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ENVIRONMENT

Can the Dead Sea Live?

Irrigation and mining are sucking the salt lake dry, but together Israel, Jordan and the Palestinian Authority could save the sacred sea

Story and photographs by Eitan Haddok

THE DEAD SEA IS A PLACE OF MYSTERY: THE LOWEST SURFACE ON EARTH, THE PURported site of Sodom and Gomorrah, a supposed font of curative waters and, despite its name, a treasure trove of unusual microbial life. Yet its future is anything but a mystery. After centuries of stability—owed to a delicate equilibrium between freshwater supply from the Jordan River and evaporation under the relentless Middle Eastern sun—the lake is now disappearing.

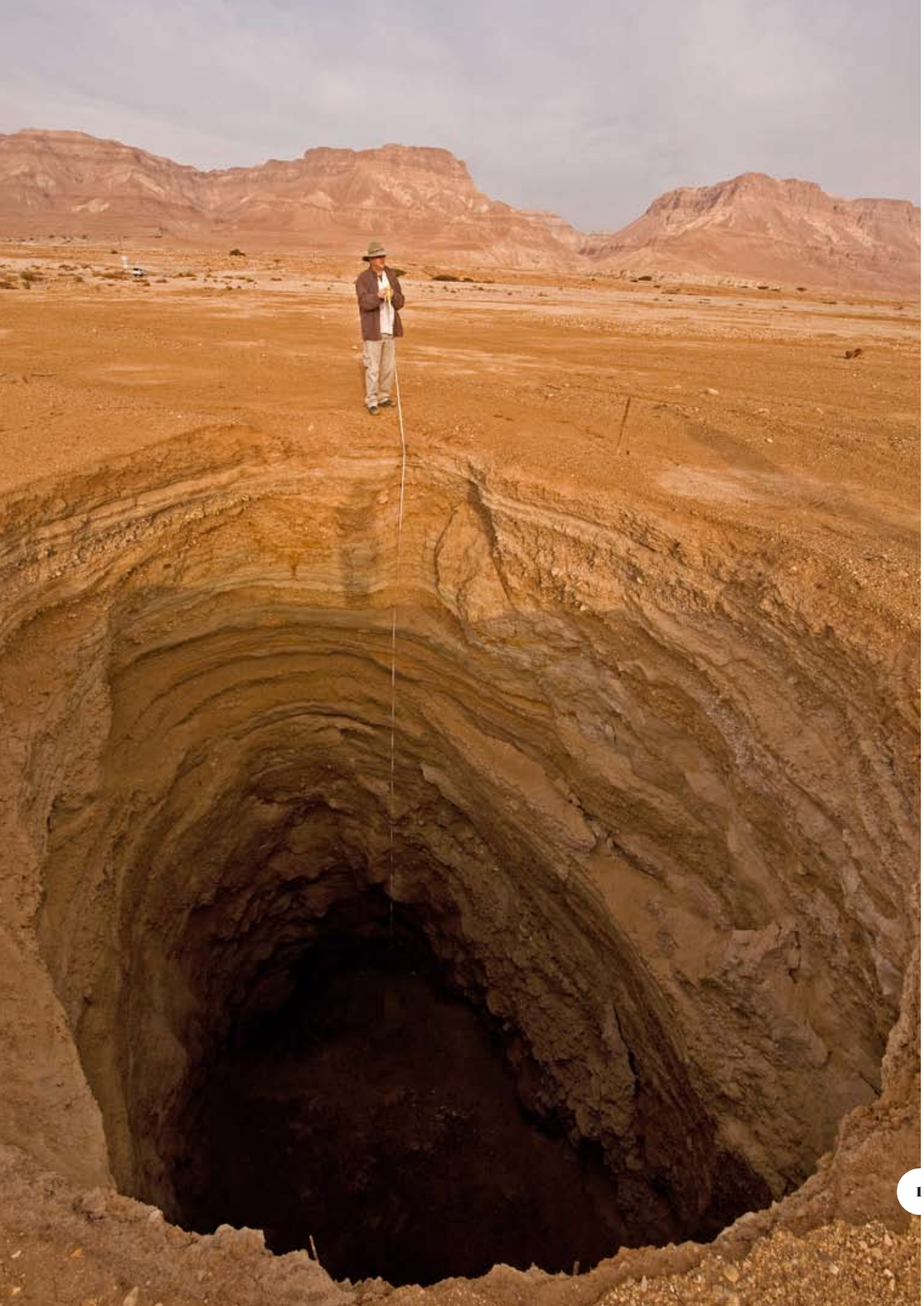
Jordanians to the east, Israelis to the west, and Syrians and Lebanese to the north are now pumping so much freshwater from the river catchment that almost none reaches the sea. Israel and Jordan are also siphoning water from the lake to extract valuable minerals, hastening the decline. Thousands of sinkholes have formed in the receding sea's wake, curtailing tourism and development along the border because no one can predict where the next gaping hole will suddenly open, potentially swallowing buildings, roads or people.

