

WORLD·WATCH

WORKING FOR A SUSTAINABLE FUTURE

A Human Thirst

by Don Hinrichsen

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A Human THIRST

Humans now appropriate more than half of all the **freshwater** in the world. Rising demands from agriculture, industry, and a growing population have left important habitats around the world high and dry.

by Don Hinrichsen ♦ Illustrations by Julia Vakser

On March 20, 2000, a group of monkeys, driven mad with thirst, clashed with desperate villagers over drinking water in a small outpost in northern Kenya near the border with Sudan. The Pan African News Agency reported that eight monkeys were killed and 10 villagers injured in what was described as a “fierce two-hour melee.” The fight erupted when relief workers arrived and began dispensing water from a tanker truck. Locals claimed that a prolonged drought had forced animals to roam out of their natural habitats to seek life-giving water in human settlements. The monkeys were later identified as generally harmless vervets.

The world’s deepening freshwater crisis—currently affecting 2.3 billion people—has already pitted farmers against city dwellers, industry against agriculture, water-rich state against water-poor state, county against county, neighbor against neighbor. Inter-species rivalry over water, such as the incident in northern Kenya, stands to become more commonplace in the near future.

“The water needs of wildlife are often the first to be sacrificed and last to be considered,” says Karin Krchnak, population and environment program manager at the National Wildlife Federation (NWF) in Washington, D.C. “We ignore the fact that working to ensure healthy freshwater ecosystems for wildlife would mean healthy waters for all.” As more and more water is withdrawn from rivers, streams, lakes and aquifers to

feed thirsty fields and the voracious needs of industry and escalating urban demands, there is often little left over for aquatic ecosystems and the wealth of plants and animals they support.

The mounting competition for freshwater resources is undermining development prospects in many areas of the world, while at the same time taking an increasing toll on natural systems, according to Krchnak, who co-authored an NWF report on population, wildlife, and water. In effect, humanity is waging an undeclared water war with nature.

“There will be no winners in this war, only losers,” warns Krchnak. By undermining the water needs of wildlife we are not just undermining other species, we are threatening the human prospect as well.

Pulling Apart the Pipes

Currently, humans expropriate 54 percent of all available freshwater from rivers, lakes, streams, and shallow aquifers. During the 20th century water use increased at double the rate of population growth: while the global population tripled, water use per capita increased by six times. Projected levels of population growth in the next 25 years alone are expected to increase the human take of available freshwater to 70 percent, according to water expert Sandra Postel, Director of the Global Water Policy Project in Amherst, Massa-



chusetts. And if per capita water consumption continues to rise at its current rate, by 2025 that share could significantly exceed 70 percent.

As a global average, most freshwater withdrawals—69 percent—are used for agriculture, while industry accounts for 23 percent and municipal use (drinking water, bathing and cleaning, and watering plants and grass) just 8 percent.

The past century of human development—the



spread of large-scale agriculture, the rapid growth of industrial development, the construction of tens of thousands of large dams, and the growing sprawl of cities—has profoundly altered the Earth's hydrological cycle. Countless rivers, streams, floodplains, and wetlands have been dammed, diverted, polluted, and filled. These components of the hydrological cycle, which function as the Earth's plumbing system, are being disconnected and plundered, piece by piece. This fragmentation has been so extensive that freshwater ecosystems are perhaps the most severely endangered today.

Consider the plight of wetlands—swamps, marshes, fens, bogs, estuaries, and tidal flats. Globally, the world has lost half of its wetlands, with most of the destruction having taken place over the past half century. The loss of these productive ecosystems is doubly harmful to the environment: wetlands not only store water and transport nutrients, but also act as natural filters, soaking up and diluting pollutants such as nitrogen and phos-

Left High and Dry

Habitat destruction, water diversions, and pollution are contributing to sharp declines in freshwater biodiversity. One-fifth of all freshwater fish are threatened or extinct. On continents where studies have been done, more than half of amphibians are in decline. And more than 1,000 bird species—many of them aquatic—are threatened.

