

Name: _____

"Return of the Aral Sea"
By Eve Conant

1. The Aral Sea is between what two countries?
2. The Aral Sea is an inland lake. While some of it is still water, most of it is what?
3. How come the Aral Sea is "coming back"?
4. Originally, how far did the sea spread?
5. Which two rivers feed the Aral Sea?
6. Why is/was water diverted from these two rivers?
7. Besides growing smaller, what other problem is the Aral Sea facing?
8. What was the salt content in 1990? What is the salinity of the ocean?
9. What happened to the life in the water because of the high salinity?
10. What effects have humans experienced because of the Aral Sea problems?
11. In 1990, what happened to the Aral Sea?
12. How many people have been affected?
13. Where is the money coming from to build the dam?

14. What is the name of the dam?

15. What has happened to the salt level since the river flow increased?

16. Compare the future of the North and South Aral Sea?

17. How has the weather changed in Aral Sea?

18. Read "The Lives of Inland Seas." What are the 4 lakes, locations, and issues in each?

RETURN OF THE ARAL SEA

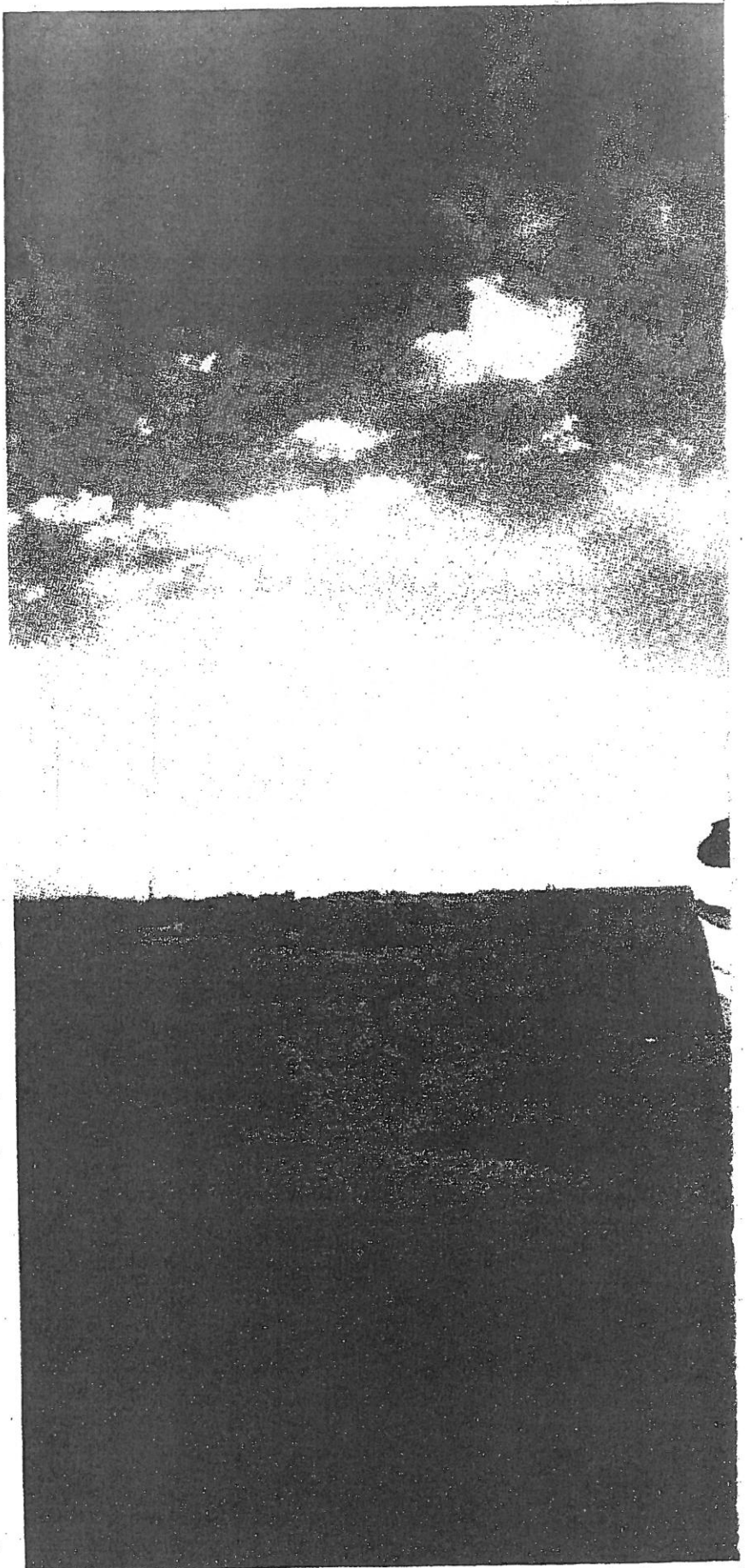
The desiccation of a remote inland lake in Central Asia is one of the world's worst ecological disasters. Now, with an \$85 million engineering project, the doomed sea is coming back to life

