ENVIRONMENTAL DISASTERS

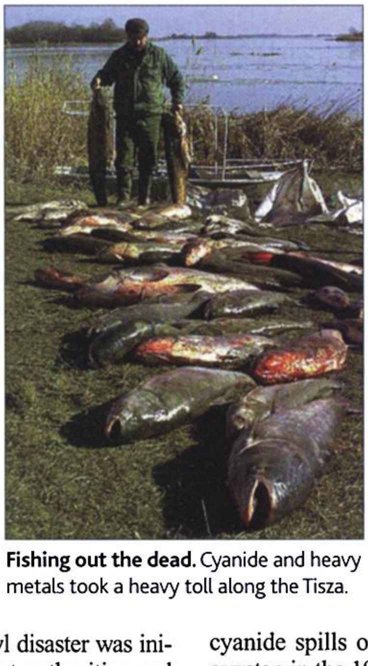
Wildlife Deaths Are a Grim Wake-Up Call in Eastern Europe

After a cyanide spill blighted a major Hungarian river last month, scientists and officials are scrambling to come up with ideas for warding off future disasters

SZOLNOK, HUNGARY—On the night of 30 January, a dike holding millions of gallons of cyanide-laced waste water gave way at a gold-extraction operation in northwestern Romania, sending a deadly waterborne plume across the Hungarian border and down the nation's second largest river. As Hungarians watched in horror, some 200 tons of dead fish floated to the surface of the blighted waters or washed up on the Tisza River's banks. Fish were only the most visible victims. The toxic brew also killed legions of microbes and threatened endangered otters and eagles that ate the tainted fish.

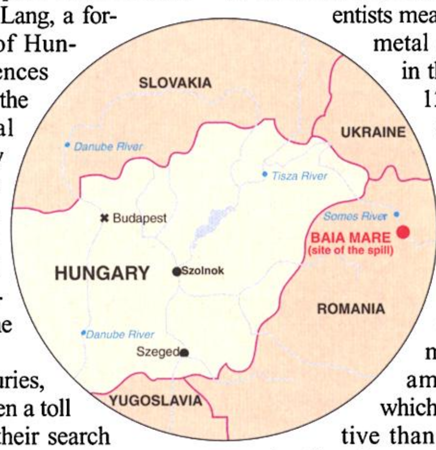
After devastating the upper Tisza, the 50-kilometer-long pulse of cyanide and heavy metals spilled into the Danube River in northern Yugoslavia, killing more fish before the much-diluted plume finally filtered into the Danube delta at the Black Sea, more than 1000 kilometers and 3 weeks after the spill. Scientists across Europe are now assessing the damage and planning how to speed the Hungarian river's revival. Some warn that in the upper Tisza and on the nearby Somes River, the accident could leave a poisonous legacy for several years if heavy metals are left to linger in the river sediments.

The accident may be the worst case of water pollution in eastern and central Europe ever. Some environmentalists even fear that the spill, depending on the extent of the long-term damage, could become Europe's biggest environmental disaster since the explosion at the Chornobyl nuclear power plant in Ukraine in 1986. But many experts think that comparison won't hold water. So far, no people are reported to have been killed by the pollution in Hungary or Romania. And whereas the Chornobyl disaster was initially downplayed by Soviet authorities and most international help took years to mobilize, the response to the Tisza contamination has been swift and broad.



Fishing out the dead. Cyanide and heavy metals took a heavy toll along the Tisza.

In conjunction with the Hungarian and Romanian governments, the European Union's (E.U.'s) commissioner for environment, Margot Wallström, has formed a task force to suggest ways to prevent further cyanide releases from gold mines in the region, and to identify and mitigate similar "hot spots" in the Danube River Basin. Says Istvan Lang, a former secretary-general of Hungary's Academy of Sciences and the founding chair of the nation's environmental council, "This tragedy should become a case study for developing an international approach to restoring ecosystems and for preventing such disasters from happening in the future."



Fool's gold? For centuries, the quest for gold has taken a toll on the environment. In their search for the mythical El Dorado, 16th century Spanish conquistadors slashed and burned their way across the Americas. Today's miners are a different breed, in many cases seeking only to extract gold from tailings left over from mining other minerals. But one of their tools, used for more than a century, is particularly hazardous: cyanide, which separates gold from ore. Mining operations often store cyanide-laced sludge in diked-off lagoons.