More than 40,000 large dams bisect waterways around the world, and more than 500,000 kilometers of river have been dredged and channelized for shipping. Deforestation, mining, grazing, industry, agriculture, and urbanization increase pollution and choke freshwater ecosystems with silt and other runoff.

Water diversion for irrigation, industry, and urban use has increased 35-fold in the past 300 years. In some cases, this increased demand has deprived entire ecosystems of water. Sprawl is an increasing concern, as the spread of urban areas is destroying important wetlands, and paved-over area is reducing the amount of water that is able to recharge aquifers.

phorus from agricultural runoff, heavy metals from mining and industrial spills, and raw sewage from human settlements.

In some areas of Europe, such as Germany and France, 80 percent of all wetlands have been destroyed. The United States has lost 50 percent of its wetlands since colonial times. More than 100 million hectares of U.S. wetlands (247 million acres) have been filled, dredged, or channeled—an area greater than the size of California, Nevada, and Oregon combined. In California alone, more than 90 percent of wetlands have been tilled under, paved over, or otherwise destroyed.

Destruction of habitat is the largest cause of biodiversity loss in almost every ecosystem, from wetlands and estuaries to prairies and forests. But biologists have found that the brunt of current plant and animal extinctions has fallen disproportionately on those species dependent on freshwater and related habitats. One fifth of the world's freshwater fish—2,000 of the 10,000 species identified so far—are endangered, vulnerable, or extinct. In North America, the continent most studied, 67 percent of all mussels, 51 percent of crayfish, 40 percent of amphibians, 37 percent of fish, and 75 percent of all freshwater mollusks are rare, imperiled, or already gone.

The global decline in amphibian populations may be the aquatic equivalent of the canary in the coal mine. Data are scarce for many species, but more than half of the amphibians studied in Western Europe, North Amer-

ica, and South America are in a rapid decline.

Around the world, more than 1,000 bird species are close to extinction, and many of these are particularly dependent on wetlands and other aquatic habitats. In Mexico's Sonora Desert, for instance, agriculture has siphoned off 97 percent of the region's water resources, reducing the migratory bird population by more than half, from 233,000 in 1970 to fewer than 100,000 today.

Pollution is also exacting a significant toll on freshwater and marine organisms. For instance, scientists studying beluga whales swimming in the contaminated St. Lawrence Seaway, which connects the Atlantic Ocean to North America's Great Lakes, found that the cetaceans have dangerously high levels of PCBs in their blubber. In fact the contamination is so severe that under Canadian law the whales actually qualify as toxic waste.

Waterways everywhere are used as sewers and waste receptacles. Exactly how much waste ends up in freshwater systems and coastal waters is not known. However, the UN Food and Agriculture Organization (FAO) estimates that every year roughly 450 cubic kilometers (99 million gallons) of wastewater (untreated or only partially treated) is discharged into rivers, lakes, and coastal areas. To dilute and transport this amount of waste requires at least 6,000 cubic kilometers (1.32 billion gallons) of clean water. The FAO estimates that if current trends continue, within 40 years the world's entire stable river flow would be needed just to dilute and transport humanity's wastes.

The Point of No Return?

The competition between people and wildlife for water is intensifying in many of the most biodiverse regions of the world. Of the 25 biodiversity hotspots designated by Conservation International, 10 are located in water-short regions. These regions—including Mexico, Central America, the Caribbean, the western United States, the Mediterranean Basin, southern Africa, and southwestern China—are home to an extremely high number of endemic and threatened species. Population pressures and overuse of resources, combined with critical water shortages, threaten to push these diverse and vital ecosystems over the brink. In a number of cases, the point of no return has already been reached.

China

China, home to 22 percent of the world's population, is already experiencing serious water shortages that threaten both people and wildlife. According to China's former environment minister, Qu Geping, China's freshwater supplies are capable of sustainably supporting no more than 650 million people—half its current population. To compensate for the tremendous shortfall, China is draining its rivers dry and mining ancient

aquifers that take thousands of years to recharge.