Concerned over losing a valuable natural and cultural resource, officials from Israel, Jordan and the Palestinian Authority have proposed an enormous conveyor system that would steadily refill the Dead Sea with water from the Red Sea to the south. Scientists are testing how the mixing waters might affect the lake's chemistry and biology or if the influx could turn the lake red. Politicians are testing whether either nation has the will to fund the $10-billion lifeline, as environmentalists oppose the pharaonical project. And governments that preside over other saline bodies, including the Aral Sea, Caspian Sea and the Great Salt Lake in Utah are watching for lessons that could apply to their own future development. Take a tour here of the dying sea and efforts to bring it back to life.

IN BRIEF

The Dead Sea, 424 meters below sea level, is dropping by a meter a year as feedwaters are tapped for irrigation and seawater is evaporated for minerals extraction.
Thousands of sinkholes are forming as receding underground saltwater allows the ground above to collapse.
A 180-kilometer system of pipes could supply needed brine from the Red Sea. Scientists are testing how the mixing waters might alter sea life.

The Dead Sea now lies 424 meters below sea level, and the water level is dropping by one meter a year. In certain places, the water's edge has receded a full kilometer from shore. More than 3,000 sinkholes have opened around the perimeter—in recent years, about one every two days. Some fill with brine; others do not.



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SUNK BY TEMPTATION

SINKHOLES (*1*) can be up to 25 meters wide and 15 meters deep. They can open abruptly, swallowing trekkers as well as buildings and roads (*3*).

Dissolution is the most widely accepted explanation: as salty lake water recedes, underground saltwater recedes along with it. Fresher underground water moves in, contacts salt layers below the surface and dissolves them, causing the surface to collapse.

Some large holes fill with brine; others do not. Lines of sinkholes sometimes form above shallow geologic faults (*2*), which can allow freshwater to intrude as saltwater recedes. Understanding such mechanisms could help explain odd sinkhole formation in Florida, Guatemala, Germany and Spain.

The sea is emptying primarily because influx from the Jordan River to the north has dwindled from about 1,300 million cubic meters a year to 30 million cubic meters a year. As a result, evaporation in the sea outstrips freshwater supply; the southern lobe of the lake hasdisappeared.

The river loss is caused by pumps in Israel, Jordan, Syria and Lebanon that take water for agriculture or domestic use (*4*); some pipes become defunct as the river is tapped out (*foreground of photograph*).

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POSSIBLE RESURRECTION

THE SEA IS ALSO DROPPING because the Dead Sea Works company in Israel and the Arab Potash Company in Jordan pipe water from the north through a canal to the south; there it spills into enormous, artificial, cascading ponds where the southern lobe used to be (*1*, *blue*, and *2*, *green*). Evaporation leaves behind concentrated minerals such as bromine, magnesium and potash, as well as salts (*3*), all of which the companies extract. Air above the vast pond region contains some of the highest levels of oxidized mercury on the planet—formed because of high bromine concentration.

Under current conditions, the Dead Sea could sink to –550 meters by 2200. The retreat could be stopped by 180 kilometers of proposed canals and pipelines that would bring in water from the Red Sea. Desalination plants along the conveyor would produce 900 million cubic meters of freshwater a year, most of which would go to Jordan. The remaining 1.1 million cubic meters of briny water would be injected into the Dead Sea. Hydroelectric plants could exploit the drop in elevation along the way. A $17-million feasiblity study by the World Bank should be completed by July. If it is built, the conveyor could stabilize the sea's level at –410 to –420 meters by 2050.

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ScientificAmerican.com/apr2011/haddok

Brine from desalination might not be a suitable substitute for Jordan River water. The brine and the sea's saltwater could stratify in layers. Algae and bacteria could grow, perhaps changing the sea's color from turquoise to reddish. Experiments in small tanks conducted by microbiologists suggest that algae blooms might indeed occur (*4*), but tests are not yet conclusive or independently duplicated.

Saving the Dead Sea could pay off in various ways. Biologists recently discovered a new form of metabolism in certain microorganisms in the water. Scientists have also transplanted genes from a unique local fungus into a yeast strain that subsequently has shown strong resistance to saline stress, as well as heat and oxidative stress. The gene could potentially help crops grow in saline soils now unsuitable for cultivation, which could bring food security to millions of people in salty lands worldwide. SA

MORE TO EXPLORE

Information about the proposed Red Sea–Dead Sea conveyor can be found at www.foeme.org and www.worldbank.org