River Crossings

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Black Carp Listing

On July 30 the U.S. Fish and Wildlife Service (FWS) published in the *Federal Register* a notice of intent to list the black carp as a "species of injurious wildlife". According to the notice, "The best available information indicates that this action is necessary to protect the interests of human beings, and wildlife and wildlife resources from the purposeful or accidental introduction and subsequent establishment of black carp populations into ecosystems of the U.S."

Black carp

Such listing would prohibit the importation of any live animal or viable egg of black carp into the U.S. except by permit for scientific, medical, educational, or zoological purposes, or without permit by Federal agencies solely for their own use. Permits would also be required for the interstate transport of live black carp or viable eggs currently held in the U.S. for scientific, medical, educational, or zoological purposes. Interstate transport of live black carp or viable eggs currently held in the U.S. for any other purpose would be prohibited.

River Crossings readers will recall that in 2000 MICRA petitioned the FWS to make such a listing. MICRA was concerned that these large Asian carp species, reportedly able to reach lengths of 5 ft. and weights of 150 lbs., would likely do significant harm to wild, threatened and endangered snail and mussel populations if allowed to escape to the wild and establish wild populations in the U.S.

At that time, catfish farmers (primarily in Arkansas and Mississippi) were proposing to stock black carp in their catfish rearing ponds to control snail populations. Snails, herons and catfish all serve as intermediate hosts for a parasitic trematode that infects catfish and reduces production. MICRA opposed such use because of the history of escape from captivity of other Asian carp species (i.e. bighead and silver carps) used for similar catfish culture purposes in the past. See the following articles for the current status of bighead and silver carp and the threat they now pose to the Great Lakes.

The FWS is soliciting comments on their proposed listing until 9/30/02. Comments may be mailed or sent by fax (703) 358-1800 to the Chief, Division of Environmental Quality, U.S. Fish and Wildlife Service, 4401 North Fairfax Drive, Suite 322, Arlington, VA 22203. Comments may also be sent by email to BlackCarp@fws.gov.

For further information contact Kari Duncan, Division of Environmental Quality, Branch of Invasive Species at (703) 358-2464 or kari_duncan@fws.gov.

Inside This Issue

Great Goby/Asian Carp Roundup

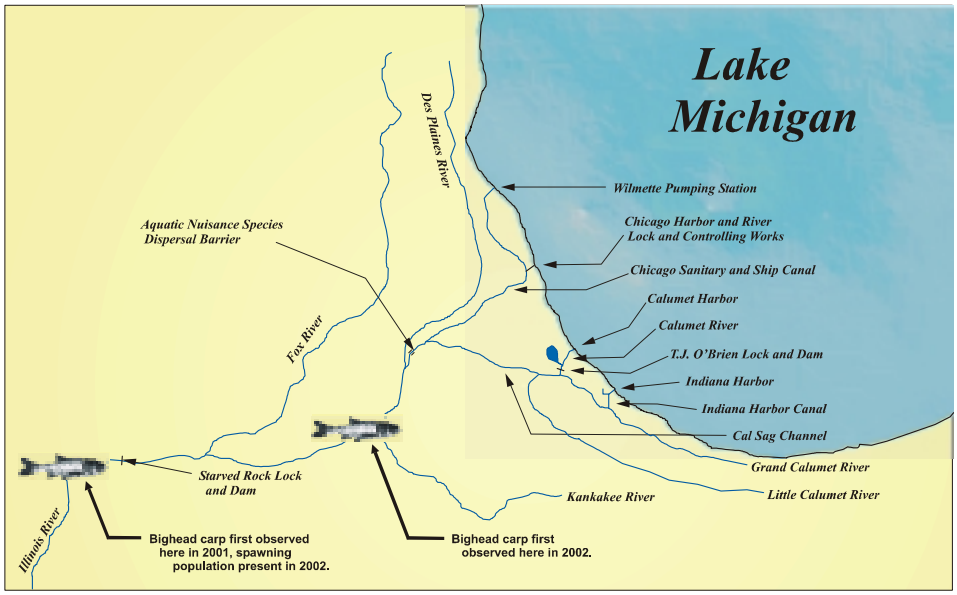
The 2002 version of the Chicago Connecting Channels/Illinois River Waterway Great Goby Roundup included not only a search and destroy mission for round gobies, but also for Asian carp. Over 100 miles of waterway were monitored by 13 groups, composed of representatives from 14 different entities, including four federal agencies, two state agencies, two regional entities, an environmental group and five private businesses. Specifically, the mission was to determine the relative abundance and downstream leading edge of the round goby infestation, and the upstream leading edge of the silver and bighead carp invasion.

Data revealed that the round gobies have not extended their range any further downstream than noted last year (i.e. just below the Brandon Road Lock and Dam near Joliet), but their numbers are increasing. Since initially invading Lake Michigan's Calumet Harbor, the gobies have moved at least 50 miles inland, or about 15% of the way down the length of the Illinois River and Waterway on their way to the Mississippi River. Also, the infestation has spread approximately 11 miles below the electrical barrier site that was designed to stop the invasion (see map at right).

Unfortunately, budget shortfalls prevented that barrier from being electrified in time to stop the goby invasion. It was, however, electrified in April of this year, and now stands as the only barrier preventing the upstream movement of Asian carp into Lake Michigan. Unfortunately, the barrier is only a temporary, prototype which biologists are now evaluating for effectiveness in repelling the Asian carp invasion.

Asian carp sightings have been reported by Illinois Department of Natural Resources biologists in the Illinois Waterway near Morris and Marseilles, Illinois, just downstream from the mouth of the Kankakee River; and by Julia Wozniak of *Midwest Generation* just above the Kankakee River mouth (see map above right). On 7/19/02 Wozniak captured a 5 lb. bighead carp at Illinois River Mile 274.4 during routine sampling. This places the carp within less than 25 miles of the electrical barrier and within 55 miles of Lake Michigan.

Goby roundup biologists first sighted several dead bighead carp floating in the Peoria Pool near Starved Rock, Illinois



Map showing the extent of the upstream colonization of Asian carp in the Illinois River between 2001 and 2002 and their "march" toward Lake Michigan.

during the June 2001 survey. This year, however, large numbers of large, live bighead carp were sighted in the same area, indicating that numbers had increased dramatically over the twelve month period. Some of these very excitable fish nearly jumped into the boats with survey crews. Also, near the mouth of the Vermillion

River (Illinois River Mile 227.0) biologists sighted what was suspected to be a concentration of spawning bighead carp. Bigheads collected at this sight measured up to 37.5 in. long and weighed up to 26 lbs (See photo below).

Twenty-six pound bighead carp collected in the Illinois River near the mouth of the Vermillion River at LaSalle on 6/20/02.

Illinois Natural History Survey biologists John Chick and Mark Pegg report that the aforementioned electric barrier may effectively prevent Asian carp from entering Lake Michigan. In the early stages of their Illinois-Indiana Sea Grant-funded study, more than 99% of the bighead carp tested were deterred by a simulated electric barrier, modeled after the actual barrier in laboratory raceways.

Thus far they report that 381 bighead carp have attempted to pass through the simulated barrier — 379 times the fish have turned around. Only one fish went through the barrier, and in fact, did it twice. "This was a smaller carp, which was not surprising. Smaller fish are less susceptible to the electric current," said Pegg. These tests were done for six continuous hours per day for three days. The idea is that as fish pass through the barrier, they feel increasing levels of electricity, which causes them to turn around. "Because the electric field of the 60 ft. wide barrier is not as strong higher up in the water column where Asian carp are typically found, there has been some concern that the barrier may not effectively repel the fish," said Pegg.

Next, they plan to explore different scenarios using the present electric barrier technology, varying the strength and width of the electric pulse within the recommended safety guidelines. They will also experiment with other barrier methods including "fish guidance systems" that use sound and a "wall of bubbles." "We will test the effectiveness of these technologies and then try them in combination. Perhaps the fish can become used to one or the other, but in combination, they may prove successful," added Pegg. They will also test the effectiveness of these technologies in augmenting the electric barrier.

Bighead and silver carp are both plankton feeders. As such, they are in direct competition for food with the native paddlefish, bigmouth buffalo and gizzard shad, as well as with all species of juvenile fish and mussels. Also because of their plankton feeding habits, capture by anglers is restricted to accidental or intentional snagging. Generally, neither species will hit an artificial lure, so sport fishing opportunities for the carp are limited. It is worthy of note, however, that one bighead carp was recently taken by a fisherman from Clinton Lake in Illinois (a power plant reservoir). This fish probably found its way to that location as a small fingerling via a bait bucket. Therefore, in addition to the electrical barrier, everyone needs to be proactive and at every opportunity educate the public on the perils of transferring bait from one body of water to another, especially from waters known to be infested with invasive species.

"When minnows are harvested for bait, smaller or newly-hatched carp may tag along," explained Pegg. Therefore fishermen should never dispose of bait by putting it into a water body said Pat Charlebois, Illinois-Indiana Sea Grant biological resource specialist. "Throw unused bait away on land or in the trash." If you are fishing with wild bait, use it only on the water body from which it was collected.

Fishermen can also learn to identify Asian carp by obtaining copies of brochures on their biology and identification prepared by the U.S. Fish & Wildlife Service. These are available by calling the LaCrosse (WI) Fishery Resources Office at (608) 783-8434, or by contacting Charlebois at (847) 872-0140. Copies may also be available from local state and federal fish and wildlife agency offices.

IJC and Chicago Mayor Daley Call for ANS Barrier Funding

On 7/5/02 the threat of invasion of Lake Michigan by Asian carp officially became an international issue. On that day the International Joint Commission (IJC) for the Great Lakes sent letters to both Colin Powell (U.S. Secretary of State) and Bill Graham (Canadian Minister of Foreign Affairs) requesting "immediate action by the governments to prevent the imminent introduction of Asian carp into the Great Lakes". The IJC letter stated that "Scientific consensus indicates that the introduction of Asian carp may result in economic and ecological damages to the Great lakes ecosystem that far exceed those brought about by the previous introduction of the sea lamprey and the zebra mussel".

The IJC held an international telephone press conference on 7/11/02 announcing their decision. The accompanying press release stated that the IJC is calling on the U.S. Government to:

- continue operation of the current electrical barrier in the Chicago River; and
- to install a second, more permanent barrier.

The IJC is further calling on both the U.S. and Canadian governments to:

- educate the public about the threat of Asian carp to the Great Lakes ecosystem;
- investigate other chemical and physical environmentally sound alternatives to prevent the movement of aquatic nuisance species to and from the Great Lakes; and
- consider implementing regulatory controls to prevent transfer of aquatic nuisance species via other pathways such as the food and bait fish industries and aquaculture.

The IJC is a binational organization established by the Boundary waters Treaty of 1909 to help Canada and the U.S. prevent and resolve disputes over use of waters along their common boundary. Under the 1978 Great Lakes Water Quality Agreement, the IJC reports on progress by the two countries to restore and maintain the chemical, physical and biological integrity of the waters of the Great Lakes basin ecosystem.

Meanwhile, on 7/13/02 Chicago Mayor Richard Daley held his own press conference in downtown Chicago announcing support for measures to stop the Asian carp

invasion. The bighead carp collected near LaSalle, IL in June (picture on page 3) was made available for viewing by the public and press at that conference. Mayor Daley voiced strong support for the barrier, stating that he plans to carry his case to the highest levels of the U.S. government for support on this issue. In mid-April, MICRA sent a letter to Mayor Daley soliciting his support for establishing a permanent barrier between Lake Michigan and the Illinois River and Waterway to prevent the spread of aquatic nuisance species.

Northern Snakehead Listing

Concern about northern snakeheads, recently found in a pond in Crofton, MD, has reached the office of U.S. Department of the Interior Secretary Gale A. Norton where plans have been published in the *Federal Register* to place 28 species of the fish on the federal injurious species list. As with the black carp mentioned earlier, such a listing would prohibit importation and interstate transportation of the fish. Under the Lacey Act amendments of 1981, anyone found importing or transporting injurious mammals, birds, fish or reptiles without a special permit could be fined and imprisoned up to six months. An injurious species is one that could injure human beings, agricultural interests, horticulture, forestry or other wildlife. The snakehead would join walking catfish, mitten crabs, and zebra mussels, other aquatic species banned under the Lacey Act. The public will have 30 days to respond to the proposal before the new regulations take effect.