Such waste has escaped from lagoons in the past. In 1995, a mine in Guyana, South America, spilled 3 million cubic meters of waste water, contaminated with cyanide and copper, into the Essequibo River. Other major cyanide spills occurred in Latvia and Kyrgyzstan in the 1990s, and heavy-metal waste from a mine in Spain sickened wildlife in the Gradiamar River and the Donana National Park in April 1998, spurring a major cleanup effort.

Last month's accident occurred in the Romanian mining town of Baia Mare, where an Australian-Romanian company, Aurul SA, has been using cyanide to treat tailings. At Baia Mare, waste water is stored in lagoons surrounded by earthen dikes. At about 10 p.m. on the night of 30 January, a dike ruptured, sending an estimated 100,000 cubic meters of waste water into a stream that flows into the Somes, a Tisza tributary that crosses into Hungary.

It wasn't until early the following evening that Romanian officials notified Hungary of the plume; the "Danube Accident Emergency Warning System" in Bucharest broadcast the alarm about 2 hours later. Tests found staggeringly high levels of cyanide in the Somes in both countries. In the following days, scientists measured concentrations of metal complexes of cyanide in the upper Tisza of up to 12 milligrams per liter (mg/l)—about 100 times higher than the country's standard for a "very polluted" river, and far higher than the E.U.'s maximum limit on cyanide in drinking water (0.05 mg/l). That's an ample amount to harm fish, which tend to be more sensitive than humans to cyanide's deadly effects—caused when the compound strangles cells by cutting off their oxygen supply.

But cyanide wasn't acting alone. The plume also carried heavy metals, including copper and zinc, that are now more worrisome than the cyanide. Hungary's environment ministry has reported that copper concentrations temporarily shot up to 36 times the "very polluted" level; zinc and lead also skyrocketed.

A team from the United Nations Environment Program just wrapped up 2 weeks of work along the rivers assessing the damage. The task now, says UN official Anders Renlund, is to "suggest what to do about the rivers, and what steps might be taken to prevent such a disaster from happening again." A group from the U.S. Environmental Protection Agency also is expected to assess the situation later this month.

Because the upper Tisza and the lower Somes were hit hardest, Hungarian scientists are concentrating their efforts there. Two fish species found only in the upper Tisza may have been pushed to the brink of extinction. Meanwhile, at Hortobagy National Park, Hungary's largest park, ecologist Gabor Szilagyi and his team have recovered the carcass of an endangered white-tailed eagle, and they are trying to save another sick eagle. Prospects may be bleak for the area's 400 protected otters, says Szilagyi: "We don't see as many footprints and other signs that they are gathering at the usual places."

Downriver, in Szeged, residents are wondering if the annual appearance of "Tisza flowers"—colorful mayflies that briefly cover the river—will take place at all this spring. And in Szolnok, scientists are analyzing river samples to find out how much pollution remains and how many organisms have survived—or how few. "There isn't much life in the river right now," says microbiologist Eniko Szilagyi, who has examined poisoned plankton.

Damage control. In his office next to the palatial Hungarian Academy of Sciences in Budapest, Lang points to a map showing the tributaries of Hungary's rivers—with more than 90% of that water coming from Romania, Ukraine, Slovakia, and Austria. A thicket of mines, chemical plants, oil refineries, and other sources of pollutants line those tributaries. "The management of environmental security cannot be stopped at the borders," he says. The Hungarian government has filed lawsuits seeking monetary damages against the operators of the Baia Mare gold-extraction lagoon, and it has threatened to sue the Romanian government to help recover the cleanup costs. The accident has stoked bilateral tensions: Romanian officials accuse the Hungarian side of exaggerating the extent of the damage, while Hungarians assert that the Romanians are downplaying the spill.

The accident has also prompted soul-searching within Hungary. The government's top science official, physicist Jozsef Palinkas, told *Science* that he was unhappy with his country's procedures for dealing with such emergencies. He will try to convince the government to "develop an early-warning system for detecting and dealing with environmental disasters." But the World Wildlife Fund (WWF) and a dozen other groups that have banded together to form the "Tisza Platform" want a wider system and more enforceable international agreements on pollution. The WWF is also calling for emergency efforts to clean up the upper Tisza and Somes rivers and the surrounding watershed, it says, "because they will form the base from which the reintroduction of aquatic life in the contaminated waterways will start."

