A BALD EAGLE ENIGMA | BATTLE FOR AN ARIZONA BIRD OASIS | GO ON A WILD GOOSE CHASE!

Audubon
WINTER 2020

RESCUE MISSION

An ambitious experiment to rejuvenate the gene pool of the Florida Scrub-Jay could point the way to preserving other threatened species.

Cloud Atlas

The high Arctic is dangerous in the dark of winter. Temperatures drop to –40 degrees. Ice cracks underfoot. Polar bears roam. Yet scientists on the Alfred Wegener Institute's MOSAiC expedition braved these hazards so they could study the Arctic atmosphere for a full year. They have urgent questions about why the region is warming faster than elsewhere on Earth, and clouds may be key. "Clouds are one of the leading sources of uncertainty in our models," says expedition co-coordinator Matthew Shupe with the University of Colorado and NOAA. So in October 2019 the *Polarstern* icebreaker was locked into the frozen ocean near the North Pole and left to drift as scientists sampled the sea, ice, and atmosphere. The data will yield insights into the Arctic's cloud cycle and a sharper picture of climate change everywhere.

PHOTOGRAPHY BY ESTHER HORVATH

Text by Hannah Waters

Meet *Miss Piggy*. She is not your typical weather balloon. Most are one-time-use tools, which carry tiny, data-transmitting instruments through six miles of atmosphere, until they pop. But *Miss Piggy*, pictured here with technician Jürgen Graeser, is built for survival. The porcine balloon stays tethered to the ground and collects data—temperature, humidity, wind, particles, and more—within the few thousand feet of atmosphere above the ice. In winter, this region is turbulent: When ice cracks, exposed seawater emits water vapor and heat that travel from the surface up into the high atmosphere and form clouds. As the Arctic warms, more cracks develop, which means more heat enters the atmosphere. How might this influx affect clouds? *Miss Piggy* will tell us.

Clockwise from bottom left: Polar bears are curious, and deadly. Guards kept watch over the scientists as they worked. When the trained sentries spotted a bear, they evacuated the ice floe by hauling remote staff back to the ship on snowmobiles and sleds, and chased the bears away with flare guns. Outfitted with heat, food, and electricity, the ship was a safe haven. It was also a scientific platform. Inside a container on the bow, atmospheric scientist Julia Schmale from the Swiss Federal Institute of Technology set up a laboratory to analyze aerosol particles. Each minuscule speck of dust, soot, ocean salt, sulfate, ammonia, or microbe is a seed around which water vapor condenses; together these form a cloud. In most places clouds cool the climate by reflecting incoming sunlight and heat back into space. But in the Arctic, winter clouds warm the region by trapping heat rising from the ocean. Nobody knows how big the effect is, Schmale says, but it might explain the Arctic's rapid warming—and help scientists understand climate change far away. Global weather is driven by temperature differences between polar and temperate regions, which means Arctic warming affects everyone. "One atmosphere connects every place on Earth," she says. Right now climate models especially lack data from winter months. By filling those gaps, Schmale aims to unpack the cloud mystery.

Parked in a dynamic, ever shifting ice floe, *Polarstern* traveled miles across the ocean every day and more than 1,000 miles in a full year. "You can't necessarily tell the floe is moving," NOAA's Shupe says. "But if you really slow yourself down—close your eyes and sit there—you can feel it." That meant the multiple encampments on the ice, hosting millions of dollars of equipment, were never on solid ground. At the atmospheric research camp known as Met City, Shupe and his crew were hoisting a 36-foot-tall tower when he heard a loud noise. "I look down and there was a crack in the ice going right under my feet," he says. Luckily the crack froze back over, and the tower sustained no injury. But at all times Met City was on the move as it drifted with the ice. Sometimes it rotated around the ship—or threatened to leave altogether. "There it is, floating on its own ice floe," Shupe recalls. "Met City really took a ride."

Clockwise from bottom left: Life on a high-Arctic icebreaker required teamwork and trust. Every week a team, including AWI biologist Allison Fong, drilled into the ice to collect 50-plus cores and process the samples for dozens of scientists on board and at home. Meanwhile, technicians cared for high-tech sensors that validate satellite data used by researchers around the globe. The few habitable structures—such as a Met City tech hut, warm enough to shelter computers and scientists—became community gathering spots. Such sites sparked conversation and collaboration. "I was bumping elbows with biologists all day long," says Shupe, a physicist. The connections between atmosphere, ice, and sea, and between physics, chemistry, and biology, became a running theme. "The gears start spinning in your head: How are these things linked?" After *Polarstern* returned to Bremerhaven, Germany, on October 12, 2020, researchers scattered back to 37 countries to pore over data. They'll eventually link up their own findings with those of friends and colleagues made on this once-in-a-lifetime expedition, and together generate improved models of how climate change is unfurling at the farthest reaches of this planet.