Although Norton's proposal would ban the importation of snakeheads into the U.S., it would not become illegal to own one in a state where they are currently allowed. Possession of snakeheads is currenly legal in at least Virginia, Maryland and the District of Columbia and illegal in 13 states, including Georgia, Florida, Texas and Colorado. Snakeheads have been found in six other states: Massachusetts, Maine, Rhode Island, Florida, California, and Hawaii, according to the Interior Department, but Maryland, California and Florida are the only two states where reproduction has been documented. Declaring the fish an injurious species in the U.S. could lead to nationwide control.

But as the Maryland case shows, snakeheads may be living even in states where they are illegal. "Possession of these fish is still an option that's up to state legislatures," said Ken Burton, U.S. Fish and Wildlife Service (FWS).
If the proposed listing is enacted, a misdemeanor violation would carry a $100,000 fine for individuals and a $200,000 fine for an organization. A felony violation would impose a $250,000 individual fine and a $500,000 fine for an organization. Burton said the effort to place the snakehead on the injurious species list has been in the works for a year and was nearing completion when the Crofton, MD case surfaced.

The northern snakehead, normally found in China, was caught by an unidentified fisherman in a Crofton shopping mall drainage ditch. At first, reports of the strange-looking fish were dismissed as most likely a native bowfin or some other kind of exotic fish that outgrew its tank and was tossed into the pond by its owner. But state officials learned otherwise after contacting Walter Courtenay Jr., an exotic fish expert and professor emeritus of zoology at Florida Atlantic University in Boca Raton. Courtenay immediately identified the creature as a northern snakehead, prized as a delicacy in China and Korea where it originates.

Officials later determined that the fish came from an Asian fish market in New York, where two years ago a Crofton resident ordered it. Prized in his native Hong Kong for flavor and curative properties, he wished to use the snakeheads to make soup for his ailing sister. But by the time the fish arrived, the man's sister had recovered. With no need to make soup, the man simply put them in an aquarium and began feeding them — at first, just a couple of goldfish now and then, but as the snakeheads grew he had to feed them as many as 12 goldfish a day. The creatures soon wore out their welcome, so the man released them into a tree-bordered pond behind the mall. The pond became an ideal snakehead home — they mated and had lots of babies. "We could very easily be talking about hundreds, if not more, juveniles in the pond," said Eric Schwaab, head of Maryland's Fisheries Department.

The Crofton man admitted releasing the fish, but said he didn't realize his actions were illegal, or that they could have terrible consequences. Natural Resources police say they can't charge him with anything because the two-year statute of limitations has run out. Even if they could, the penalty is simply a ticket and a $40 fine.

Snakehead species are described by Sterba (1966) as very elongate fishes, native to Africa and southern and southeastern Asia. The body is similar in appearance to the native bowfin (see diagram below). The head is very large, and the mouth if very deeply cleft and widely distensible, with a complete set of teeth. The anterior nasal opening is formed into a tubular process. Dorsal and anal fins are very long and without spines. Scales are cycloid or ctenoid and very large and plate-like on the upper surface of the head (Sterba 1966).

African (above) and Asian (below) snakehead.

Snakeheads possess an accessory respiratory organ in the form of a simple diverticulum from the gill chamber which allows them to carry on supplementary air-breathing and thus to exist in very dirty water or even to wriggle overland during droughts (Sterba 1966). The latter most likely accounts for the reports in the press of snakeheads being able to "walk". All snakeheads are predators, and even able to prey upon fishes as long as themselves; only small, young snakeheads feed upon earthworms or tadpoles (Sterba 1966).

All snakeheads are extraordinarily hardy and are thus not difficult to maintain in aquaria (Sterba 1966). Young specimens conceal themselves in plant thickets; while adults (once fed) usually just lie idly on the bottom. Several snakehead species have been bread in captivity. Their eggs contain an oil droplet, causing them to rise to the surface (Sterba 1966), where they develop quickly. Young hatch in 2-3 days at 78-82 °F. Some species can reach lengths of up to 4 feet. All snakehead species are very good leapers, so aquariums must be well-covered. Sterba reports that the only difficulty for the aquarist is that snakeheads require live fishes for food and their appetites are almost

insatiable. In captivity snakeheads can become accustomed to eating meat, and they are very social, soon recognizing their keeper.

The snakehead has been depicted as sort of a monster that can live on land for three days. Snakeheads are said to eat other fish, frogs and even ducklings, and are able to walk on their fins across land to another lake or canal. When no other prey is available, snakeheads turn cannibalistic and eat each other, Burton said. They protect their eggs, and there are recorded attacks on people who got too close, he said. Snakeheads have a wide mouth, powerful jaws and "razor-sharp" teeth, Burton said, but he knew of no case where they have killed a human.

Since snakeheads are reported to be capable of clearing out a pond of all living creatures and then wriggling on to new hunting grounds overland, biologists from the Maryland Department of Natural Resources (MDDNR) and FWS quickly mobilized in Crofton, setting out to sandbag the infected pond, which sits in the floodplain of the Little Patuxent River. "The fear is: This thing could hop from the pond, across the floodplain and into the river, and then all bets are off," said Bob Lunsford, MDDNR biologist. "It's the baddest bunny in the bush. It has no known predators in this environment, can grow to 15 pounds, and it can get up and walk. What more do you need?" An angler netted a half-dozen baby snakeheads after spotting them flipping onto lily pads and sucking down insects.

Every method available (i.e. minnow traps, fishing, electroshocking, etc.) was used by state and federal officials to try to clean the pond of snakeheads, but nothing worked very well. They couldn't pump out the pond, because the only place to dump the water was into the nearby Patuxent River, where lots of native fish would become fodder for any voracious snakehead or snakeheads which escaped. So a team of 15 experts, including Courtenay, recommended eradication with rotenone, a fish poison.

Jim Beers, a retired FWS biologist, said the pond should have been poisoned the instant the first snakehead was discovered. "I was absolutely flabbergasted they didn't do it immediately," Beers said. He also said the snakehead should have been on the injurious species list from the beginning. "If the U.S. Fish and Wildlife Service and the federal government were doing their jobs, they would be looking at things like this across the world," he said. "They should not be letting these things in."

Courtenay said snakeheads began arriving in this country 30 years ago as a delicacy for Asian food markets. Because they can survive for days out of water, they easily ship and arrive at the markets alive. FWS officials said that from 1997 to 2000, more than 16,500 snakeheads of various species legally entered the U.S. Scientists say snakeheads have adapted alarmingly well to U.S. climes, and the variety of species is capable of establishing populations from Canada to South America.

Burton said an established colony of bullseye snakeheads — the largest species, with adults about 4 feet long — was discovered last year in residential lakes and adjoining canals in Tamarac in Broward County, FL. Since both juveniles and adults were found, it was clear that the fish have been reproducing. FWS officials said it is likely that the bullseye snakehead "will expand its range in peninsular Florida" because the fish like that climate. Additionally, the northern snakehead has been caught in the St. Johns River below Lake Harney in Seminole and Volusia counties in Florida. Officials said the bullseye snakehead could have been introduced in Broward County after an escape from a fish farm, or in the case of both species, they may have been purposely introduced to establish a source for food fish.

Snakeheads are rarely kept as aquarium pets, but are often sold in live fish markets as food. Michael Hresko, manager of a pet store, said the snakehead ban would cost his store the sale of several hundred fish a year. He said they are prized by people who like large, aggressive fish. A six-inch snakehead costs about $7 and eventually eat up to $8 worth of goldfish a day. "There's other fish to sell, different kinds of cichlids that are nasty," Hresko said. "I just worry that they'll ban all large fish."

At his laboratory in Florida, Courtenay keeps two northern snakeheads in an isolated tank, feeding them golden shiners — more than a half-dozen a day. In eight months, they grew five inches and put on a good amount of weight. Courtenay is not sure how much because "I don't think anybody's been dumb enough to stick their fingers" in the tank, he said. "They're terrific predators with lots of teeth. This is not something you really want to see outside the laboratory."

Based on these reports it seems likely that snakeheads could be present somewhere in the Mississippi River Basin, but just haven't yet been reported. One unconfirmed report placed one in the Cuyahoga River in Cleveland (Great Lakes Basin). Pet store and aquarium enthusiasts should thus beware. Courtenay is finalizing a risk report on snakeheads for the FWS, and is unequivocal in his assessment. "There is nothing good about this fish from an ecological standpoint," he said. "Get rid of it. You don't want it."

Sources: Jeff Barnes, *The Washington Times*, 7/23/02; Tom Doggett, *Reuters*, 7/23/02; Bob Dart, *Cox News Service*, 7/23/02; Jackie Powder, *Baltimore Sun*, 7/23/02; Anita Huslin, *Washington Post*, 6/27, 7/12 and 7/23/02; and Sterba, G. 1966. Freshwater *fishes of the world*. The Pet Library, Ltd. 877 pp.

Concerns About Genetically Engineered Fish

In this "brave new world" everything seems to be constantly changing, with some changes for the good, but others, while intentioned for good, may be fraught with problems beyond comprehension. Among those are creation of:

- new species characteristics,
- new strains of species, or even
- complete new species through techniques

of genetic engineering. In the case of fish, the creation of potential Frankenfish!

For example, some fish, as well as some other plants and animals have evolved a mechanism to reduce the freezing point of their bodily fluids without appreciably changing their osmolarity. They do this through the production of antifreeze proteins (AFPs) that adsorb to the surface of ice crystals as they form, thereby preventing crystal growth which would otherwise lead to cell damage.

Because of these unique aspects, these proteins are up to 500 times more effective at lowering freezing temperature than any other known solute molecule. Several distinct classes of AFPs, distinguished by their molecular structure, have been isolated

from fish, insect, and plant sources. To date, those from fish sources are perhaps better known and have been more thoroughly characterized than those from other species.

Commercial AFP applications currently under evaluation include:

- cold protection of mammalian cells, tissues, and organs;
- enhanced tumor cell destruction during cryosurgery;
- longer shelf life for and better quality of frozen foods;
- protection of fish and plants against cold and freezing temperatures; and
- improved growth characteristics in transgenic fish by using AFP gene promoters.

The first three applications utilize purified AFP from natural sources or recombinant expression systems, while the last two are implemented by gene transfer to the target organism.

Genes coding for antifreeze proteins have been successfully transferred into Atlantic salmon, and a gene from flounder that codes for AFPs has been transferred to goldfish, affording transgenic individuals higher survival rates at colder temperatures without effecting external appearance any way. Commercialization of these transgenic goldfish has not been approved in the U.S. But if approved, transgenic goldfish containing the AFP gene would likely persist and mature under a broader water temperature range, allowing aquaculturists greater flexibility in the conditions under which the fish could be propagated. Likewise, transgenic goldfish would likely be more active in colder waters than nontransgenic individuals, thereby enhancing their attractiveness as a baitfish.

Nontransgenic goldfish have been documented to exhibit competitive advantages over native fish, including endangered species. Goldfish hybridize with related native species, such as the common carp and alter aquatic vegetation and water conditions. Transgenic goldfish with the AFP gene would likely maintain an even more competitive advantage over some native species if notable, periodic temperature decreases in certain geographic locations represented a limiting factor for fish populations. Goldfish eggs injected with AFP genes have been shown to produce offspring that are significantly more tolerant of low temperatures than controls. The "acquired" ability to withstand those types of "ecological crunches" may thus afford transgenic goldfish a competitive (numerical) advantage over other species.

AFP genes have also been transferred into fish to provide freeze protection during aquaculture production. Although first attempts did not provide the level of protection desired, new constructs consisting of more effective AFPs with stronger promoters and enhancer elements are underway. AFP promoter elements have also been adapted to drive the expression of growth hormone genes. These constructs, when transferred to some species have produced enhanced juvenile growth rates, by virtue of the environmental response element of the AFP promoter, producing elevated growth hormone expression during winter months. Other promoters have also been evaluated as driving elements for growth hormone expression with reportedly similar results.

Potential adverse effects that might result from the intentional or accidental release of transgenic fish include the following:

Biological Barrier Breakdown-

- The potential exists for vector-mediated horizontal gene transfer and recombination to create new pathogenic bacteria and viruses or unforeseen effects.
- Vector-mediated horizontal gene transfer could occur to unrelated species via bacteria, viruses, or mobile genetic elements.

Proliferation of the Transgene-

- The vectors carrying the transgene, might be perpetuated and amplified given the right environmental conditions. Once let loose, they may be impossible to control or recall.
- The transgene may move to a related species via hybridization (i.e. goldfish-carp hybrids), or to wild, populations by introgression.

