Land Letter
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1. INVASIVE SPECIES: Great Lakes, Mississippi River are front lines for efforts against aquatic invaders

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This story is part of an ongoing series on invasive species.

Ask federal or state-level officials tasked with addressing the spread of non-native aquatic invasive species about the single biggest challenge of their job and they would likely tell you that it all boils down to the tried-and-true regulatory practice of risk assessment.

At the top of the list of high risk targets for these officials are two of the most pervasive non-native species present in the United States: the Asian carp and the zebra mussel. Combined, the two species are threatening an all-out invasion of the Mississippi River basin and the Great Lakes region, which represent North America's psychological border between East and West.

The budget for dealing with the Asian carp and zebra mussels species is, by all accounts, small. There is no centralized office for aquatic invasive species control, no Department of Aquatic Security Asian Carp and Zebra Mussels Division. And how can you stop or limit the spread of such species when there is no consensus on exactly how large their respective populations are or how far they have truly managed to spread? What about the fact that you are dealing with animals that live in ecosystems that are constantly shifting and evolving?

"The problem is that we are not very good yet at assessing risk," U.S. Geological Services research fisheries biologist Duane Chapman told *Land Letter*. "Although we are starting to get better at it -- we think -- we still have a long way to go. Humans, if they don't understand a risk, tend to either over or underemphasize it. Clearly, there is a lot of both going on," he said.

Even so, Chapman says consensus is emerging on identifying the priority areas for aquatic invasives, determining what needs to be done immediately and planning for future actions.

State of consensus

According to the FWS **Aquatic Nuisance Species Task Force**'s Asian carp working group Chairman Greg Conover, the biggest problem associated with gathering consensus on the risks associated with the spread of Asian carp and zebra mussels is the fact that officials are reacting and responding to the damages associated with the two species after the fact of their introduction into the United States.

Jumping Asian carp have migrated up the Illinois River, west of the Mississippi. Photo by Mike Smith, courtesy of Illinois River Biological Station.

The four species of Asian carps present in the Mississippi River basin were first recognized as being a widespread threat to other native fish species beginning in the 1960s but were likely imported into the United States in the mid-19th century for use in aquaculture ponds. Now, because the fish have no natural predators in U.S. inland waters, they feed voraciously and grow so big that they force smaller, native species into the margins of the Mississippi River basin and its adjacent rivers and streams.

FWS is currently considering designating the silver carp and largescale silver carp as "injurious species" under the federal Lacey Act.

In support of such an action, members of the Great Lakes Commission in October passed a resolution urging the federal government to prohibit import, interstate transport or acquisition of all forms of the Asian carp. Recently, Michigan

Attorney General Mike Cox (R), who sits on the Great Lakes Commission, wrote to FWS officials to urge a listing, saying "If these species enter the Great Lakes, they will have a devastating impact on the Great Lakes ecosystem and the $4.5 billion Great Lakes fishery."

FWS Fisheries Program Region 3 spokesman Michael Hoff -- whose eight-state jurisdiction encompasses the Mississippi River and the Great Lakes region -- told *Land Letter* that the goal with Asian carp so far centers around keeping them contained within the river's basin so that they do not spread into the Great Lakes where their population could grow to exponential proportions.

In May, the Army Corps of Engineers activated a $7 million electric barrier in the Chicago Sanitary and Ship Canal, which is the only shipping link between the Great Lakes and the Mississippi River system, in an effort to stop the spread of Asian carp (*Greenwire*, April 28).

"But several years ago, before the barrier was erected, [FWS] and the city of Chicago held a summit that concluded by recommending that there needs to be a long-term solution for Asian carp and zebra mussel containment that will likely need to go beyond technological barriers," Hoff said.

In April, the Aquatic Nuisance Species Task Force's Asian carp working group provided Hoff and other federal and state-level officials with the first consensus document on how to begin addressing Asian carp containment issues in the short- and long-term. The **Draft Management and Control Plan for Asian Carps in the United States** -- open for public comment until Dec. 26 -- recommends that officials in the regions most affected by Asian carp pursue seven goals toward the long-term containment and possible eradication of the fish.

The goals include: the reduction of feral populations of carp through the use of commercial and recreational harvesting as well as various scientific methods; the use of various strategies to manage 22 pathways for accidental or deliberate unauthorized introductions of Asian carps; and the creation of a long-term, cooperative national effort between federal, state, tribal and private stakeholders to contain existing populations and prevent their spread.