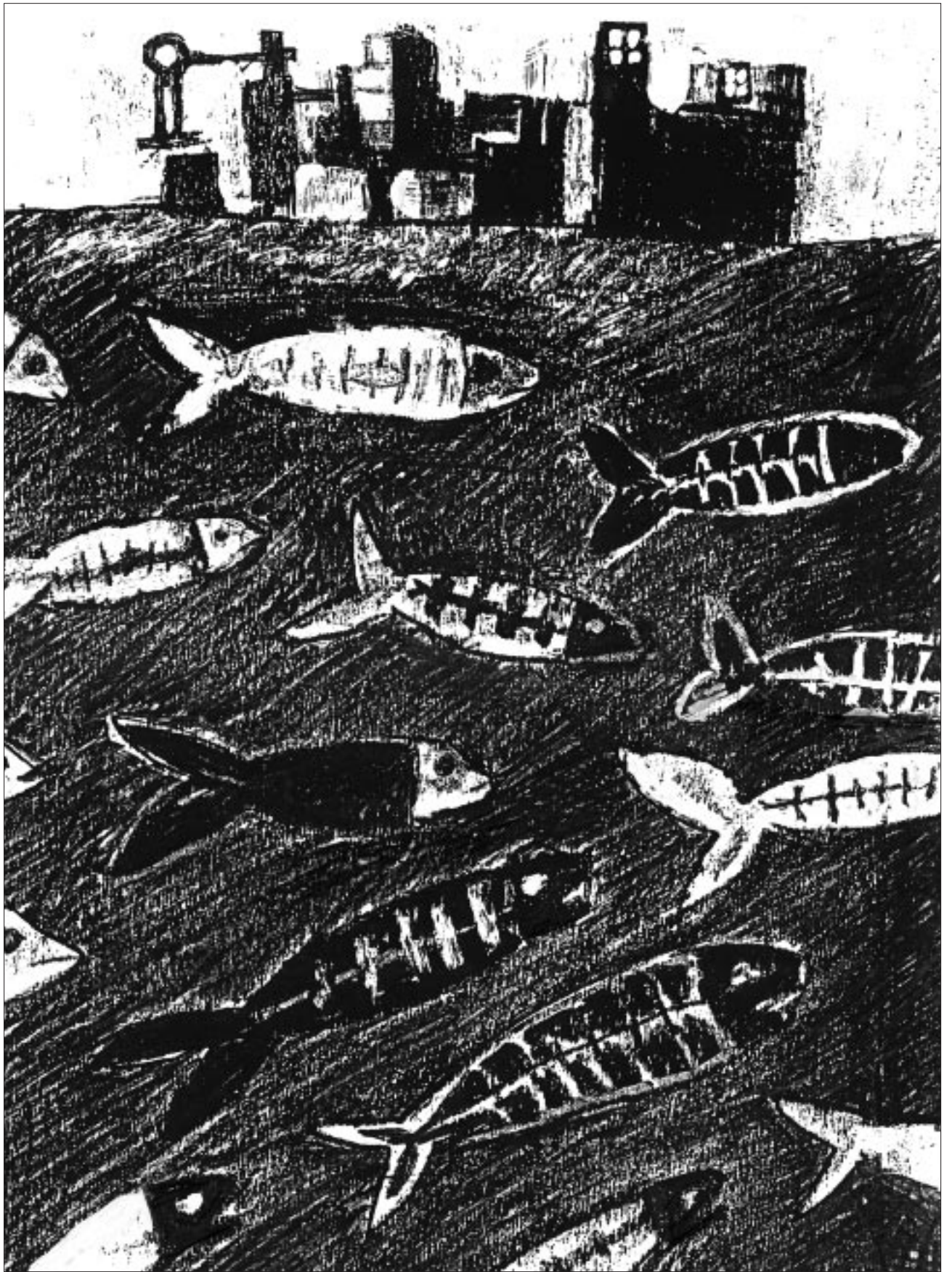
As a result, the country has completely overwhelmed its freshwater ecosystems. Even in the water-rich Yangtze River Basin, water demands from farms, industry, and a giant population have polluted and degraded freshwater and riparian ecosystems. The Yangtze is one of the longest rivers in Asia, winding 6,300 kilometers on its way to the Yellow Sea. This massive watershed is home to around 400 million people, one-



third of the total population of China. But the population density is high, averaging 200 people per square kilometer. As the river, sluggish with sediment and laced with agricultural, industrial, and municipal wastes, nears its wide delta, population densities soar to over 350 people per square kilometer.