BY EVE CONANT

Ecologist Maira Nurkisheva is driving over what was once the northern shore of the Aral Sea, a vast inland lake straddling the border between Kazakhstan and Uzbekistan. Rusting abandoned ships dot the sandy seabed. Some have been scavenged for scrap metal; the others provide shade for irritable herds of Bactrian camels. There are few other signs of life. When we reach the nearby village of Birlistik, which used to overlook a bay on the sea, we see that its mud-walled huts now face an insecticide-laced desert, filled with tumbleweeds and toxic shrubs, that stretches as far as the eye can see. Yet the villagers all speak enthusiastically of the *boget*, or dam, that is part of the grand waterworks project for which Nurkisheva is a consultant. Fifteen-year-old Parxhat Kutmanbetov explains in Kazakh, and Nurkisheva translates: "I've never seen the sea. But now I am sure the sea is coming back."

If all goes as planned, within a few years the Aral Sea could creep back to within three miles of the village. Revival of the shrunken sea hinges on an \$85 million renovation of Kazakhstan's dilapidated system of river canals, sluices, and channels, culminating in an eight-mile dam across the middle of the northern part of the sea. The effort, a collaboration between the World Bank and the oil-rich Kazakh government, aims to reverse the decades of desiccation that have shriveled one of the world's biggest inland bodies of water.

Four decades ago, the Aral Sea offered a constant supply of fish. Two dozen species thrived in its waters, including caviar-rich sturgeon, pike perch, and silver





Combating 40 years of shrinkage, a new dam between the north and south seas is reviving the northern part.

terribly wrong. "The sea was dying in front of my eyes," remembers fishery director Agilbek Aimbetov. "We survived on enthusiasm alone," he says, using a popular Soviet-era euphemism for working for little or no pay.

Not only was the sea drying up, it was growing lethally salty. Like the Great Salt Lake in Utah, the Aral Sea has no naturally occurring outlets and over time collects salt from river deposits. With less water flowing in, the process accelerated. By the late 1980s, 10,424 square miles of seafloor had become desert and was layered with toxic salts. Water salinity had risen from 10 grams per liter in the 1950s, when the sea was healthy, to about 26 grams per liter in 1990. (At 35 grams per liter, it would be as salty as the ocean.) All 24 species of fish disappeared. The water "wasn't quite salt paste yet, but nothing could survive in it," says Masood Ahmad of the World Bank, who was project leader for the massive undertaking in Kazakhstan. "No biological life was possible."

The effects rippled throughout the region. Without this source of food or water, only a few dozen of the 180 known native land-animal species survived the desiccation. When the fishing industry collapsed in the 1980s, thousands of locals fled their villages to search for a new life in larger cities. Those remaining behind eked out an existence on the land. Tuberculosis reached epidemic proportions, and infant mortality rates quadrupled, with acute respiratory diseases accounting for 50 percent of the deaths. Potable

water became scarce throughout the area, and even breathing the air was risky. Chemical runoff from agricultural fields simply dried on the seafloor and was ferried back into towns with the first winds.

By 1990 the shrinking waters had separated into two parts—the northern "Small Sea" in Kazakhstan and the southern "Large Sea" in neighboring Uzbekistan. As the seas evaporated, hard-packed sand replaced water around the hundreds of islands that had dotted the sea and had provided a haven for wildlife. When the waters vanished around Vozrozhdeniya Island, a Soviet germ-warfare facility for open-air testing of anthrax, plague, and smallpox in the southern Aral Sea, U.S. officials in 2000 became so worried that they sent funds and experts to clean up buried stockpiles of the remaining lethal bacteria. In 2002 the U.N. estimated that winds carried 200,000 tons of salt and toxic sand each day throughout the Aral Sea region and thousands of miles beyond, sometimes reaching as far as Russia's Arctic north—a problem that still continues.

"Everything is polluted with herbicides, metals, and salt," says the Aralsk regional hospital's head doctor, Arginbau Asanbaev. Experts believe the ecological disaster has displaced more than 100,000 people and affected the health of more than 5 million people throughout the region.