Asian carp "is a battle that we have to fight on several different fronts all at once," said Conover, chairman of the working group. "Containment is probably the greatest cost we are looking at in the plan; it's where we incur the greatest direct expenses -- we can't eradicate these species, just manage them."

He added that the anticipated cost for the 139 programs outlined in the management plan are about $283 million for implementation over the next 20 years. "If you look at what the plan is estimating, it's pretty obvious that we don't have that kind of money. Instead, it's reliant on the need for different agencies across many different levels to partner together," Conover said.

FWS Fisheries Program Branch of Invasive Species Chief Kari Duncan told *Land Letter* that the budget for addressing aquatic invasive species issues in fiscal 2006 was $5.83 million, of which $1.75 million went to state and local level programs. Hoff added that FWS Region 3's budget for fiscal 2006 related to aquatic invasives was $557,000 and the agency provided $440,000 to states and the Great Lakes Indian Fish and Wildlife Commission to implement state and interstate aquatic nuisance species management plans in Iowa, Illinois, Indiana, Michigan, Ohio and Wisconsin, as well as the creation of the St. Croix Interstate Management Plan.

Overall, Duncan and Hoff agree that the Aquatic Nuisance Species Task Force is the most effective clearinghouse for the creation of state level plans and the distribution of FWS grant money for research and control initiatives. To date, the task force oversees 14 state-level aquatic invasive management plans, two interstate plans and 12 plans that are currently under construction.

"If you look at those [fiscal 2006 budget] figures then it becomes pretty obvious that there is not a lot of money going toward aquatic invasives simply because there is so much going on with invasive species nationally," Duncan said.

Research as the key to containment

One glance at the Web sites for the recent **Invasive Asian Carps in North America symposium**, the Agriculture Department's **National Invasive Species Information Center** or the Aquatic Nuisance Species Task Force will reveal that there is no shortage of research analyzing how to stop the spread of aquatic invasives over the long-term.

Fisheries biologist Chapman, who is ideally placed to be at the center of many of the ongoing investigations into Asian carp and zebra mussels through his role at the USGS Columbia Environmental Research Center in Missouri, told *Land Letter* that there are two main problems associated with doing research aimed at management or eradication of the two species.

The first, Chapman said, is that "we are just now starting to see the quantifiable effects on native fishes related to the spread of Asian carp. But even then it becomes very hard to truly quantify any real damages because you are dealing with rivers and streams where the ecosystems change so much from year to year." The basic problem with the carp though is that they are making the native fish skinnier, he added.

"In my personal opinion, the Asian carp is already the most abundant large fish in North America. But there is no genetic method to determine their population," Chapman said, pointing out the second major problem when dealing with the fish. "We never thought 20 years ago that Asian carps would become a problem in the wild because U.S. rivers do not look like Asian rivers and in the aquaculture ponds the various species of carp were notoriously susceptible to predators."

Zebra mussels have proliferated in the Great Lakes and river systems, with the population now estimated at over 50 trillion. Photo courtesy of USGS.

The same two problems can be attributed to zebra mussels, Chapman said. "There have been no victories to date with the zebra mussel in the Mississippi River. They are really doing a number on the endangered mussels there and all people can really do is clean off the endangered species and let them go elsewhere," he explained.

The zebra mussel -- which first began to block drain pipes and disrupt the operations of power plants in the Great Lakes area in the late 1980s -- evidently entered the United States via the ballast water of ships navigating the waterways and began to compete with native species ranging from other mussels to ducks for resources, spreading southward into the Mississippi River.

But if a research-led approach is going to help solve management issues associated with Asian carp and zebra mussels, then the example of the control program used in the Great Lakes to contain the spread of sea lampreys is the model federal and state agencies should be looking at, Chapman said. "The sea lamprey is an example of an invasive species that is fairly under control, but not before it caused huge declines in a number of native fish populations that were important," he said, explaining that a combination of control methods such as electric currents, chemical lampricides and barriers have met with a fair amount of success.

Also, there may be hope for drastically reducing Asian carp populations in the form of genetic research on common carp in Australia. "In theory, you could drive the carps to extinction by making all the males you catch sterile. Early models of the Australian research are showing that you can dramatically drive down the amount of adult and spawning individuals using these techniques. But unless you are dealing with a small population of fish in a controlled ecosystem then genetics work really becomes a tool for damage limitation," Chapman said.