Behavior Modification-

- Because all transgenes (by design) modify some characteristic of the target organism, transgenic organisms are expected to outperform their non-transgenic counterparts during at least some life history stage. One example of this is in the fact that many animals exhibit mate selection based on male body size. Transgenic males exhibiting larger than average adult body size, as a result of a growth hormone transgene for example, may have a mating advantage over their wild counterparts. Thus, the frequency of the transgene may rapidly increase in the wild population. It is generally assumed that the biological load imposed by a transgene will eventually result in a net disadvantage to the genetically modified animal thus keeping the transgene in check. Under the latter scenario, the introgression of the transgene into the wild population will cause the ultimate collapse of both the wild and transgenic populations.
- Behavior modification as a result of transgene action may be elaborated in juvenile animals as well as adults. Rainbow trout treated with growth hormone were shown to be much more aggressive feeders than non-treated animals. In the face of simulated predation by model herons, treated trout resumed feeding earlier, foraged closer to the surface, and ate more than non-treated fish. Thus fish bearing growth hormone transgenes may also outcompete wild fish, but also may be more susceptible to predation.

Range Expansion and Increase of Invasiveness -

- Some transgenes such as those coding for the production of antifreeze protein may well allow escaped animals to occupy colder climes than their current range. Further, they may be able to remain active during cold weather while native species are dormant thus depleting both habitat and forage. Goldfish, for example, are already widespread and considered a nuisance in many areas. Freeze resistant animals could potentially overwhelm many aquatic habitats. The propensity of goldfish to hybridize with carp could allow the migration of this trait into that species exacerbating the problem.

Ingestion of transgenic elements-

- The potential exists for ingestion by parasites, birds, insects or other animals and transmission of the transgenes to other organisms.
- The potential exists for release of vectors carrying transgenes and marker genes from dead transgenic organisms, solid wastes, and cells and transfer to soil bacteria and fungi where they form a long-term reservoir for replication, recombination and infection of other organisms.
- Ingestion of transgenic organisms by human beings and animals, could result in infection of gut bacteria or gut cells, creating mobile long-term enteric reservoirs for replication, recombination and dispersal of vectors.

Direct release of transgenic elements-

- Release of transgenes in laboratory effluents to the general environment, could result in further transport by wind and water.
- Accidental fertilization of non-transgenic eggs could occur in fish hatchery operations by transgenic sperm.
- The potential exists for development of a wide-spectrum of transposable element vectors that are easily mobilized, and integrated into whole groups of animals where they are readily expressed.

The amount of risk associated with gene introgression is a function of the scope of the release, the number of escaped animals, the number of potentially affected native species, and the interrelation of at least four population variables:

- reproductive potential of escaped individuals,
- frequency of introgression of the modified genes,
- fitness of the introgressed individuals, and
- potential demographic decline due to genetic load of introgressed genes.

The reproductive potential of escaped individuals is based on: 1) the survival rate and fertility of the individuals, and 2) environmental conditions affecting reproduction in the affected ecosystem, such as length of spawning season and available spawning habitat. The frequency with which introgressed genes will spread and increase within the population is related to gene flow. Several models are available to estimate this variable. Despite the prediction that introgressed individuals will exhibit lower fitness than non-introgressed individuals, not all new genetic modifications will be maladaptive. Regarding the genetic load of introgressed genes, natural selection is expected to remove maladaptive genes from a population, however, depending on the severity of the maladaptation, the number of generations required for this process can be very large.

One option to control the spread of transgenic genes is to induce sterility (i.e. triploidy). However, the use of triploidy does not eliminate all environmental risks and its ability to ensure environmental safety is complicated by three factors:

- the effectiveness of triploidy induction varies among species and methods used;
- although triploids are functionally sterile, the males may exhibit spawning behavior with fertile diploid females, leading to decreased reproductive success of the fertile diploid females; and
- in cases where large numbers of individuals are released, sufficient numbers of sterile triploids may survive and grow for an indeterminate number of years beyond the normal life span to pose heightened competition with diploid conspecifics or predation upon otherwise invulnerable prey. In some cases, such prey may be juvenile conspecifics.

Despite familiarity with the unmodified organism, there remains some amount of risk associated with the unexpected survival and persistence of escaped or intentionally released transgenic and non-native (non-transgenic) fish. For instance, released genetically modified fish could survive, reproduce, and persist in a broader range of accessible ecosystems than would be expected from studies of their biology in their native range. For example, in spite of assumptions that smolts and immature adults could not survive in freshwater, the Laurentian Great Lakes experienced population explosions of pink salmon two decades after 21,000 juveniles were flushed down the drain of a Lake Superior hatchery.

Fortunately, the FDA can regulate transgenic animals through the new animal drug (NAD) approval process. The Federal Food Drug and Cosmetic Act (FFDCA) defines a "drug" to include "articles … intended to affect the structure or any function of the body of man or other animals." Also, approval of a NAD is a "major federal action" under the terms of NEPA, requiring submission of an environmental assessment (EA) or a claim of categorical exclusion. For transgenic fish, the EA will facilitate the environmental component of FDA's "safety" review by providing information relevant to determining whether a NAD's environmental consequences could affect the health of man or animal and render it "unsafe."

The FDA regulatory process thus provides some protection against the release of undesirable transgenic organisms, but does not guarantee that none will be released. More work is underway on these matters, and more protections will likely be implemented in the not too distant future.

Source: Excerpted, in part, from a U.S. Department of the Interior White Paper prepared for the Council of Environmental Quality under the Clinton Administration.

Hybridization, Evolution, and Preservation of Endangered Species

Though definitions vary, hybrids are generally created when different species interbreed — or, if not species, then animals or plants from distinct lineages or with distinct adaptations to their environment. Hybridization has been found in many species including: mice, frogs, fish, insects, birds, trees and flowers. In fact, in the mid-1990's, wildlife biologists saved the endangered Florida panther from extinction by crossbreeding it with the closely related Texas cougar, opening the way for use of hybridization in saving endangered species.

Most species cannot crossbreed because of genetic, behavioral and ecological barriers. But new findings indicate that hybridization between species does occur and can sometimes produce new species — calling into question the long-standing view that a species is "a population of interbreeding organisms that is reproductively isolated from other species".

Many hybrids are little more than evolutionary failures that fade away, said Dr. Michael Arnold, a professor of biology at the University of Georgia and author of "*Natural Hybridization and Evolution*" (1997). But hybrid lineages can also become new species given the right circumstances, he added.

Scientists have long recognized that the mixing of different lineages usually occurs in areas called hybrid zones. These, ranging in size from a few feet to many miles, often form border areas between wetlands and dry uplands, for example said Dr. Loren H. Rieseberg, Indiana University biology professor. Or they may be disturbed habitats, often resulting from human activities. Hybrids, so created, may ultimately vanish if not constantly recreated, Dr. Rieseberg said, but unless they are sterile, they can serve to transfer thousands of genes between the parent populations. Those genes may play no evolutionary role, he added, but they can provide organisms with the genetic flexibility to colonize new habitats.

Hybridization has become an important issue in conservation biology, and its significance is expected to grow as habitats shrink and ecosystems change, bringing some formerly separate populations into contact and isolating others. Some biologists feel that the two sturgeon species (i.e. shovelnose and pallid), native to the Mississippi and

Missouri rivers, may be facing this issue. These rivers have been so channelized and regulated by man, that the traditional separate spawning habitats of the two species have been destroyed or modified into one habitat type. That habitat is used, but not necessarily desired, by either species. This forces the two sturgeon species to spawn in the same areas and at the same time, resulting in the mixing of their reproductive materials in the water column, producing the hybrids which are now common in both rivers.

Without the intervention of man to undo some of these changes by restoring more natural flow regimes and some of the former habitats, the two species could be lost and replaced by a new species which may or may not be fit to survive for the long term. The two existing sturgeon species have proven their viability as the product of millions of years of natural evolution through adaptation to long-term natural change. The new hybrid, created as a result of man's actions within the past hundred or so years, would not have the benefit of all of those years of evolution, and therefore may not be fit to survive long-term catastrophic change that could be brought on by future natural or man-induced change such as global warming.

Source: Mark Derr, *The New York Times*, 7/9/02

Sturgeon Gains Critical Habitat

The anadromous Gulf of Mexico sturgeon will gain critical habitat in seven river systems from Louisiana to Florida under a court-ordered proposal by the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS). The proposal responds to an eight-year legal battle between the two services and *Earthjustice Legal Defense Fund*, culminating in a decision by a U.S. District Court judge in Louisiana forcing the agencies to designate critical habitat.

The Gulf sturgeon was listed as a threatened species under the Endangered Species Act in 1991. After listing, the services have a one-year, ESA-imposed deadline to designate critical habitat. The services decided that critical habitat for the sturgeon was "not prudent," with which the judge disagreed. "We had to pull the FWS kicking and screaming to designate critical habitat," said David Guest, an attorney in *Earthjustice's* Tallahassee office. The proposal, published in the *Federal Register*, encompasses 1,580 river miles and 2,333 square miles of estuarine and marine habitat. The river systems affected include the Pearl, Pascagoula, Escambia, Yellow, Choctawhatchee, Apalachicola and Suwannee. The services have until 2/28/03 to finalize the habitat designation after soliciting public comment.

Guest says the designation could affect dredging and dam building on the rivers, specifically a dredging project in the Pearl River, and early negotiations for building another dam on the Pearl or Yellow rivers. The services maintain, however, that the designation will merely show the public where conservation efforts for the Gulf sturgeon would be most effective. Their position that critical habitat will not affect current river operations is justified by the record of rules FWS has published over the years to interpret the critical habitat section of ESA. Under the act, it is unlawful to adversely modify any area of designated critical habitat for a listed species (section 7). But FWS has interpreted this section to the point where federal agencies can justify the position that critical habitat offers little to no additional conservation benefits beyond listing.

The Gulf sturgeon is one of the most ancient fish species at around 350 million years old. The fish live up to 50 years and weigh up to 500 pounds. According to Guest, they descended from coldwater Atlantic sturgeon that were trapped in the warmwater Gulf during the last ice age. The sturgeon adapted by spending their winters in the cool saltwater of the Gulf, and summering in coldwater springs in the estuaries where they feed and spawn. Like other anadromous fish species, the sturgeon return to their natal streams to spawn.

Natalie M. Henry, *Greenwire*, 6/7/02

Paddlefish Caviar Lands Dealers in Court

Two Tennessee caviar dealers were found guilty on 5/16/02 of dealing in eggs from paddlefish, a species protected under federal law. Franklin and Carolyn Hale, doing business as *Royaloff Caviar*, were found guilty of six felony violations of the Lacey Act and conspiracy to violate the Lacey Act. Wendy Haney-Melson, the pair's daughter, was found guilty of conspiracy to violate the Lacey Act for her role in creating false documents and purchasing illegal paddlefish caviar.

Egg masses (caviar) taken from a large female paddlefish.

The Lacey Act is a federal statute which makes it unlawful to sell, receive or purchase any wildlife taken, possessed, transported or sold in violation of any law or regulation of any state. Charges against the pair include purchasing paddlefish caviar harvested during closed Tennessee seasons and in closed waters. Wildlife officials estimate that more than 8,400 pounds of paddlefish caviar, with an estimated black market value of $483,000 was collected by the defendants.

Each female paddlefish with eggs provides an average of seven pounds of caviar, and it is not uncommon for commercial fishermen to kill four to five male and female paddlefish without eggs for each egg-bearing female found. In fact recent estimates indicate that as many as 25 male and female paddlefish may be killed to find one with eggs. The decrease in number of egg-bearing females is thought to be related to increased harvest to support the international caviar trade. With the collapse of the Soviet Union, illegal harvest of sturgeon (the traditional source of caviar) in Eastern European waters lead to the collapse of sturgeon populations. Consequently, demand for caviar has focused on less desirable species such as the paddlefish, found only in waters of the Mississippi River Basin.

Biologists estimate that between 5,000 and 6,000 wild paddlefish could have been sacrificed to produce the 8,400 pounds of caviar cited in the *Royaloff Caviar* Lacey Act violation. Special agents from the U.S. Fish and Wildlife Service (FWS) and wildlife investigators from the Tennessee Wildlife Resources Agency (TWRA) worked together to prepare the case. "There is a global market for our natural resources and without constant vigilance, we will lose the fish and wildlife populations which are a cornerstone of our quality of life," said

Sam Hamilton, FWS southeast regional director. "Such public resources must be managed for the benefit of all citizens." Penalties for each violation of the Lacey Act include up to five years imprisonment and $250,000 fine for an individual or $500,000 fine for an organization. Federal sentencing guidelines consider the value of wildlife and role of each individual in establishing an appropriate sentence.