Plans to save the sea abounded; "assessment fatigued" locals joked that if each visiting scientist had brought a bucket of water, the sea would be filled. The Soviets dreamed up a \$40 billion scheme to divert rivers flowing into the Arctic Sea into the Aral instead, but the plan was shelved for lack of cash. After the Soviet Union collapsed, desperate Kazakh villagers built a primitive dam out of sand to keep the water that trickled into the northern sea from draining away into

carp, known locally as fat tongue. The sea spread over more than 26,000 square miles, and ships could travel 250 miles from the northern port of Aralsk, in Kazakhstan, to the southern harbor of Muynak in Uzbekistan. But Soviet-sponsored irrigation projects, begun in the 1950s, diverted water from two rivers that fed the sea: the Amu Darya and the Syr Darya. By the late '90s, the Aral Sea was known as the world's fastest-disappearing body of water. It had then shrunk by more than half and lost nearly three-fourths of its volume.

Now, after decades of grim losses, the news from the Aral Sea is good: Since the dam's completion last August, the smaller, northern part of the Aral Sea has swelled by 30 percent, flooding more than 300 square miles of parched, sun-bleached seabed.

For thousands of years, people have lived in the Aral Sea basin, which served as an oasis on the Silk Road, the trading route that linked China to Europe. "Three thousand years ago, this was an agricultural region," says Philip Micklin, an Aral Sea expert and geographer emeritus from Western Michigan University. "You'd have seen wooden irrigation canals all along the Amu Darya." Even in 1558, Anthony Jenkinson, an envoy for Queen Elizabeth I, foresaw trouble: "In short time all that land is like to be destroyed, and to become a wilderness for want of water."

Soviet planners in the 1950s diverted much of the rivers' flow to water fields of rice and cotton in Kazakhstan and Uzbekistan and in farther-flung Tajikistan and Turkmenistan. The irrigation system was so leaky that many canals lost more than 50 percent of the diverted river water en route to the fields, which cut the amount flowing into the sea. By the 1970s, everyone could see that something had gone

the southern portion. The dam washed away in the late '90s.

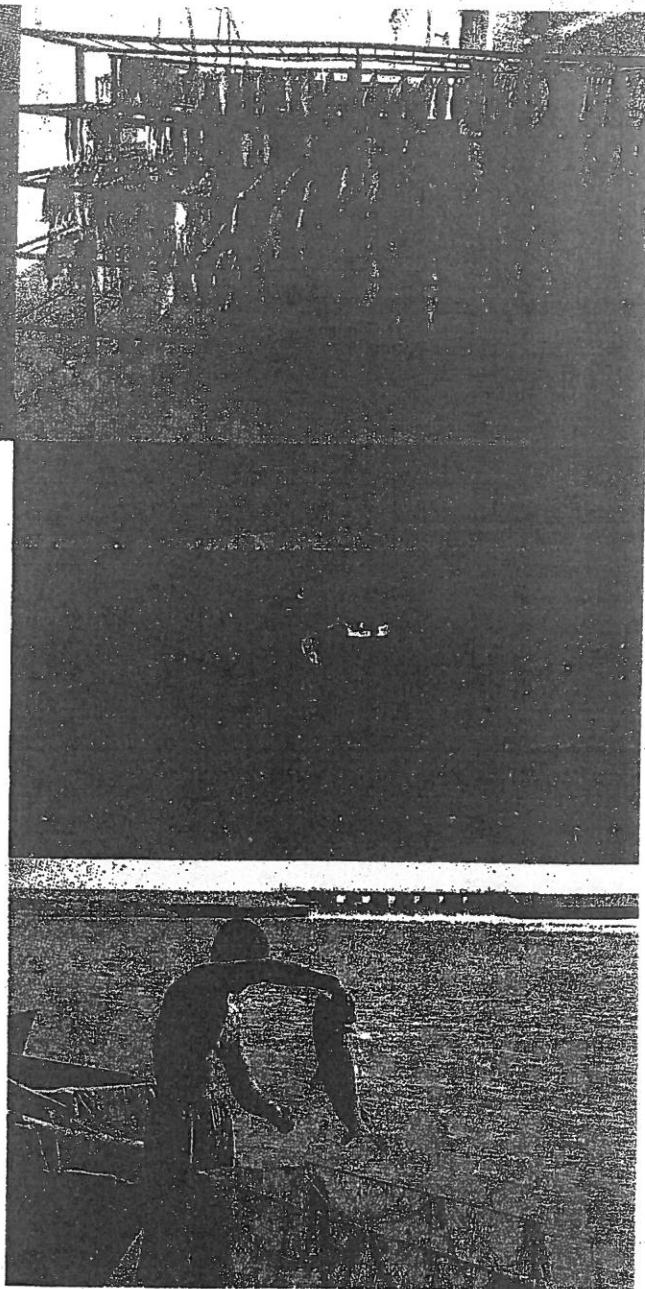
After years of failed initiatives, bureaucratic negligence, and post-Soviet squabbling among former republics, there is now real hope for the Aral Sea. The effort by the World Bank and the Kazakh government, begun in 2001, has reconstructed nearly 60 miles of canals, sluices, and waterworks, dramatically improving water distribution in Kazakhstan. The river flow now efficiently irrigates fields along the banks of the Syr Darya and runs into and rejuvenates the dried-up Aral Sea.