It may take months before Hungarian officials decide on a course of remediation, which could include seeding the river with pollutant-eating microbes. In the meantime, says hydrobiologist Oszkar Balazs, the algae and plankton that survived, as well as organisms that flow in from unaffected tributaries, will help breath new life into the Tisza. Tibor Müller, who heads the Hortobagy Fish Farm, thinks the river will heal within 5 years. Others expect a slower recovery. Biodiversity will suffer for decades, predicts the WWF's Gyorgy Gado. However, he says, "life will return to the Tisza, eventually." –ROBERT KOENIG

OBESITY RESEARCH

Tracing Leptin's Partners in Regulating Body Weight

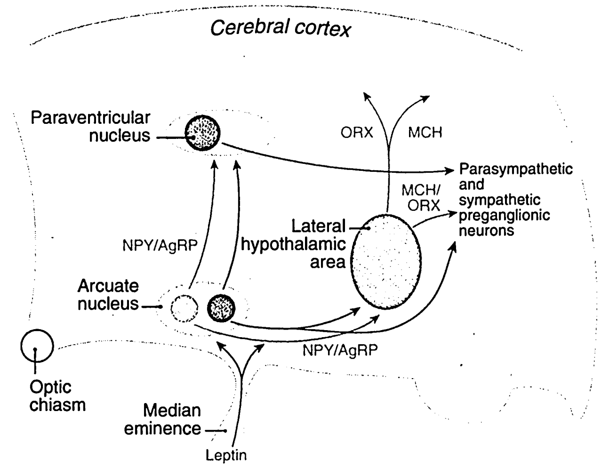
Although the hormone leptin hasn't turned out to be a "magic bullet" for obesity, it has partners in controlling weight—any of which may be antiobesity targets

When Jeffrey Friedman and his colleagues at The Rockefeller University in New York City discovered in 1994 that defects in a hormone called leptin make mice grossly fat, the news brought hope to millions of obese people. Could injections of a natural hormone do what the latest diet couldn't? The biotech firm Amgen Inc. of Thousand Oaks, California, was sufficiently impressed to plunk down $25 million for the rights to leptin, and the hormone seemed headed for the pharmaceutical big time. Since then, leptin's star has—perhaps predictably—fallen. The low point came last year when a clinical trial showed that high doses of leptin produced, at best, modest weight losses in a subset of obese patients. The hormone turned out to be anything but obesity's "magic bullet" (*Science*, 29 October 1999, p. 881).

Is leptin, then, the pharmaceutical equivalent of a fad diet—an overhyped solution to a serious personal and national problem? Not at all, say obesity researchers. Even as the clinical efforts were faltering, basic lab research—much of it stimulated by the discovery of leptin—has been pushing ahead, sketching out a much clearer picture of just how the body controls its weight. And this information is providing many potential new targets for antiobesity drugs. Researchers have identified a wealth of molecules involved in weight regulation, some of which cooperate with leptin to suppress appetite, while others blunt the hormone's fat-busting effects.

Neuroanatomists, meanwhile, are fast on the trail of how and where these molecules work. For the most part, the hot spot is the brain. But leptin also acts on muscle and fat tissue, and a cadre of endocrinologists is teasing out its effects there, too (see sidebar). "Compared to where we were even 3 to 4 years ago, we have an enormous base of new knowledge that we hadn't even a whiff of before," says endocrinologist Jeffrey Flier of Beth Israel Deaconess Medical Center and Harvard Medical School in Boston.

Researchers have been trying to solve the puzzle of what causes obesity for decades. Progress limped along, however, until Friedman's team set the field afire. They reported that mutations in the leptin gene cause hereditary obesity in a long-studied strain of mutant mice. Just 1 year later, Louis Tartaglia's team at Millennium Pharmaceuticals in Cambridge, Massachusetts, and their colleagues at Hoffmann–La Roche in Nutley, New Jersey, hunted down the receptor through which the hormone exerts its weight-suppressing effects. Those discoveries, says Tartaglia, "really provided some genetic entry points into these [obesity]



Wired. Once in the brain, leptin acts on the appetite-enhancing (green) and appetite-inhibiting (red) neurons of the arcuate nucleus. These in turn can influence other brain areas and also the sympathetic and parasympathetic neurons, which communicate with the body periphery.

SOURCE: *NEURON*, 22, 221 (1999)