The effects of the country's intense water demands, mostly for agriculture, can be seen in the dry lake beds on the Gianghan Plain. In 1950 this ecologically rich area supported over 1,000 lakes. Within three decades, new dams and irrigation canals had siphoned off so much water that only 300 lakes were left.

China's water demands have taken a huge toll on the country's wildlife. Studies carried out in the Yangtze's middle and lower reaches show that in natural lakes and wetlands still connected to the river, the number of fish species averages 100. In lakes and wetlands cut off and marooned from the river because of diversions and drainage, no more than 30 survive. Pop-



ulations of three of the Yangtze's largest and most productive fisheries—the silver, bighead, and grass carp—have dropped by half since the 1950s.

Mammals and reptiles are in similar straits. The Yangtze's shrinking and polluted waters are home to the most endangered dolphin in the world—the Yangtze River dolphin, or Baiji. There are only around 100 of these very rare freshwater dolphins left in the wild, but biologists predict they will be gone in a decade. And if any survive, their fate will be sealed when the massive Three Gorges Dam is completed in 2013. The dam is expected to decrease water flows downstream, exacerbate the effects of pollution, and reduce the number of prey species that the dolphins eat. Likewise, the Yangtze's Chinese alligators, which live mostly in a small stretch near the river's swollen, silt-laden mouth, are not expected to survive the next 10 years. In recent years, the alligator population has dropped to between 800 and 1,000.

The Aral Sea

The most striking example of human water demands destroying an ecosystem is the nearly complete annihilation of the 64,500 square kilometer Aral Sea, located in Central Asia between Kazakhstan and Uzbekistan. Once the fourth largest inland sea in the world, it has contracted by half its size and lost three-quarters of its volume since the 1960s, when its two feeder rivers—the Amu Darya and the Syr Darya—were diverted to irrigate cotton fields and rice paddies (see Endpiece, page 40).

The water diversions have also deprived the region's lakes and wetlands of their life source. At the Aral Sea's northern end in Kazakhstan, the lakes of the Syr Darya delta shrank from about 500 square kilometers to 40 square kilometers between 1960 and 1980. By 1995, more than 50 lakes in the Amu Darya delta had dried up and the surrounding wetlands had withered from 550,000 hectares to less than 20,000 hectares.

The unique *tugay* forests—dense thickets of small shrubs, grasses, sedges and reeds—that once covered 13,000 square kilometers around the fringes of the sea have been decimated. By 1999 less than 1,000 square kilometers of fragmented and isolated forest remained.

The habitat destruction has dramatically reduced the number of mammals that used to flourish around the Aral Sea: of 173 species found in 1960, only 38 remained in 1990. Though the ruined deltas still attract waterfowl and other wetland species, the number of migrant and nesting birds has declined from 500 species to fewer than 285 today.

Plant life has been hard hit by the increase in soil salinity, aridity, and heat. Forty years ago, botanists had identified 1,200 species of flowering plants, including 29 endemic species. Today, the endemics

Alien Invaders

“Rapidly growing populations place heavy demand on freshwater resources and intensify pressures on wildlands,” concludes a combined World Resources Institute and Worldwatch report called “Watersheds of the World.” But increasingly, the introduction of exotic or alien species is playing a large role in wreaking havoc on freshwater habitats.

The spread of invasive species is a global phenomenon, and is increasingly fostered by the growth of aquaculture, shipping, and commerce. Whether introduced by accident or on purpose, these alien invaders are capable of altering habitats and extirpating native species en masse.

The invasion and insidious spread of the zebra mussel in the U.S. Great Lakes highlights the tremendous costs to ecosystems and species. A native of Eastern Europe, the zebra mussel arrived in the Great Lakes in 1988, released most likely through the discharge of ballast waters from a cargo ship. Once established, it spread rapidly throughout the region.