"The paddlefish is an important component of Tennessee's wildlife diversity. We establish regulations designed to protect this resource for the enjoyment of future generations," said TWRA executive director Gary Myers. "When individuals violate those regulations, they diminish the quality of our aquatic resources."

Large Missouri River paddlefish taken below Gavins Point Dam.

In 1992, due to increased demand for paddlefish caviar and due to continued decrease in paddlefish populations, the American paddlefish was listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), a treaty that governs wildlife trade. All other species of sturgeon and paddlefish were added to the CITES list in 1998. The natural range of the paddlefish covers the entire Mississippi River Basin, and the species was historically found in all of the Basin's larger rivers. Today, however, it has been extirpated from many reaches where it was formerly common, and state and federal agencies are actively trying to reestablish the species through artificial propagation and stocking.

Since 1994, MICRA has sponsored a Basinwide Paddlefish Stock Assessment Project. This project involves participants from 22 states and several federal agencies. As part of that project, biologists have captured thousands of wild paddlefish and marked them with a small stainless steel coded wire tag (barely visible to the unaided eye). Additionally, all hatchery-reared paddlefish, totalling in the millions, have and continue to be marked with these same coded wire tags. These tags enable biologists to identify the fish when taken in future scientific and sport or commercial fishery captures, and thus to track movement and distribution, age, growth and condition of the individual since its last capture. MICRA's project is the largest assessment of its kind ever attempted on a river basin as large as the Mississippi. When finished this project will rival similar large-scale studies conducted on anadromous salmon populations on the east and west coasts.

Sources: *LYCOS Environment News Service*, 5/22/02

Bush Administration Puts MO River Plans on Hold

The White House, in order to avoid getting involved in a regional water feud, is quietly backing a five-year delay in changing water management practices for the Missouri River. The Army Corps of Engineers' (Corps) long-postponed "preferred alternative" for changing River operations recommends the delay in order to study the impact of higher water levels, even while concluding that they could benefit wildlife.

The Bush administration's plan marks a significant shift from a year ago, when the Corps was preparing to adopt a "spring rise" in the river as early as next year, along with reduced flows in the summer. The politically sensitive plan, which the Corps and the administration have kept secret, also endorses summer flows at levels higher than what the U.S. Fish and Wildlife Service (FWS) says is necessary to protect endangered birds (i.e. piping plover and least tern).

Officials from the Corps, the FWS and the White House Office of Environmental Quality (WHOEQ) have provided no comment, but people in government familiar with the behind-the-scenes activity said the administration laid out its plans at a Pentagon meeting on 5/21/02 among the three government entities. Besides the five-year delay for the spring rise, the Corps is reportedly proposing that summer flows not drop beneath 28,000 cfs downstream from Gavins Point Dam in South Dakota. The FWS has said that flow needs to drop to 21,000 cfs to benefit wildlife.

At the time of the meeting, a 5/31/02 deadline loomed for the Corps to announce changes that would be incorporated into its revised Missouri River Master Manual, the "bible" used to manage river flows by opening and closing gates at six dams. The changes were to be made next year. The White House plans, revealed at the meeting, were never announced publicly. Instead, the Corps and FWS were ordered to return to the table for more discussions. At a Senate energy subcommittee hearing in early July, Corps and FWS officials declined to divulge details of the administration's course, despite several requests by Sen. Byron Dorgan, D/ND. Also, the White House declined to send representatives to the hearing.

Talks between the Corps and FWS are scheduled to continue through July and maybe longer. No matter the outcome, it is bound to upset powerful interests along the Missouri River, where the prospect of changing flows for the benefit of wildlife has aroused passions and triggered warfare between states over water.

Comments at the Senate subcommittee hearing offer a sampling of these strong sentiments. Sen. Jean Carnahan, D/MO, asserted that flow changes "will lead to economic disaster and destroy generations of hard work" in her state. Sen. Tim Johnson, D/SD, argued that water releases to support downstream barge traffic "will cost my state more money this year than the entire economic benefits of the negligible barge industry." Ernie Blazar, spokesman for Sen. Kit Bond, R/MO, said that the senator could not comment on "rumors" about a Corps plan. But, Blazar said, Bond thinks there are issues that still need to be studied, such as how flow changes on the Missouri would affect the Mississippi River. "He's in favor of an ultimate decision that takes care of birds, fish and people," Blazar said.

Environmental groups are poised to take the issue to federal court, and in 2000 filed an

intent to sue, required before they could actually file a lawsuit. "I wouldn't be surprised to see lawsuits from both sides," said Richard Opper, executive director of the Missouri River Basin Association. Opper's group represents eight states along the river from Montana to Missouri. Opper said his association had recommended the 28,000 cfs level. Flows below that would cause too much economic harm, he said. The group also recommended higher spring flows once every three years during a 10-year demonstration project. But the Corps apparently wasn't ready to sign on to that suggestion, Opper said.

The recommended delay is considered a victory for downstream states, including Nebraska and Iowa, which argue that the flow change plan pushed by the FWS amounts to a thinly veiled drive by the upriver states, (Montana and the Dakotas), to keep more water in their reservoirs, which have become popular destinations for fishing and boating. Downstream states fear that a spring rise might flood farmland and worry that low summer flows would disrupt barge traffic and stress power stations and municipal water supplies. Environmental advocates argue that sufficient evidence already supports flow changes. Chad Smith, Midwestern field director of the environmental advocacy group *American Rivers*, said that the proposed delay is "a slap in the face to everyone in the basin. The Corps is simply ignoring the science and trying to deal in the political realm, which is not their charge as the federal agency that manages this river."

As noted earlier, the FWS has said that nests of two endangered species of shorebirds cannot be moved from sandbars to accommodate increased releases of water from two Missouri River dams. According to Paul Johnston, a Corps' spokesman, this could halt barge traffic because the drought-stricken Missouri is at its minimum navigational flow now. The Corps had planned to accommodate barge traffic by releasing water from the Gavins Point and Fort Randall dams in South Dakota in order to increase flow. Before doing that, however, they needed to move shorebirds that had built their nests on islands and sandbars that would be flooded. FWS officials told the Corps that under federal law, this action was not permitted .

Without a heavy rain, that leaves barge traffic in shallow water, Johnston said. "I can foresee that in a relatively short time there will essentially be no navigation from Kansas City to Sioux City," he said. Corps officials said they are working with the FWS to find a way to support navigation while protecting the shorebirds, though neither agency felt that there would be a quick resolution. Mike Olson, FWS Missouri River Coordinator in Bismarck, ND, said the decision was in keeping with its legal obligation to protect the endangered birds, and that "The choice being made not to flood these listed birds is being made by the Corps, and we certainly applaud that."

American Rivers president Rebecca Wodder praised the FWS, "Today's news that river flows will not be manipulated at the expense of endangered species may be the turning point in the long effort to restore America's longest river." But Johnston says barge companies already have been complaining that their barges are bumping the bottom of the river. "That starts giving us concern that we're going to have an oil spill down in the river," he said. Environmentalists argue that

Missouri River navigation should be halted altogether anyway because it is one of the least economically justified federal projects in the nation. At last count only one, maybe two barge companies continue to use the river. Severe channelization caused by the Corps' navigation and bank stabilization project has significantly shortened and steepened the river's grade, creating strong currents which are difficult to navigate. Thus, instead of pushing 15 barges, as is common on the Upper Mississippi, Missouri River tows can push only 6 barges or less, significantly impacting the project's economic viability.

Meanwhile, Dean Hildebrand, Director of the North Dakota Game and Fish Department, has grown tired of the Corps' decision to "again do nothing but talk and study". Hildebrand says, "...it is now necessary to seek federal legislation that would provide a fair and equitable distribution and utilization of water. If it requires a financial settlement with downstream interests so be it." "Of course", he says, "long-term solutions will continue to be hampered by 'bad' Washington politics simply intended to maintain the status quo." "Perhaps" he says, " a concerted legal effort is now needed to right the wrongs".

Sources: *St. Louis Post-Dispatch*, 7/14/02; and *Kansas City Star*, 7/6/02 and 7/15/02; *New York Times*, 7/702, Dean Hildebrand, *Matters of Opinion*, North Dakota Game and Fish Department, Bismarck

Southeastern Water Wars

Alabama, Georgia and Florida share water resources of the Alabama-Coosa-Tallapoosa (ACT) river basin. However, Trey Glenn, Alabama's Director of Water Resources, said his state is rethinking its current proposed agreement with Georgia, especially in light of new Corps of Engineers (Corps) analyses regarding water consumption in Atlanta.

State negotiators repeatedly have said that the basins are linked for purposes of water negotiations, but a month ago the Corps released preliminary findings on the amount of water metropolitan Atlanta is permanently removing from the Chattahoochee River. Those findings show the city occasionally consumed more water between 1998 and 2001 than Georgia leaders had projected it would need by the year 2030!

Glenn said the Corps' findings "were inconsistent with previous projections … (showing) a more accelerated growth than what we had been anticipating." He said the new findings concern Alabama, which worries that Atlanta's accelerated rate of water consumption in the Chattahoochee could spill over to the Alabama-Coosa-Tallapoosa (ACT) river basin. Currently , almost all of metro Atlanta's water supply is taken from the Chattahoochee. Georgia projects, however, that by 2030 a substantial portion of Atlanta's water will be taken from the Coosa and its tributaries as well.

Attention has also shifted to the ACT recently because of threats by Florida to walk out of the talks — a move that likely would send the dispute to the U.S. Supreme Court. However, Florida's chief negotiator, Doug Barr, cited two developments for the

Sunshine State's ongoing commitment to the negotiations. Barr first mentioned the Corps' study of metro-Atlanta's consumption from the Chattahoochee. Then he applauded Georgia for suggesting that stream flow requirements be placed on the Chattahoochee at a location downstream from Atlanta, known as Whitesburg. "It's a very promising possibility," Barr said.

Georgia made the concession, in part, to counter a previous Florida proposal that required guaranteed wastewater returns, acknowledged Bob Kerr, Georgia's chief negotiator. Kerr said the additional stream flow requirement gives Georgia better flexibility for managing its water than guaranteed returns, and assures people downstream that a certain amount of water will flow past Atlanta. "What we are doing is evaluating all the potential options and all the ways we can respond and try to come up with something that is fair to everybody," Kerr said.

Negotiations to end the bitter water feud involving the ACT will continue, at least for another month. Representatives of the three states unanimously approved a motion that pushed back a 6/17/02 deadline for resolving their water disputes. Earlier this year, Alabama and Georgia representatives had set a 1/13/03 deadline for the ACT.

Source: Jason Landers, *Anniston Star*, 6/13/02

Colorado Water Supplies Drying Up

A key northern Colorado water supply is quickly drying up, and water available for delivery could be just 30% of normal next year, officials report. An estimated 720,000 people will be affected by these forecast shortfalls from the Colorado-Big Thompson (C-BT) Project, including thousands of farmers and ranchers and residents in 30 northern Colorado cities. The largest municipal users on that list are Fort Collins, Greeley, Loveland, Longmont and Boulder. This year only 70% of the normal supply is reaching customers.

Water in the C-BT Project is evaporating much quicker than expected this year, during the worst drought to strike the state in a century. That has prompted a grim outlook for water availability next year. "It's ugly," said Brian Werner of the Northern Colorado Water Conservancy District. "We never expected the numbers to get so bad, and then get worse." The water district manages the C-BT, the state's largest trans-mountain diversion system and a crucial water source for northern Colorado. The project collects water from the Colorado River Basin, carries it over the mountains and delivers it for use on the Front Range.

Fort Collins, a city of 127,000, gets water chiefly from the Cache la Poudre River and C-BT. Boulder, with about 103,000 people, gets water from the Silver Lake Watershed, Barker Reservoir and the C-BT. Greeley, with a population of 76,000, gets water from the Poudre River, Big Thompson River and the C-BT. "The C-BT system is such an important complementary part of our water supply that this low a quota is going to hurt us," said Carol Ellinghouse, water resources coordinator for the city of Boulder.

Most northern Colorado cities, anticipating a drop in supplies, already have begun water restrictions. Fort Collins is expected to move from voluntary water cutbacks of 10% to mandatory restrictions that would require lawn watering no more than twice a week, between 6 p.m. and 10 a.m. Werner said a "quadruple whammy" is worsening the water picture: record-low snowpack, runoff and precipitation, combined with temperatures that already have reached record highs in early summer. "All of it's hitting us at one time", he said. "We're concerned, there's no question. We're in the third year of a drought, and we don't know if this is the third year in a three-year drought or the third year in a six-year drought." The water level at Lake Granby is the most obvious sign of an emerging water crisis in the C-BT system. The lake, high in the Colorado River Basin on the Western Slope, is the CB-T's largest storage vessel. The lake is usually 78% full this time of year; but is now just 31% full.

