York Department of Environmental Conservation classified Haverstraw Bay as a "***Significant Coastal Fish and Wildlife Habitat***," resulting in close monitoring and regulation.

The ratio of salt water to fresh water in an estuary determines the kind of species that live in it. As one would expect, the Hudson gets less salty as one travels inland, away from the ocean. Salt disappears from the river around the city of Newburgh, about 56 miles inland. The salinity in the river changes with the season and the amount of rainfall. In the spring, fresh water from rain and melting snow pushes the salty river water closer to the ocean. Catfish, carp, and black bass thrive on the nutrients in the outer fringes of this tidal "***salt wedge***."

Fish commonly found in both fresh and salt water are ***anadromous*** species that mature in the ocean and then swim into fresh water to spawn. Drive over any of the highway bridges crossing the lower Hudson or its tributaries and you will see a sign with the bony blue outline of a fish, reading "Hudson River Estuary." The fish is an ***Atlantic sturgeon.*** Selected as the symbol of the Hudson River, the sturgeon is a living relic from the age of dinosaurs. The fish has bony plates instead of scales. Its semi-reptilian appearance is due to the fact that it hasn't changed much in a hundred million years. Sturgeons can weigh from 70 to 500 pounds and grow to about six feet long. It takes 15 to 20 years for a sturgeon to become sexually mature, and it can live for 60 to 80 years.

Atlantic sturgeon

During most of the year sturgeon live in the ocean, swimming 50 to 100 miles offshore. Tagging studies have found Hudson River sturgeon as far north as the Gulf of Maine and as far south as the Chesapeake Bay. In the spring, when the river is flushed with fresh water, sturgeon swim upstream to spawn.

When Europeans colonized New York in the seventeenth century, sturgeon were so plentiful during their spring spawning run that they would clog the river's main channel, creating a navigational hazard. They were considered trash fish, but gradually tastes changed. By the late nineteenth century, smoked sturgeon was a delicacy. The residents of New York's capital, Albany, ate so much sturgeon steak they affectionately called it *Albany beef.*

Sturgeon eggs or roe were even more sought after than sturgeon steaks. ***Caviar*** from Hudson River sturgeon was served in the best New York City restaurants, and was a competitor to prized Beluga and other imported varieties from Russia and Iran. Thousands of pounds of Hudson River caviar were exported to Europe every year.

American caviar

The popularity of "Albany beef" combined with the profits to be had from caviar led to overfishing and the subsequent collapse of the fishery. Most commercial sturgeon fishing ended around 1900, but the population did not recover. The sturgeon's long life cycle made it particularly vulnerable to pollution, which

increased during the twentieth century. When the cleanup of the river began in the 1970's, the sturgeon started to return, but it will take many generations for them to reach their former numbers. Sturgeon are now a protected species, and it is illegal to catch them.


Zebra mussel

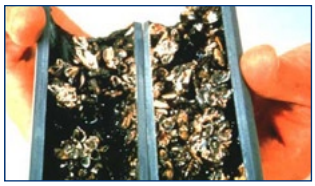
One species that is thriving is the ***zebra mussel***. Zebra mussels are like marine blue mussels but much smaller, with black and white stripes. They are not native to the Hudson but were brought there, unintentionally, in the 1980's. The little mussel was an aquatic stowaway in the ballast water of a ship. (Ballast water is seawater pumped into special tanks in a ship's hold to provide ballast – or extra weight – to give the ship a safer, steadier ride when it is not laden with cargo.)


Ballast water release

Only an inch to an inch and a half long, zebra mussels feed by filtering microscopic food particles out of the water. In the Hudson River they have done very well. According to aquatic biologist David Strayer (interviewed on-camera in the *Swim for the River* DVD), "There's enough zebra mussels in the Hudson right now to filter all the water in the river in every one to four days during the summertime."

Thanks to all the zebra mussels, water in the lower Hudson River is much clearer than it was. You might think that water clarity is a good thing until you consider this: Zebra mussels consume most of the suspended food particles (***phytoplankton, zooplankton***) that other organisms rely on. If you could put all the zebra mussels in the Hudson River on one side of a balance and all the other consumers in the river – fish, shellfish, plankton, worms, bacteria, etc. – were on the opposite side, the zebra mussels would outweigh everything else combined. They are crowding out other species. Some native shellfish are disappearing; some fish populations are declining. Strayer concludes: "The Hudson may look the same as it did before the zebra mussel invasion, but to an ecologist it's a completely different river."


Zebra mussels are crowding out other species


Water intake pipe blocked by zebra mussels

Zebra mussels also wreak havoc on man-made structures. They attach to boat hulls and clog the water intake pipes for cities and power plants. Since they first appeared in North America, $250 million has been spent to scrape them from intake pipes, to chlorinate water to discourage mussel larvae and to replace damaged equipment.

There is no lasting solution, no chemical or biological agent that could be used to eradicate the species without doing grave collateral damage to the ecosystem. The mussels let loose in the waterways of North America are unstoppable.

What can be learned from our experience with zebra mussels? David Strayer laments that many people, including environmental policy makers, think of zebra mussels or other

invasive species as simply "bad luck" – like getting struck by lightning. Something that just happens without warning or prediction and cannot be avoided. This is not true.

Zebra mussels are part of a man-created global phenomenon. They are what scientists call an "***invasive species***," life forms introduced to the environment by man – sometimes on purpose, sometimes not. Dozens of alien species are transported from one continent to another every year – in the ballast water of ships, in wooden shipping pallets that are home to wood-boring insects, in animal and agricultural products, and in human passengers. We never hear about most of these organisms because they are relatively benign or do not adjust to their new environment. But occasionally an invasive species such as the zebra mussel asserts itself in a spectacularly destructive way. Other invaders that have made headlines are water chestnuts, ***gypsy moths***, starlings, ***chestnut blight***, ***West Nile virus***, ***SARS***, AIDS, and ***avian flu***.

Some epidemics and invasive species can be stopped by regulating global transportation. Zebra mussels would not be in North America if ships had been required to sterilize their ballast tanks. If wooden shipping pallets were replaced with recycled plastic ones, a medium for the transport of wood-boring insects would be removed. Quarantine during a potential epidemic could save hundreds of thousands of lives.

Although we may not be able to stop invasive species once they are let out of the bag, we can take preventative measures. What we need is the public awareness and political will to make these measures possible.