The Kok-Aral Dam, the project's centerpiece, traps the increased flow from the Syr Darya into the northern Aral Sea, preventing it from draining away into the southern Aral Sea, most of which lies in neighboring Uzbekistan. Composed of packed fine sand topped with coarser sand, the dam spans eight miles and looks like a slightly elevated gravel road. Its long, gentle slope protects it from being washed away.

The dam was finished in August 2005. In just seven months, the water level near the dam rose from 126 to 138 feet, fanning northward over 310 square miles of parched seabed and adding about 28 million cubic feet of lifesaving water. Optimists had hoped that in 5 to 10 years, flow from the Syr Darya influx would result in a significant spillover into the southern sea. In February 2006, the dam's spillway opened far ahead of schedule, providing a preferred fishing hole for locals. Kudabai Zhiyenbayev, the leader of the sparsely populated region, says: "There are seven wonders in the world, and this dam is the eighth. To divide the sea in two and save it—it's a miracle."

Alan Howitt, project manager for the enormous construction effort, says improved river management overall has been key. When he first saw the Soviet-era channels and control gates along the once-mighty Syr Darya, he was shocked. "They were rusted and full of holes. It was a mess." His engineers covered holes with steel plates, widened sluices, and in some areas even straightened the river. The flow of the Syr Darya soon doubled to 28,252 cubic feet per second.

With water levels rising, thickets of reeds have cropped up along the banks of the Syr Darya, providing harbor and food for waterfowl, which in turn has led to more Asiatic foxes, wolves, and wild asses, or kulans, and boars. But the creature that excites leading Aral Sea specialist Nick Aladin, head of the Brackish Water Laboratory at the Russian Academy of Sciences in St. Petersburg, is the cladoceran, known as the jumping water flea. In his lilting Russian accent, Aladin explains that "*Cladocera* are very, very tasty for all fish. Even the piranhas in my home aquarium love them." When the Syr Darya and



Clockwise from top left: Fishermen haul in carp on the shore of the new earthen dam separating the northern and southern Aral Sea; bream dry at a fishery center sponsored by Aral Tenizi, a Danish organization; dawn greets fishermen working nets in the northern Aral Sea; near the dam a young Kazakh shows off one of dozens of carp he has caught by midmorning.

the Aral Sea were choked off, the region's 12 species of *Cladocera* dwindled to one or two. The return of the fleas, and the countless species that feed on them, says Aladin, "is a very good sign."

The next phase of the project will bring further improvements that benefit the north, perhaps a higher dam or an additional dam that would allow waters to flow even further northward. Other possibilities include hydropower and a greater emphasis on fishery development, which could draw funding for both government and private commercial fishing enterprises. With rumors circulating of fishermen making upwards of \$800 a day, villages closest to the dam are

"Assessment fatigued" locals joked that if each visiting scientist had brought a bucket of water, the sea would be filled

already vying for international investment.

Zhienbayev, who grew up not far from here, gazes at the fishermen drawing in net after net. "I'm so happy. I've waited my whole life for this. Not long ago this was all sand; we called this the Dead Sea." One of the fishermen from his village, 26-year-old Darxhan Rysmakgombetov, comes to shore with dozens of carp flapping violently in his net. "I caught these in an hour," he says, beaming. Until recently, the only fish that could survive the salt levels were brine shrimp and a special salt-tolerant flounder that had been introduced in 1979. Locals thought the fish was "very strange looking," said Zhienbayev. "No one wanted to eat it."