To make matters worse for the state, the rivers of southwestern Colorado, in the fire impacted areas, are also at record lows for early summer and, as scattered monsoon rains swell streams, several are flowing black as tar with runoff ash from the Missionary Ridge fire. Fire runoff has fouled streams and ditches that deliver water from the Pine River and Vallecito Reservoir to residential and agricultural users.

Federal, state and local water managers agree that another nearly snowless winter would mean disaster. Without heavy monsoon rains, the water outlook could be bleak as early as summer's end, they say. But the rains could also be a curse. Flash floods, rock and landslides and thick black runoff are predicted in the Animas, Florida and Pine river drainages. Fire-singed, drought-diminished Vallecito Reservoir has supplied millions of gallons of water to fight the Missionary Ridge blaze. It also provides drinking water to the town of Bayfield and to the Southern Ute Tribe.

The cities and towns of Durango, Pagosa Springs, Silverton, Dolores and Cortez are also suffering from water shortages. Some farmers in the area received only a third of their normal supply this spring and summer. In early July Durango had to shut off its inlet on the Florida River for 12 hours after a cloudburst choked the river with ash and black muck. Instead of continuing to take in the muddy slurry and risk clogging the water works, the city opted to pump more water from the Animas River. But in early July the Animas had shrunk to a wide, shallow stream at the Durango gauge, running at 165 cfs. That is 25% less than the previous record low for the date, 215 cfs, during the Dust Bowl drought of 1934. The river's record low was 94 cfs in 1957.

State water engineer in Durango, Ken Beegles, said that a level below 50 cfs would be critical and require intense management and rationing. But flows below 15 cfs would be a crisis for Durango, he said, perhaps requiring the city to condemn or force the sale of water rights held by other users. "It's hard to tell," Beegles said. Because we have deep ice banks high in the mountains I think the Animas will run this summer. But if we have another dry winter like last winter, next summer streams could go underground in many areas."

Silverton takes its water from Bear and Boulder creeks, two tributaries of the Animas. But senior water users downstream are close to placing a call on the river that could deprive Silverton of water. However, the state would not honor a call to shut off drinking water until it controlled or shut off a number of downstream diversions, such as those filling decorative ponds, Beegles said. Like many rural residential areas throughout southwestern Colorado, Silverton also relies on groundwater. But without snow and rain to replenish them, local aquifers could dry up within a year or so. "The clock is ticking on groundwater," Beegles said.

Source: Coleman Cornelius, *Denver Post*, 6/28/02 and Electa Draper, *Denver Post*, 7/15/02

Forest Service Cuts Instream Flow Requirement

Under intense pressure from Colorado politicians, the U.S. Forest Service (USFS) backed away from a plan to require reservoir owners on the White River National Forest to release water to maintain fish habitat during the dry fall and winter. State officials called the USFS's retreat "a huge victory in the effort to protect Colorado's water." "It's a line beyond which the state will never go," said Greg Walcher, director of the Colorado Department of Natural Resources. However, conservation groups called the change a "misguided retreat" from a sensible plan to protect declining trout populations. "Rivers and streams are the lifeblood of the White River National Forest," said Melinda Kassen, director of *Trout Unlimited's Colorado Water Project*. "Eviscerating the modest measures in the draft plan is bad news for fish, other wildlife and anglers."

For decades, the USFS's practice of requiring so-called bypass flows from high-elevation reservoirs to protect fish habitat has irritated water-hungry Western politicians. Several Front Range communities have water-storage facilities in the White River forest, where they collect snowmelt for use later in the season. When the proposed plan for the 2.3 million-acre forest was released in 1999, it called for protecting flows on at least 10% of the forest's streams and rivers. To do that, the USFS proposed requiring the flows as a condition for relicensing existing reservoirs. This idea infuriated Rep. Scott McInnis, R/CO, chairman of the House Forest and Forest Health Subcommittee. "Colorado doesn't need a federal bully to protect the environmental health of our rivers and streams," he said. McInnis highlighted the issue at a hearing of his subcommittee in August. And Gov. Bill Owens' administration kept banging the drum to make sure Bush appointees satisfied their concerns.

The final plan removes the 10% requirement and substitutes a pledge that the USFS would work cooperatively with the state to protect minimum stream flows. "We think they dodged a major bullet," said Walcher, who said the state wants an "iron-clad" commitment from the USFS to abandon bypass flows nationally. Conservation groups say federal land managers simply wilted before political pressure. "What that means is there's no bright lines, and that makes it very hard to say something doesn't comply with the plan," Kassen said.

But McInnis and Sen. Ben Nighthorse Campbell, R/CO, said the vagueness of the language made them uneasy, as it appeared to leave forest managers too much discretion. "Needless to say, we'll be watching closely to make sure the USFS's lack of clarity isn't a reversal of its commitment not to impose bypass flows," McInnis said. Kassen said the plan contains some improvements on water issues, such as a strategy to restore imperiled Colorado River cutthroat trout and to monitor trout and aquatic insect populations as an indicator of forest health.

Sources: Theo Stein and Mike Soraghan, *Denver Post*, 6/5/02

Arkansas and Oklahoma Continue Phosphorus Negotiations

Arkansas environmental agencies, in negotiations with their counterparts in Oklahoma, have offered to enforce a phosphorous limit of 1 ppm in wastewater coming from Northwest Arkansas cities and adopt more regulations for chicken litter. The phosphorous discharge from Springdale, home of several of the state's largest poultry processing plants, is six times the proposed limit. Fayetteville and Rogers, two of the largest cities in the Illinois River watershed, either surpass the proposed 1 ppm limit in their effluent or nearly meet it, state Department of Environmental Quality (DEQ) figures show.

Earlier this year Oklahoma adopted a standard of 0.37 ppm for its scenic rivers, including the Illinois which flows across the Arkansas state line into Oklahoma. Led by Gov. Mike Huckabee, Arkansas officials have questioned whether that limit is achievable. Drew Edmondson, Oklahoma attorney general, said after attending a recent meeting that it is a "good sign" that poultry companies came to the meeting to cooperate in drafting an enforceable agreement between the states.

Arkansas DEQ Director Marcus Devine and state Soil and Water Conservation Commission director Randall Young offered tighter regulation of chicken litter, starting with registration of poultry growers and licensing of commercial phosphorous applicators. Those proposals have the backing of Arkansas' poultry companies, Young said. Both states will draw up more detailed proposals and a possible timetable for implementing them before the next negotiating round in early September.

Springdale is in the process of upgrading its treatment plant and that would significantly lower the city's phosphorous discharge levels. Statewide registration of poultry feeding operations will give the state a complete list of all poultry farmers with contracts with integrated poultry companies, Young said. Each of those growers would then have to provide a "comprehensive nutrient management plan" to control runoff of nutrients, including phosphorous. Arkansas would also want Oklahoma to adopt similar standards for its poultry growers, Young said.

In addition, "we're proposing a certification process for commercial and private applicators" of chicken litter, which is used as a fertilizer, Young said. The requirement for a certificate would give the state authority to enforce the use of proper equipment that is properly maintained, he said. Many poultry growers have similar requirements already drawn into contracts with the poultry companies they supply, but commercial applicators of litter are not regulated now, Young said.

Arkansas officials also offered to adopt a certification process for the technicians or consultants who design nutrient management plans for farmers, and encouraged Oklahoma to do the same. The negotiators also proposed that the commission be allowed to make inspections and level civil penalties for improper handling of litter, with the right to refer serious violations to the environmental department, which can sue for damages, Young said. "The critical issue, though, is to find a strategy to deal with the excess litter," to get it out of the Illinois watershed or the watershed of other sensitive rivers and streams, Young said. This could involve transporting the fertilizer to farms in eastern Arkansas or making it into a fuel source for generating power, he said.

Oklahoma Water Resources Board officials have noted recent phosphorus levels on the Illinois River just inside the Oklahoma state line at seven times the proposed standard. Because Arkansas officials "took several steps in the right direction" at the July meeting Edmondson said that Oklahoma will continue to defer the filing of any litigation." Edmondson called the July meeting "very productive," and said that the goal of the negotiations is a consent decree, which is a voluntary remedy sanctioned by a judge.

A lawsuit spelling out the issues could be

filed together with an agreed-upon consent order negotiated between the states, Edmondson explained. A third party, like an environmental group, could seek to intervene in the case, but "they would be on their own." A third party probably would not be successful in changing a consent order when the environmental agencies from both states agree that the order is in the best interest of both states.

Sources: Jack Money, *Oklahoma City Daily Oklahoman*, 7/9/02; Doug Thompson and Scott F. Davis, *Arkansas News Bureau*, 7/9/02; and *Greenwire*, 7/1-0/02

Missouri Hog Farmer Sued

Missouri Attorney General Jay Nixon in early June sued *Premium Standard Farms* over a string of waste spills at the company's hog farms in northern Missouri. The Kansas City-based company is the nation's second-largest pork producer. Other hog waste spills into rural streams and fields have prompted previous lawsuits against the company.

The most recent spill occurred on 5/21/02. A pipe burst, and more than 1,000 gallons of manure and urine drained into a tributary of Little Medicine Creek and a nearby lake in Mercer County. The number of fish killed was not known. Nixon is seeking damages for the fish killed in this and other spills, plus reimbursement for the state's investigative costs.

The fine for breaking Missouri's Clean Water Law is as much as $10,000 per day per incident. Filed in Jackson County Circuit Court, the lawsuit also names *ContiGroup Companies Inc*. as a defendant. Formerly known as *Continental Grain*, *ContiGroup* owns a majority share in *Premium Standard*. The lawsuit covers incidents dating back to 1999, including cases in which the company applied too much manure as fertilizer on farmland.

Together, *Premium Standard* and *ContiGroup* are licensed to keep 1.1 million hogs in northern Missouri. The company's farms there are designed to handle more than 750 million gallons of animal waste per year. This is not the first time that the attorney general and *Premium Standard* have gone to court over hog waste. In 1999, the two parties reached a consent decree that required the company to spend $25 million on new technology to handle hog waste and prevent future spills.

Premium Standard is not happy about the new spills, but "we're making great progress on the environmental improvements," spokesman Charlie Arnot said. "Each time we have an incident, we go back and do a root-cause analysis" in order to keep mistakes from happening again, Arnot said. A company news release described the 5/21 spill as "an unfortunate anomaly."

Environmental activists welcomed the lawsuit but were skeptical about the state's ability to make *Premium Standard* improve. They said there have been other cases and other settlements and other promises that things will get better. "It still stinks at my house," said Rolf Christen, secretary-treasurer of the *Citizens Legal Environmental Action Network*. "We still have spills all over the place. We haven't gotten a nickel's worth better. ...Nothing has changed."

Source: James Hart, *The Kansas City Star*, 6/5/02

Riparian Restoration

Vermont's Lake Champlain is cleaner today, thanks to the Vermont Department of Environmental Conservation (DEC) and EPA's section 319 National Monitoring Program (NMP). The *Lake Champlain Basin Agricultural Watersheds Section 319 National Monitoring Program Project* was one of 23 special nonpoint source pollution (NPS) control monitoring studies conducted across the nation in EPA's NMP. The project was designed to evaluate how effectively riparian zone restoration practices could reduce the concentrations and loads of nutrients, sediment, and bacteria from grazing land.

Completed in 2001, the $1.7 million, 7-year project has demonstrated that implementation of simple and inexpensive pollution control measures can yield significant improvements in water quality. In the early 1990's Lake Champlain consistently failed to meet Vermont's water quality standards for phosphorus, largely because of agricultural runoff. In addition, water quality data from the Missisquoi River, a tributary of Lake Champlain, showed high levels of phosphorus, bacteria, and organic matter, also from agricultural sources. Project investigators identified livestock access to streams as a significant source of pollution and designed the project to address it. The primary goals of the Lake Champlain project were the same as for all of EPA's NMP projects: (1) to evaluate the effectiveness of NPS pollution control technologies; and (2) to improve scientists' understanding of NPS pollution.

In 1997, after three years of pre-treatment monitoring, one year was spent installing Best Management Practices (BMPs) along selected agricultural sections of two Missisquoi River tributaries. A third control stream was monitored but not treated. To keep costs low in the two treated streams, inexpensive riparian restoration measures such as livestock exclusion, riparian restoration, and bioengineered streambank protections were employed. Treatment areas were selected through baseline farm inventories, direct inspection of streams and riparian areas, and interpretation of aerial video imagery. Treatment measures were designed and funded with assistance from the USDA Natural Resources Conservation Service, the U.S. Fish and Wildlife Service, and EPA.