The mussels have crowded out native species that cannot compete with them for space and food. A study of the mussels in western Lake Erie found that all of the native clams at each of 17 sampling stations had been wiped out. Moreover, the last known population of the winged maple leaf clam, found in the St. Croix River in the upper Mississippi River basin, is now threatened by advancing ranks of the zebra mussel.

have vanished. The number of plant species that can survive the increasingly harsh climate is a fraction of the original number.

Most experts agree that the sea itself may very well disappear entirely within two decades. But the region's freshwater habitats and related communities of plants and animals have already been consigned to oblivion.

Lake Chad

Lake Chad, too, has shrunk—to one-tenth of its former size. In 1960, with a surface area of 25,000 square kilometers, it was the second-largest lake in Africa. When last surveyed, it was down to only 2,000 square kilometers. And here, too, massive water withdrawals from the watershed to feed irrigated agriculture have reduced the amount of water flowing into the lake to a trickle, especially during the dry season.

Lake Chad is wedged between four nations: populous Nigeria to the southwest, Niger on the northwest shore, Chad to the northeast, and Cameroon on a

small section of the south shore. Nigeria has the largest population in Africa, with 130 million inhabitants. Population-growth rates in these countries average 3 percent a year, enough to double human numbers in one generation. And population growth rates in the regions around the lake are even higher than the national averages. People gravitate to this area because the lake and its rivers are the only sources of surface water for agricultural production in an otherwise dry and increas-



ingly desertified region.

Although water has been flowing into the lake from its rivers over the past decade, the lake is still in serious ecological trouble. The lake's fisheries have more or less collapsed from over-exploitation and loss of aquatic habitats as its waters have been drained away. Though some 40 commercially valuable species remain, their populations are too small to be harvested in commercial quantities. Only one species—the mudfish—remains in viable populations.

As the lake has withered, it has been unable to provide suitable habitat for a host of other species. All large carnivores, such as lions and leopards, have been exterminated by hunting and habitat loss. Other large animals, such as rhinos and hippopotamuses, are found in greatly reduced numbers in isolated, small populations. Bird life still thrives around the lake, but the variety and numbers of breeding pairs have dropped significantly over the past 40 years.

A Blue Revolution

As these examples illustrate, the challenge for the world community is to launch a “blue revolution” that will help governments and communities manage water resources on a more sustainable basis for all users. “We not only have to regulate supplies of freshwater better, we need to reduce the demand side of the equation,” says Swedish hydrologist Malin Falkenmark, a senior scientist with Sweden’s Natural Science Research Council. “We need to ask how much water is available and how best can we use it, not how much do we need and where do we get it.” Increasingly, where we get it from is at the expense of aquatic ecosystems.

If blindly meeting demand precipitated, in large measure, the world’s current water crisis, reducing demand and matching supplies with end uses will help get us back on track to a more equitable water future for everyone. While serious water initiatives were launched in the wake of the World Summit on Sustainable Development held in Johannesburg, South Africa, not one of them addressed the water needs of ecosystems.

There is an important lesson here: just as animals cannot thrive when disconnected from their habitats, neither can humanity live disconnected from the water cycle and the natural systems that have evolved to maintain it. It is not a matter of “either or” says NWF’s Krchnak. “We have no real choices here. Either we as a species live within the limits of the water cycle and utilize it rationally, or we could end up in constant competition with each other and with nature over remaining supplies. Ultimately, if nature loses, we lose.”

By allowing natural systems to die, we may be threatening our own future. After all, there is a growing consensus that natural ecosystems have immense, almost incalculable value. Robert Costanza, a resource economist at the University of Maryland, has estimated the global value of freshwater wetlands, including related riverine and lake systems, at close to \$5 trillion a year. This figure is based on their value as flood regulators, waste treatment plants, and wildlife habitats, as well as for fisheries production and recreation.

The nightmarish scenarios envisioned for a water-starved not too distant future should be enough to compel action at all levels. The water needs of people and wildlife are inextricably bound together. Unfortunately, it will probably take more incidents like the one in northern Kenya before we learn to share water resources, balancing the needs of nature with the needs of humanity.

Don Hinrichsen is a UN consultant. He is former editor-in-chief of Ambio and was a news correspondent in Europe for 15 years.