According to Hoff, the focus on managing zebra mussels centers on public outreach and there is no research available as with Asian carp designed to make the mussels sterile. "Various municipalities are working on various chemical solutions called 'biobullets,'" he said, which are micro-encapsulated potassium chloride toxic pills that can be fed easily to zebra mussels while sparing other mussels. "Zebra mussels filter particles in a different size range than the majority of native mussels, so the potential for selective biobullet treatments is being examined within some municipalities."

"The best that we can do on the research front is continue with a program designed to keep [Asian carp and zebra mussel] populations down," Chapman said. "Control efforts will always have a cost of some kind, whether it be the placement of toxic chemicals in the water to kill young lampreys or having a large number of genetically modified carps running around."

The role of the public

While Asian carp control programs have research initiatives and successful control models to build on, the fight to stop the spread of zebra mussels comes down to a public relations war, Mississippi River Basin Panel on Aquatic Invasive Species and Mississippi Interstate Cooperative Resource Association spokesman Jerry Rasmussen said.

"Because they have become so prevalent in such a short period of time, the goal now is really to keep them out of small lakes west of the Mississippi," Rasmussen said, adding that there are reports that zebra mussels are appearing in lakes in Kansas.

"I just don't see how we can ever get to a point where we can say we will be able to fully control the arrival and

From a single site in 1988, zebra mussels have spread throughout the Midwestern river system, as shown in this 2005 USGS map, and they occasionally are sighted moving West as 'aquatic hitchhikers.' Click on the image for a larger version of the map.

spread of zebra mussels," Duncan said. "It's alarming because when I go out west to do research on them the sheer quantity of zebra mussels covering everything of all sizes is astounding."

Currently, there are three Aquatic Nuisance Species Task Force-sanctioned public-private partnerships -- **Stop Aquatic Hitchhikers!**, **Habitattitude** and the **100th Meridian Initiative**.

Of the three, Hoff said that the 100th Meridian Initiative carried out the most effective public outreach program to date by simply informing people who take advantage of the recreational areas of the Great Lakes and Saint Croix National Scenic Riverway to pull zebra mussels off rocks and other animals whenever they can and dispose of them. "So far we've effectively managed to prevent the colonization of zebra mussels west of the 100th meridian," he said.

But the success of outreach programs such as the 100th Meridian group in convincing the public that it is important to dispose of them completely rather than simply supplant them in other waterways has not prevented the animals from stretching their range from the Hudson Bay to the Gulf of Mexico.

Fifty trillion and counting

According to FWS, the zebra mussel population reached an estimated 50 trillion this year since their arrival 20 years ago via a ship's hull or in its ballast water. And while a House bill is in the works to regulate ballast water discharges nationwide, Great Lakes utilities already spend $200 million per year getting rid of the mussels from their power plant water intake pipes that suck in water from the lakes for cooling purposes (*E&ENews Daily*, July 12).

A voracious filter feeder the zebra mussel cleans the water of the Great Lakes too well, forcing light-sensitive fish and plants into deeper water. They are also a primary but low-quality food source for whitefish. But zebra mussels lack a nutrient that whitefish need and the fish are smaller and slower to reproduce as a result of feeding on them.

And while some researchers such as University of Maryland professor Mark Sagoff contend that controlling zebra mussels is a pointless activity, others such as Chapman argue that it would be "irresponsible" to ignore the threats they pose because they are "ecosystem engineers that make drastic changes to any environment they enter."

"A lot of people want to see invasives controlled and native species of fish and mussels preserved. It's an issue of global homogenization," Chapman said. "If I go to New Orleans I want to be able to eat fish there that is different from the fish I would eat in Seattle. Ecology doesn't say it's a bad thing to have Chinese fish in the U.S.; that's a societal issue."

But, just as with Asian carp, assessing the risks and costs associated with the continued spread of zebra mussels is hard to quantify. "Zebra mussels shells cover beaches where they cut your feet, they cause bluegreen algae blooms because they don't eat the bluegreens and there is evidence that they cycle pollutants into the foodchain," Chapman said. "We definitely don't want them to spread further. California is terrified that zebra mussels will invade and clog their extensive aqueduct system."

Duncan agreed adding that zebra mussel controls vary by state, but the lack of a "National Zebra Mussel Clearinghouse" and not enough money for grants for local groups to go out and attack the problems at the ground level are two factors that are allowing their spread to continue.