The combined efforts removed cows from streams and restored approximately 30 to 50% of pastured riparian zones in the treated watersheds. On one farm, a new bridge was built to allow cows to cross into a pasture without walking through a stream; on another, a culvert was installed under a livestock travel lane to re-route water flow away from the cattle. On many others, local volunteer groups, landowners, and project staff installed new fencing or relocated existing fencing to areas where livestock should be excluded, constructed livestock watering systems, and applied bioengineering measures like tree revetments and willow plantings along streambanks to protect eroded areas. Protection of the riparian areas allowed growth of natural vegetation along the stream. The cost of these treatments totaled approximately $40,000 in the two treated watersheds.

During the three years after BMP installation, streambanks healed dramatically and sections of the streams became narrow and deeper, offering better habitat for fish and other stream life. Growth of grasses, shrubs, and willows in the stream buffer increased after grazing pressure was removed. Areas where cows had trampled the banks and muddied the stream bottom stabilized quickly.

Treated and untreated watersheds were monitored through November 2000. Data from the untreated control watershed helped account for the year-to-year variations in weather. In the first treated watershed, average phosphorus, nitrogen, and sediment levels in the stream decreased by 12 to 34%, and *E. coli* and fecal coliform bacteria counts dropped by 30 to 40% compared to pre-treatment levels. Phosphorus, nitrogen, and sediment export from the watershed decreased 30 to 50%. The stream protection kept nearly 1 ton of phosphorus, 2 tons of nitrogen, and 126 tons of sediment out of the water each year. These changes, combined with the narrower and deeper stream, led to improvements in the macroinvertebrate community as well.

Results were less dramatic in the second treated watershed. Nutrients, sediment, and bacteria declined significantly during the first two years of treatment (1998-1999), but these improvements were overwhelmed in 2000 by severe erosion and concentrated polluted runoff from a non-cooperating landowner upstream of the treated area. This incidence of water quality deterioration, despite riparian treatment, emphasizes the need to monitor land use over the entire watershed and not just in the study areas.

Landowners participated in the project for various reasons. One farmer installed all the fencing with his own resources because he wanted his children to be able to "fish in clean water." Another farmer participated because a bridge allowed his herd to cross the stream easily without being blocked by high water during summer storms. Once landowners began the process, they found the treatments to be simple to install and maintain, and easy to incorporate into their normal farm management practices. In addition, farmers were pleasantly surprised by the small amount of land that needed to be removed from grazing to protect the stream.

Those farmers who chose not participate in the project did so for various reasons. DEC officials said some farmers believed that brush growing along the streambanks was unsightly and unacceptable. DEC hopes to change this attitude with future education efforts. But despite the impact of the unplanned land-use changes in one of the treated watersheds, the study showed that riparian zone protection and restoration can be a cost-effective tool for reducing NPS pollution and loads from livestock grazing lands. This set of simple and inexpensive practices, applied as part of the overall NPS management effort in the Lake Champlain Basin, serves as an example for impaired watersheds across the country.

Copies of the final project report may be obtained from Rick Hopkins, Vermont DEC Water Quality Division, rickh@dec.anr.state.vt.us. Additional information, including a copy of the project's Final Executive Summary, is available online at: www.anr.state.vt.us/dec/waterq/VT319Watershed.htm

Source: *Nonpoint Source News-Notes*, Notes on Watershed Management, Issue Number 68, 06/2002

Changing Grazing Practices

Some California ranchers and environmentalists are working together to achieve balance by implementing innovative grazing practices that are both environmentally sensitive and economically viable. A booklet called *Grazing for Change*, published by the *California Cattlemen's Association* and the *High Sierra Resource Conservation and Development Council* highlights these changes. It features nine ranchers and their successful range and watershed management strategies that could easily be embraced by ranchers and farmers elsewhere.

For example, landowners in Bridgeport Valley have teamed up with the *Bridgeport Valley Ranchers Organization* to develop an extensive water quality program evaluating their efforts to implement rangeland water quality management plans. These plans typically include irrigation ditch and fencing repair, streambank stabilization, and the use of fire and weed control to enhance vegetation. The self-monitoring program documents their efforts to protect waterways such as the Bridgeport Reservoir and the East Walker River, which are home to migratory ducks and are internationally recognized as blue ribbon trout waters. To date, monitoring results indicate improved water quality.

The booklet also features *The Nature Conservancy's* (TNC) effort to monitor grasslands at its Vina Plains Preserve. By monitoring for both species composition and the amount of matter remaining after the grazing season ends, TNC hopes "to show that grassland can be managed for both livestock production and endangered species," explains Rich Reiner. TNC's monitoring results are used as part of an "adaptive management strategy" to annually adjust the Preserve's management. Monitoring to date shows a reduction in weeds, an increase in native plants, and higher forage protein in grazed and periodically burned pastures.

Other case studies feature ranchers implementing innovative grazing practices such as offstream rotational grazing, water development, brush and woody vegetation control and removal, implementation of rangeland water quality management plans, riparian and native perennial grass restoration, controlled burning programs, and conservation easements. These practices increase riparian vegetation and mitigate watershed problems such as erosion, competition by invasive nonnative plant species, and poor water quality.

For more information, contact Dan Macon, *High Sierra Resource Conservation and Development Council*, 251 Auburn Ravine, #105, Auburn, CA 95603. Phone: (530) 823-5687 x115; e-mail: dan.macon@ca.usda.gov

Source: *Nonpoint Source News-Notes*, Issue Number: 68, 06/2002

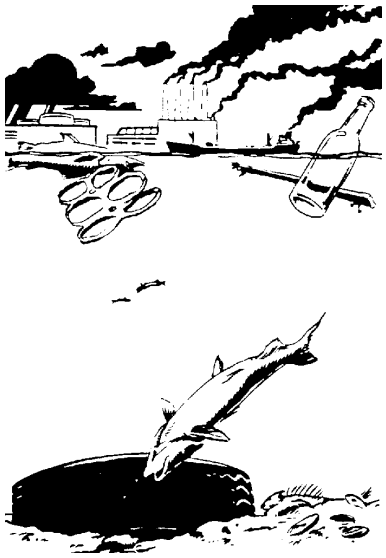
Lake Erie Dead Zone

Last summer, deep in the heart of Lake Erie, offshore between Ohio and Ontario, scientists detected the worst dead zone (an area devoid of life) since the early 1980's, an ominous sign that the lake's environmental progress is shifting into reverse. Already there are abundant warnings that the dead zone will return again this summer and people are concerned that it may get larger. The dramatic cleanup of the 240-mile-long Great Lake — once among the world's most polluted waterways — has long been considered one of the environmental movement's greatest achievements. Any reversal could devastate tourism and fishing economies prospering along the shoreline. Scientists from the U.S. and Canada say they are baffled by what is happening.

A recent U.S. EPA report says last year's dead zone in Lake Erie's central basin duplicated how "anoxia was prevalent in the late 1960's." "However, it is unclear why this may be reappearing," the report says. "What we're seeing in the lake is that phosphorous levels are going up, and they are going up faster than they should," said David Rockwell, an EPA researcher at the

Great Lakes National Program Office in Chicago. "And last year, we had the most rapid depletion of oxygen that we have measured since 1983." At that time, about 90% of Lake Erie's central basin was devoid of oxygen, according to old records.

This year, already by early June, an EPA boat, the *Lake Guardian*, found samples of water that were unusually clouded with algae and other forms of floating plant life. Too much algae is a sign that nutrients such as phosphorus and nitrogen are overabundant — a combination that eventually creates a barren region beneath the surface.



In effect, the nutrients enrich the lake to death. A lake can die when its bottom becomes covered with too much decomposing plant matter, which consumes more and more oxygen as it rots. When the oxygen is gone, the suffocating swath becomes lifeless. Oxygen deprivation takes place nearly every summer somewhere in the deep waters of central Lake Erie. The water remains anoxic until the upper layer of the lake cools in the fall, and mixing occurs. The western basin is so shallow that its waters mix all year long. The eastern basin, the lake's deepest section, is not threatened with oxygen depletion because its much greater water volume can absorb the seasonal changes.

Gerald Matisoff, a Case Western Reserve University geo-chemist heading the U.S. side of the Lake Erie investigation, said an eight-boat flotilla of research vessels will crisscross the central basin this summer in search of answers. Scientists will gather thousands of water samples to more precisely measure the dead zone's boundaries, depths and development in June, July and August. By midsummer, the U.S. and Canada will have about 40 researchers from 17 universities studying the area like a scientific SWAT team.

"Back in the 1960's and 1970's, the lake had the same problems. We thought they were solved, and for the last 10 years we've been patting ourselves on the back," Matisoff said. "All of a sudden we've got a disturbing trend of degrading water quality. The question is: How come?" Many scientists suspect that zebra mussels and other exotic species such as round gobies are starting to reshape Lake Erie's ecosystem in ways that scientists have yet to fathom, Matisoff said. Others theorize that the lake may be suffering from the effects of climate changes linked to global warming.

Another theory is that sewage treatment plants could be dumping excess wastes, said Murray Charlton, a scientist at Canada's National Water Research Institute. The lake should not be in decline after nearly $8 billion was spent on new sewage treatment plants since the 1970's. Laws were passed to restrict the use of phosphate laundry detergents. Farmers even changed tillage practices to reduce fertilizer runoff. Those moves cut the flow of phosphates into the lake by more than half — from 24,000 tons a year to less than 11,000 tons.

Most puzzling to scientists are water-quality measurements taken by Canadian researchers the last two years near Niagara Falls, where the lake's waters exit. They show phosphorous levels leaving Lake Erie have "markedly exceeded the quantity entering" each year from sewage treatment plants, farms and other known sources. By all prior calculations, Lake Erie should still be growing cleaner, Charlton said. "I don't want to sound alarmist," he said, "But we have no idea, really, what is going on."

Source: Bill Sloat and Molly Kavanaugh, *The (Cleveland) Plain Dealer*, 6/14/02

Acid Rain Effects on Trees

Acid rain threatens forests in more ways than previously thought according to a recent study published in the *Proceedings of the National Academy of Sciences*. The study found that plant roots access a small proportion of nutrients in the soil, leaving much of them tied up in minerals and rocks. Scientists had long thought that trees get essential metals from weathered rock particles deep in the soil, but the new study suggests that they get their nutrients almost exclusively from the atmosphere, forcing them to rely on a small pool of nutrients in the topsoil that is continually recycled and replaced by the atmosphere. Because acid rain leaches essential metal nutrients such as potassium, calcium and magnesium from topsoil, the tight pool of nutrients is a concern. By disturbing this small pool, acid rain puts the forests at risk.

Martin Kennedy, one of the study's authors and an assistant professor of sedimentary geology at the University of California-Riverside, says the small pool of nutrients has important implications for forests in the Northeast and Europe suffering from industrial pollution. "Pretty soon, we'll be at a crossroads for changing the amount of acids we're releasing", he said. The effects of mineral depletion can already be seen in parts of Germany, where trees are dying from magnesium loss stemming from acid rain, not from the direct effects of the acid. Kennedy says similar effects could be seen soon in the Adirondacks as the forests start to suffer from loss of soil nutrients.

The study's findings imply that old growth forests are the most at risk from acid rain because they're also the most closely tied to receiving nutrients from the atmosphere. Every unit of acid added to the soil removes an equal amount of nutrients. The hydrogen in the acid leaches more nutrients than the weathering of rocks or precipitation replenishes. "Plants can't do anything with hydrogen, and they can't do anything at all if they don't have calcium and magnesium," Kennedy said.

Experimenting on trees in healthy and unpolluted Chilean forests, the scientists analyzed the levels of strontium in soils, stream water, rain and plants. They found that rain contributed 85 to 99% of the strontium, and thus other similar elements. Using an artificial chemical tracer to observe the movement of nutrients through the soil plant system, the researchers found that most of the tracer was lost from the topsoil within three years. Loss of the element within such a short period implies that only a small pool of nutrients exists in the upper soil.

The study appears to contradict findings published most recently in the 6/13/02 edition of *Nature* in which *Hubbard Brook Research Foundation* scientists found that trees in the Northeast's polluted forests were accessing nutrients from deeper rock. Clean Air Task Force senior scientist Bruce Hill says the study raises some interesting

questions, but it's not enough to overturn the "robust" conclusions of 30 years of *Hubbard Brook* research. "At this stage, we need to wait and see what kind of implications this has in the Eastern ecosystems most hard hit by acid rain," Hill said. But if the study's conclusions are even partially correct, Hill said, it would mean the sooner industries reduce sulfur and nitrogen emissions, the sooner the ecosystem would respond. "If that were true, wouldn't it be possible to have a more immediate ecosystem recovery response? That would be an exciting outcome," he said.