With increased river flow, the salt level has been dropping, reaching about 14 grams per liter this summer. The water by the dam, which I sampled, is still somewhat briny but hardly the salty, chemical cocktail I'd expected. Because of releases from local hatcheries, 11 species, including pike perch, silver carp, and *vobla*—a delicacy when dried—are now thriving.

Zhienbayev whispers that he has "a commercial secret." Last year, during a preliminary attempt to release sturgeon into the lakes around the Aral Sea, he and his villagers surreptitiously stashed away 100 fingerlings in a hatchery pond. That pond is the centerpiece of his dusty village, Tastak, where locals proudly display a wheelbarrow full of gasping, knobby-spined sturgeon, soon to be full of what the villagers call their black gold—caviar. Once the salinity of the Aral Sea drops to half what it is now, in perhaps two years, larger hatcheries will begin releasing sturgeon into it.

Several years ago the U.N. predicted that the Aral Sea might disappear entirely by 2020, and that fate is still plausible for the southern portion. While oil-rich Kazakhstan has the resources to invest in longer-term solutions, the resource-poor Uzbeks seem more inclined to search for oil in the barren sea bottom than to finance a rescue of the sea itself.

"It's two parallel universes," says Aladin. "They are happy in the north and poor in the south." Philip Micklin, of Western Michigan University, says that despite spillover from the dam, the southern portion of the sea in Uzbekistan will probably shrink a little bit faster than it would have before the dam's construction. "That's just the truth of it. The Uzbek government didn't raise any objection to the dam, but it's not going to help them."

Aladin and Micklin contend that rerouting the Amu Darya, the

southern sea's primary tributary, to flow into the western or eastern portions of the sea could slow or stop the shrinkage. But more people in Uzbekistan depend on agriculture than in Kazakhstan. Deciding how to apportion water resources in a poor land is "a difficult decision," says Aladin. "It's like the mother of two children during the siege of Leningrad who must decide which child to keep alive, which one gets the bread."

Even Masood Ahmad agrees it would be almost impossible to save the sea in its entirety. "If we brought all river water back to the Aral Sea, it would still take more than 70 years to fill it back up, just like it took 50 years to bring it down." Of course, doing that would be ruinous for the farmers who rely on river water for agriculture. One of the reasons for the project's success is that the participants were limited to Kazakhstan. Previous restoration efforts had stalled because of problems with cooperation among multiple states. Nonetheless, the outcome of this project might hold the solution for other troubled waterways, such as the Salton Sea in California or Lake Chad in Central Africa.

In the meantime, the largest town on the northern Aral Sea, Aralsk, awaits the return of water to its withered harbor. But even at a distance, the people are experiencing benefits. The rising waters have already influenced the region's weather, bringing clouds and rainstorms last May that had been absent for decades. Farmers benefit because the increase in precipitation extends the growing season.

The town's chief doctor, Asanbaev, sees other signs of improvement. In the past year, the incidence of anemia among young women has decreased from about 70 to 80 percent to around 50 percent. Like many locals, he thinks better nutrition is the reason. Fish are easier to get now that the sea, once 62 miles away, is just 9 miles distant.

"Thanks to the rebuilding of this dam, there are already satellite dishes on our homes, cars in the streets, weddings, a new school," boasts deputy mayor of Aralsk, Gabit Ospanov. Yet he grows quiet when asked about neighboring Uzbekistan, home to the larger portion of the sea, which will reap few of the dam's benefits. "Each government must think of its own people," he seems to recite. "We showed them what to do. Now they can do what they want." ■

THE LIVES OF INLAND SEAS

Salt lakes are often ancient bodies of water that wax and wane with long-term changes in climate. Some salt lakes will shrink, but others will gain water because of regional changes in rain, glacial runoff, and temperature. The growing demand for water worldwide, however, poses a more immediate threat to salt lakes. Here's

a snapshot of some permanent inland seas around the world:

* The Caspian Sea in Central Asia, larger and far more ancient than the Aral Sea, has been rising since 1977.

* The Dead Sea, shrunk by water diversions from the Jordan River, now bears as much salt as physically possible. Israel and Jordan proposed refilling the Dead Sea by building a 200-mile conduit to the Red Sea. Conservation groups protested.

* Mono Lake in Northern California, which is 2.5 times saltier than the ocean, was saved by a lawsuit in 1983. The California Supreme Court ruled, in effect, for the ecosystem and against the water demands of the City of Los Angeles.

* The Salton Sea in Southern California could lose nearly all its fish by 2021, threatening the many migratory birds that depend on it. A \$1 billion plan to rescue a portion of the sea is being considered.

Jessica Ruvinsky