Kathleen C. Weathers of the *Institute of Ecosystem Studies* said the study supports a growing body of research showing that shallow-rooted trees, especially in near-coast systems, may be more likely to cycle and "use" atmospheric sources of calcium, but more research is warranted. She said the overall message is that atmospheric inputs of calcium are important. "We need to consider where and how plants access the nutrients they need and what anthropogenic changes do to affect both the availability and supply of those nutrients, and their cycling, or leaching," Weathers said. "In the case of these near-coast systems, it seems that any alteration of the calcium inputs via atmospheric deposition could have serious consequences."

Source: Eryn Gable, *Greenwire*, 7/15/02

Fish Advisories Increased in 2001

The number of fish consumption advisories issued by states fell 8% in 2001, but according to the USEPA the more important measure — acreage of waters covered by the advisories — actually grew. Mercury remains the leading contaminant of fish, accounting for all or part of 75% of the advisories. Over-arching the situation, however, is the fact that growth in the number of advisories and acres affected is mostly due to greater efforts by the states to test fish and warn the public, EPA noted.

At issue is the bioaccumulation of 39 chemicals, which can remain in the water or sediment and intensify in fish flesh as the chemicals move up through the food chain. Top predators such as largemouth bass and walleye — which are commonly eaten by people — can have chemical concentrations a million times higher than that of the water in which they live. Mercury, which is linked to neurological problems, especially in infants and children, is the chemical of greatest concern, but PCBs, chlordane, dioxins and DDT also pose risks (the five chemicals were at least partly responsible for 96% of the 2001 advisories).

According to the USEPA, 28% of U.S. lake acreage (79,119 lakes totalling 11.3 million acres) and 14% of U.S. river miles (485,205) were under advisories in 2001, and the total number of warnings for the year was 2,618. By comparison, in 1993, 14,962 lakes and 74,505 river miles were under advisories. In fact, 28 states had statewide advisories last year, though not all were danger warnings. Maryland, Missouri, North Dakota and Pennsylvania bumped up their piecemeal mercury warnings to the statewide level — increasing the national lake acreage and river mile warning figures in the process — while Alaska issued a statewide advisory only to say fish taken from all its waters were safe to eat.

Coastlines are also included in the fish advisories, and in 2001 an estimated 71% of shores along the lower 48 states were under advisories. All of the Gulf Coast and 92% of the Atlantic Coast were under warnings, but the Pacific Coast only saw local advisories. All the Gulf Coast warnings were for mercury, while the Atlantic warnings were for mercury, PCBs, dioxins and cadmium.

All of the Great Lakes and connecting waters were under advisories in 2001, though the mileage and acres were not included in EPA's calculations. Other "Great Waters" under advisory included Lake Champlain (for mercury and PCBs), waters feeding Chesapeake Bay (for PCBs and kepone), 20 National Estuary Program sites and 14 National Estuary Research Reserve System sites.

Tim Breen, *Greenwire* 6/27/02

Spring Viremia Detected in Carp

The first confirmed North American diagnosis of Spring Viremia of Carp (SVC) has been documented at a fish hatchery in North Carolina. SVC is caused by the virus *Rhabdovirus carpio*. The good news is that it is a very contagious disease, affecting non-native species such as the common carp, grass carp, bighead carp, crucian carp (goldfish), and sheatfish fry. The bad news is that there is a significant number of native fish species that could also be susceptible to the viral pathogen. These include all cyprinids (minnows), possibly esocids (pike), and at least one salmonid (trout). Outbreaks seem to occur when water temperature increases in the spring. Young, farmed fish are very susceptible, and any stress puts the fish at greater risk of infection. The virus is spread in the feces, as well as possibly in the urine and gill mucus. The carp louse and a leech can also transmit the infection.

The hatchery in North Carolina where SVC was identified observed a 10% death rate per week of young koi in their processing facility tanks, where they were being observed for a 7-10 day period for quality control. There were no signs of illness in these fish while they were in the ponds, prior to being placed in the processing facility tank. Illness was only observed after the koi were placed in the processing facility.

Samples from the koi were sent to the University of Arkansas, Pine Bluff Laboratory, an Animal and Plant Health Inspection Service (APHIS) approved diagnostic facility, and then forwarded on to the Office International des Epizooties (OIE) Reference Laboratory for confirmation. The OIE Reference Laboratory confirmed SVD on 6/25/02. All of the fish in the processing facility either died or were euthanized. The infected fish originated from 4 out of 120 ponds located at the hatchery. The 4 affected ponds have be en depopulated and drained. There are no longer signs of SVC disease in any of the ponds or processing facilities at the hatchery. This may be due to the rise in water temperature which may inactivate the SVC virus in the environment and may also result in the inactivation of the SVC virus in infected fish.

Tanks and ponds at the infected hatchery have been sampled, except for a lined display pond holding large koi. The koi in this particular display pond originated from the hatchery and have been present in the display pond for several years. The koi in the display pond will be bled and serum will be sent to the OIE Reference Laboratory for testing even though there appears no epidemiological link to the fish from the infected ponds. The hatchery has agreed to enter into a certification program in which representatives from the (APHIS) will routinely monitor and test for the virus.

For additional information contact: USDA, APHIS, Veterinary Services, Emergency Programs staff at 301-734-8073, 800-940-6524, or EMOC@APHIS.USDA.GOV

Global Warming and Disease

Warming temperatures around the world are increasing the geographical range and virulence of diseases, a trend that could mean more devastating epidemics in humans, animals, and plants, according to a report published in the magazine *Science* on 6/20/02. Already, the dengue virus in Latin America and Rift Valley fever in the Middle East, which can cause people to vomit blood, have expanded their deadly range. Meanwhile, an oyster disease has gained a foothold in Maine waters, the report said.

Researchers have long accepted that global warming will affect a wide range of organisms, but they are only now beginning to predict what those will be. While climate change scientists have studied a handful of human diseases, the recent *Science* report was the first to study dozens of diseases in both humans and nonhumans. "We are seeing lots of anecdotes and they are beginning to tell a story,'' said Andrew P. Dobson, professor at Princeton University's department of ecology and evolutionary biology and one of the authors. "It's a much more scary threat than bioterrorism.''

The report comes at a crucial time. Earlier this month, the Bush administration concluded that man-made sources of heat-trapping, or greenhouse, gases were responsible for global warming. The *Science* report adds to the growing evidence that nearly every part of the natural world could suffer in some way from the long-term warming trend. It notes that many regions, including New England, could be losing one of their best defenses against disease: cold weather. Every fall, mosquitoes that may be carrying the deadly West Nile virus, for example, are killed off before they multiply and spread the disease too widely. But as global warming heats up the Earth, even by minute degrees, disease-carrying organisms may regenerate faster or go into new areas where populations may have little or no natural resistance.

''It's possible that the time that it takes for [a disease-carrying organism] population to double might be halved with a single degree or half degree of warming,'' said Rick Ostfeld, an animal ecologist at the *Institute of Ecosystem Studies* in Millbrook, N.Y., one of authors. "What we found were striking patterns of climate warming and spread of disease, and greater incidence of disease."

The report notes that with increased temperature, mosquitoes that carry the dengue virus bite more often. Slime mold grows faster on eelgrass. Parasites that attach to butterflies gather in greater density. Not everyone will consider the news bad, however. A fungus in frogs decreases with higher temperatures. An avian cholera that favors cold weather could disappear.
Of course, not all disease spread can be attributed to climate change. Authors say many other reasons can account for it, including increased human travel and resistant bugs. Still, the spread of Rift Valley fever and even eastern oyster disease appears to be largely related to long-term temperature fluctuations. Rift Valley, a particularly nasty disease spread across the Red Sea in 2000 and killed 200 people in Yemen and Saudi Arabia; and its range is expanding.

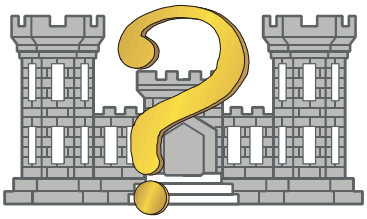
Eastern oyster disease is now found in Maine waters that have warmed slightly in recent years. "The disease is normally limited by cold winters,'' said C. Drew Harvell, lead author of the report and a Cornell professor in the department of ecology and evolutionary biology. She said the virus was in Long Island and then jumped to Maine. "While there are multiple reasons for the redistribution of emerging disease... it's clear there is an emerging pattern here," said Paul Epstein, associate director of Harvard Medical School's *Center for Health and the Global Environment*. "We've clearly underestimated the rate at which climate would change, and we have underestimated the response of ecological systems to that warming."

Source: Beth Daley, *Boston Globe*, 6/21/02

Corps Officials Admit Reform Needed

Top officials with the U.S. Army Corps of Engineers (Corps) acknowledged in mid June that the agency needs to be reformed in the wake of several embarrassing blunders in which it grossly miscalculated the costs and benefits of expensive projects that would not otherwise have been approved. "I'm willing to state categorically that the Corps must change," said Corps chief engineer Robert Flowers in testimony before the Senate Environment and Public Works Committee. "We've had some high-profile failures. That's simply unacceptable."

Les Brownlee, acting assistant Secretary of the Army for civil works, a political appointee and the top Corps official, agreed. "This administration supports the goals of Corps reform and is willing to work with the committee to eliminate unneeded water projects to pursue only those that are worthy," he said. The officials stopped short, however, of giving their blessing to legislation by Sens. Robert Smith (R/NH), John McCain (R/AZ) and Russ Feingold (D/WI) — S. 1987, the *Corps of Engineers Modernization and Improvement Act* — that would require independent reviews of large or controversial Corps projects, shift more of the cost to local government, and put stricter guidelines on replacing wetlands that are lost during construction.



"The last thing I'd want to do would be to criticize someone's effort to make something better," Brownlee said in response to a question about his position on S. 1987. But "What would be the impact on riverine transportation and economic competitiveness?", he asked. "Is the primary goal to shift the focus away from economic development and toward environmental restoration?"

Meanwhile, an independent study just released by the *National Academy of Sciences* says that Corps planners should seek an independent review for each of their large-scale engineering projects. The academy's report to Congress advised the Secretary of the Army to create an administrative group that could decide whether the Corps' planning studies should be reviewed internally or externally. It also said any planning studies involving high costs, controversy, a broad area, or large environmental risk should be sent for an external review. "The highest degree of credibility will be achieved if responsibility for external review is given to an organization that is independent of the Corps," said James Mitchell, a professor emeritus at Virginia Tech who chaired the academy committee that wrote the report.

Congress asked for the report in the wake of whistle-blowers' allegations that Corps officials manufactured a case for spending $1 billion to enlarge barge locks on the upper Mississippi and Illinois rivers. The

report was seen by environmental groups as confirming their belief that the Corps has an institutional bias toward building huge dams and other projects.

"There are mountains of evidence that Corps projects are based on bad economics and bad science that have resulted in the needless destruction of countless rivers, wetlands and bays," said Scott Faber of *Environmental Defense*, an advocacy group. "This report confirms we have the fox guarding the hen house," said Mark Van Putten, president of the *National Wildlife Federation*. "The most highly regarded scientists in the nation have eliminated any doubt that independent review is absolutely necessary to restore credibility to the Corps' project plans." Van Putten said projects like a $165 million hydraulic pump arrangement that would affect more than 200,000 acres of wetlands in Mississippi and a $319 million prairie irrigation system in Arkansas probably wouldn't stand up to a "reality check" afforded by outside review.

Meanwhile, Maj. Gen. Robert H. Griffin, the Corps' civil works director, said he viewed the report as a valuable tool deserving of careful study. "We continue to improve our planning capability," Griffin said. "The Corps also agrees with others who are calling for a more holistic watershed approach to the nation's water resource issues." Spokesman David Hewitt defended the Corps, saying that on average "only 16 out of every 100 (projects) pass muster." He also said the Corps has gone through a "cultural shift" the past several decades. "There's been a change not only in the way we do business," he said, "but there's been a change to ensure that we look toward building sustainability into all that we say and do."

Senate. Majority Leader Tom Daschle (D/SD) said that he supports overhauling the Corps and would sign on to S. 1987 as a co-sponsor. Also, while conservation groups have long supported making the Corps more environmentally responsible, Keith Ashdown of *Taxpayers for Common Sense* (TCS) said more and more lean-government lobbyists are joining the fight. "There is a growing chorus of fiscal responsibility advocates that want to see the Corps reformed," he said. The *National Taxpayers Union* and *Citizens Against Government Waste* have joined TCS in supporting Smith's bill.

Smith said he would do everything possible to block this year's Water Resources Development Act (WRDA) — a two-year bill that authorizes new Corps water projects — unless Corps reform is a part of the legislation. While many in Congress cherish the WRDA bills as a source of federal dollars flowing to their home districts, Sen. Kit Bond (R/MO) said he would do without the bill if it meant adopting some of the changes Smith advocates, especially the independent review, which Bond feels will slow Corps projects. "If this will slow the process even more, then we probably will not have a WRDA bill," he said. "I did not start this fight, but I will join it with enthusiasm," he said.

Source: Damon Franz, *Greenwire*, 6/19/02 and John Heilprin, *AP*, 7/26/02

Meetings of Interest

Sep 2-6: 4th International Symposium on Aquatic Animal Health, New Orleans, LA. See: www.vetmed.lsu.edu/isaah2002.htm.

Sep 3-6: Riversymposium. Brisbane, Australia. Visit: www.riverfestival.com.au. Contact: conference@riverfestival.com.au or call +61 7 3846 7444

Sep 8-11: Dam Safety 2002. Tampa, FL. Contact Association of Dam Safety Officials at 859-257-5140 or email info@damsafety.org

Sep 10-12: Design and Nature 2002: Comparing Design in Nature with Science and Engineering. Udine, Italy. Contact Rachel Green. 01144(0) 238 0293223**,** *rgreen@wessex.ac.uk*

Sept. 22-26: Rocky Mountain Summit: Sustaining Ecosystems and Their People. Whitefish, MT. Contact Julia Rodriguez or Jessie Williams-Bell, 573/882-9291

Oct. 7-9: Wetlands 2002. Indianapolis, IN. Visit www.Core4.org/Wetlands

Oct 10-13: 12th National Conference of the Society of Environmental Journalists. Baltimore, MD. Contact Beth Parke, 215/884-8174, sej@sej.org

Nov 12-14: Symposium on the Effects of Fishing and Benthic Habitats: Linking Geology, Biology, Socioeconomics, and Management, Tampa, FL. Contact Peter Barnes, pbarnes@usgs.gov.

23-27 March 2003: The Future of Aquatic Ecosystems. Zurich, Switzerland. Organized by the Foundation for Environmental Conservation and Swiss Federal Institute of Environmental Science & Technology (EAWAG). See http://www.icef.eawag.ch. Contact: icef@eawag.ch

July 6-11, 2003: Ninth International Conference on River Research and Applications, New South Wales, Australia. See http/:www.conlog.com.au/NISORS. Contact: Ms. Elizabeth Medley, conference@conlog.com.au or A/Professor Martin Thoms, thoms@scides.canberra.edu.au

Aug 21-22, 2003: Maritime Environmental Engineering Technical Symposium 2003. Arlington, VA. Contact David Breslin, BreslinDA@navsea.navy.mil

Congressional Action Pertinent to the Mississippi River Basin

Aquaculture and Marketing

S. 1494: Lincoln (AR) and 6 Co-sponsors. To amend the Federal Food, Drug, and Cosmetic Act to limit the use of the common name "catfish" in the marketing of fish.

S. 1898: McConnell (KY). To establish the Green River National Wildlife Refuge in the State of Kentucky.

H. R. 2439: Ross (AR) and 10 Co-sponsors. To amend the Agricultural Marketing Act of 1946 to require that retailers of farm-raised fish inform consumers, at the final point of sale, of the country of origin of the commodities.

Corps of Engineers Reform

H. R. 1310: Kind (WI) and 13 Co-sponsors; **S. 646:** Feingold (WI); and **S. 1987:** Smith (NH) and 2 Co-sponsors. To reform the Army Corps of Engineers.

H. R. 2353: Tancredo (C)) and 5 Co-sponsors. To revise certain policies of the Army Corps of Engineers for the purpose of improving the Corps' community relations, and for other purposes.

Endangered Species Act (ESA) Amendments:

- S. 911: Smith (OR) and Baucus (MT). To reauthorize the ESA of 1973.
- S. 347: Thomas (CA). To improve the listing, recovery planning, and delisting, and for other purposes.
- S. 1912: Smith (OR) and **H. R. 2829:** Walden (OR) and 6 Co-sponsors.. To require the Secretary of the Interior and the Secretary of Commerce to give greater weight to scientific or commercial data that is empirical or has been field-tested or peer-reviewed, and for other purposes.
- H. R. 1402: Thomas (CA). To reform the regulatory process under the ESA.
- H. R. 2409: Otter (ID) and Simpson (ID). To vest in the Secretary of the Interior functions under that ESA with respect to species of fish that spawn in fresh or estuarine waters and migrate to ocean waters, and species of fish that spawn in ocean waters and migrate to fresh waters.
- H. R. 3705: Pombo (CA). To require the Secretary of the Interior to use the best sound science available in implementing the ESA.
- H. R. 4579: Miller (CA) and 77 Co-sponsors. To ensure the recovery of our Nation's declining biological diversity; to reaffirm and strengthen this Nation's commitment to protect wildlife; to safeguard our children's economic and ecological future; and to provide assurances to local governments, communities, and individuals in their planning and economic development efforts.

Federal Water Pollution Control Act (FWPCA) Amendments:

- S. 678: Bond (MO) and **- H. R. 325 :** Tanner (TN) and 11 Co-sponsors. To establish a program for fisheries habitat protection, restoration, and enhancement, and for other purposes.
- H. R. 1474: Jones (NC) and 16 Co-sponsors. To address wetlands mitigation banking, and for other purposes.
- H. R. 1750: Dingell (MI) and 29 Co-sponsors. To authorize funding for the State water pollution control revolving fund program for fiscal years 2002 through 2006.
- H. R. 668: Kelly (NY) and 15 Co-sponsors and **H. R. 3792:** Kelly (NY) and Tauscher (CA). To authorize appropriations for State water pollution control revolving funds, and for other purposes.
- H. R. 4572: Dingell (MI). To increase certain criminal penalties, and for other purposes.
- H. R. 4683: Pallone (NJ) and Shays (CT). To clarify that fill material cannot be comprised of waste.

Forestry

H. R. 1494: McKinney (GA) and 109 Co-sponsors. To save taxpayers money, reduce the deficit, cut corporate welfare, protect communities from wildfires, and protect and restore America's natural heritage by eliminating the fiscally wasteful and ecologically destructive commercial logging program on Federal public lands, restoring native biodiversity in our Federal public forests, and facilitating the economic recovery and diversification of communities affected by the Federal logging program.

Fish and Wildlife

S. 531: Lincoln (AR) and Dorgan (ND) and **H. R. 1013:** Deal (GA) and 3 Co-sponsors. To promote recreation on Federal lakes, to require Federal agencies responsible for managing Federal lakes to pursue strategies for enhancing recreational experiences of the public, and for other purposes.

S. 990: The American Wildlife Enhancement Act of 2001, Amends the Pittman-Robertson Wildlife Restoration Act to improve the provisions relating to wildlife conservation and restoration programs, and for other purposes. Passed.

S. 1314: Breaux (LA) and Hutchison (TX); **H. R. 3104:** Peterson (MN) and 5 Co-sponsors; and **H. R. 3547:** Peterson (MN) and Green (TX). To protect the public's ability to fish for sport, and for other purposes.

S. 1328: Landrieu (LA). "Conservation and Reinvestment Act".

H. R. 3570: Bereuter (NE). To direct the Secretary of the Interior to monitor the health of the Missouri River and measure biological, chemical, and physical responses to changes in river management and other significant variables.

H.R. 3727: Peterson (MN), and 7 Co-sponsors. To authorize the Interior Secretary to issue regulations under the Migratory Bird Treaty Act that would allow states to establish hunting seasons for double-crested cormorants.

Mining

H. R. 4078: Udall (CO). To provide for the reclamation of abandoned hardrock mines, and for other purposes.

Nonindigenous Aquatic Nuisance Species Act (NISA) Amendments:

- S. 1034: Stabenow (MI) and 12 Co-sponsors. To require the Secretary of Transportation to promulgate and review regulations to ensure, to the maximum extent practicable, that vessels entering the Great Lakes do not spread nonindigenous aquatic species, to require treatment of ballast water and its sediments through the most effective and efficient techniques available, and for other purposes.
- H. R. 2732: Baird (WA) and 22 Co-sponsors. To prevent the westward spread of aquatic nuisance species by directing the Secretary of the Interior to prevent westward spread of such species across and beyond the 100th meridian, monitor water bodies, and provide rapid response capacity in certain Western States, and for other purposes.
- H. R. 3558: Gilchrest (MD) and Underwood (Guam). To protect, conserve, and restore native fish, wildlife, and their natural habitats on Federal lands through cooperative, incentive-based grants to control, mitigate, and eradicate harmful nonnative species, and for other purposes.

Public Lands

H. R. 883: Young (AK). To preserve the sovereignty of the U.S. over public lands and acquired lands owned by the U.S., and to preserve State sovereignty and private property rights in non-Federal lands surrounding those public lands and acquired lands.

H. R. 1381: Udall (CO). To direct the Secretary of the Interior to establish the Cooperative Landscape Conservation Program.

H. R. 3962: Peterson (PA) and 5 Co-sponsors. To limit the authority of the Federal Government to acquire land for

certain Federal agencies in counties in which 50 percent or more of the total acreage is owned by the Federal Government and under the administrative jurisdiction of such agencies.

Water

S. 350: Chaffee (RI) and 55 Co-sponsors. To amend the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 to promote the cleanup and reuse of brownfields, to provide financial assistance for brownfields revitalization, to enhance State response programs, and for other purposes

S. 446: Crapo (ID) and Craig (ID) and **H. R. 1156:** Simpson (ID) and 4 Co-sponsors. To preserve the authority of States over water within their boundaries, to delegate to States the authority of Congress to regulate water, and for other purposes.

S. 447: Crapo (ID) and 2 Co-sponsors and **H. R. 705**, Simpson and 6 Co-sponsors. To subject the United States to imposition of fees and costs in proceedings relating to State water rights adjudications.

S. 1137: Harken (IA) and Grassley (IA) and **H. R. 2372:** Boswell. To direct the Secretary of the Army to convey the remaining water supply storage allocation in Rathbun Lake, Iowa, to the Rathbun Regional Water Association.

S. 1148: Burns (MT) and **H. R. 2202:** Rehberg (MT). To convey the Lower Yellowstone Irrigation Project, the Savage Unit of the Pick-Sloan Missouri Basin Program, and the Intake Irrigation Project to the appurtenant irrigation districts.

S. 1255: Wyden (OR) and Brownback (KS). To encourage the use of carbon storage sequestration practices in the United States.

S. 1537: Bingaman (NM) and 2 Co-sponsors. To authorize the Secretary of the Interior to conduct a hydrogeologic mapping, modeling, and monitoring program for the High Plains Aquifer and to establish the High Plains Aquifer Coordination Council to facilitate groundwater conservation in the High Plains.

S. 1538: Bingaman (NM) and 2 Co-sponsors and **H. R. 3121:** Moran (KS) and Udall (NM). To further continued economic viability in the communities on the High Plains by promoting sustainable groundwater management of the Ogallala Aquifer.

S. 1961: Graham (FL) and 3 Co-sponsors. To improve the financial and environmental sustainability of U.S. water programs

S. 2118: Jeffords (VT). To amend the Toxic Substances Control Act and the Federal Insecticide, Fungicide, and Rodenticide Act to implement the Stockholm Convention on Persistent Organic Pollutants and the Protocol on Persistent Organic Pollutants to the Convention on Long-Range Transboundary Air Pollution.

H. R. 1800: Kind (WI) and 20 Co-sponsors. To establish the Upper Mississippi River Stewardship Initiative to monitor and reduce sediment and nutrient loss in the Upper Mississippi River.

H. R. 2694: Horn (CA). To redesignate the Environmental Protection Agency as the Department of Environmental Protection, and for other purposes

H. R. 3561: Linder (GA) and 2 Co-sponsors. To establish the Twenty-First Century Water Policy Commission.

H. R. 4709: Slaughter (NY). To amend the Public Health Services Act to authorize the Director of the National Institute of Environmental Health Sciences to conduct and coordinate a research program on hormone disruption.

Source: *U.S. Congress On Line*

River Crossings

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