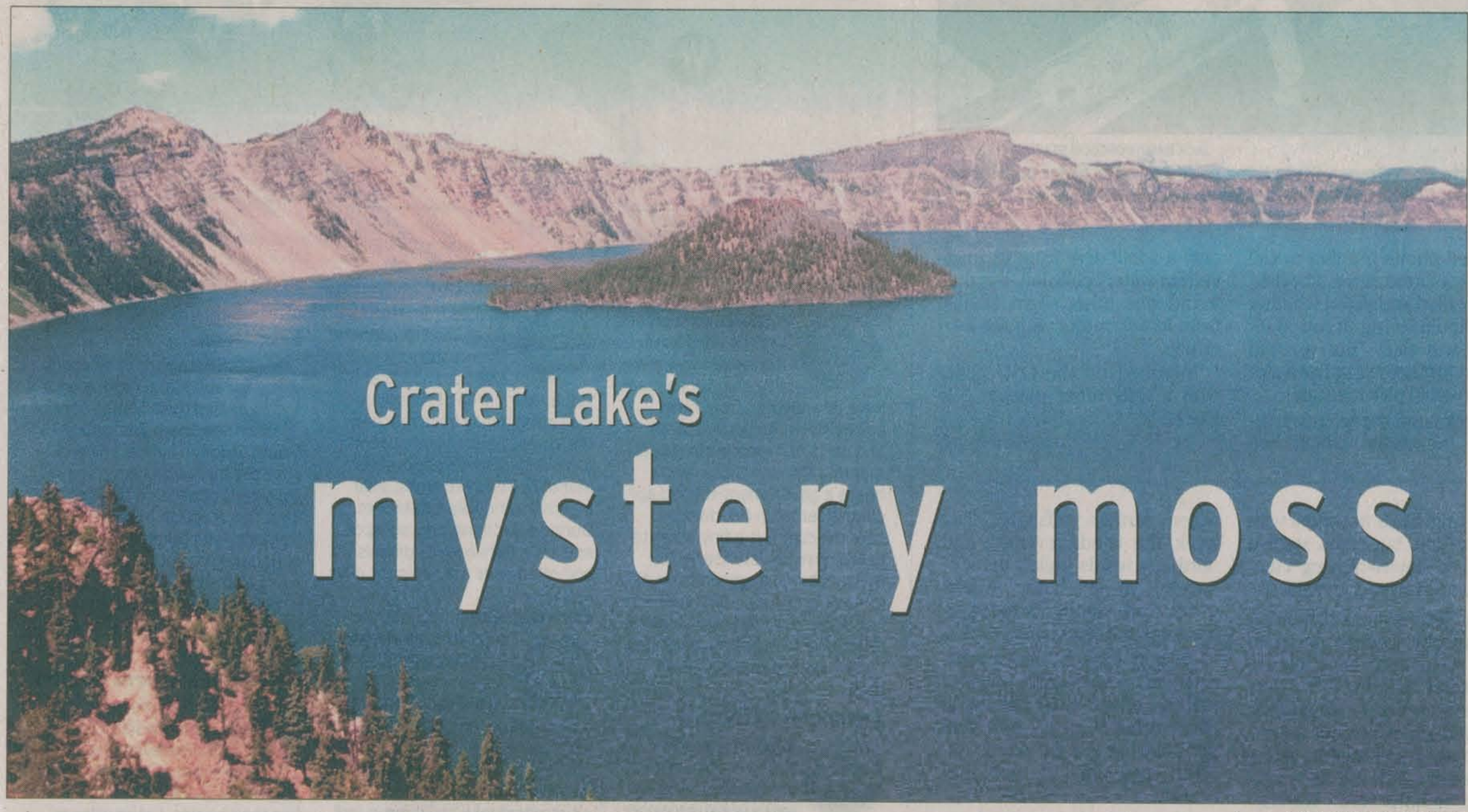

Crater Lake's mystery moss

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Scientists probe an unexplored ecosystem on a submerged volcanic platform near Wizard Island

By BEN LARSON | THE OREGONIAN

Storm clouds gather overhead and rain begins to dimple the choppy surface of the wind-swept water, but Crater Lake biologist Mark Buktenica and his team are unruffled.

The legendary lake still has secrets to tell, and the crew of the research vessel Neuston is eager to uncover them. Even the wave-battered boat seems restless, pulling against its tether like a race horse champing at the bit. The crew cuts the boat loose and speeds into the gloom.

The soggy day of field work that Buktenica led July 18 is part of a broader research program to monitor the lake's health and explore its unique ecology. This summer, researchers are unleashing an arsenal of instruments on a complex underwater moss colony that thrives on a platform of submerged volcanic rock around Wizard Island on the lake's west side.

"It's very clear that there's this whole ecosystem buried in the moss that we're totally unaware of," said Bob Collier, an Oregon State University geochemist who will conduct further research at Crater Lake this month.

By now, the story of the lake's creation is familiar: A violent volcanic explosion 7,700 years ago drained Mount Mazama of the magma within, and the remaining mountaintop collapsed in on itself. After filling with water from snow and rain, the volcanic basin — a caldera — would become one of Oregon's most famous landmarks.

The lake bottom is as deep as 1,943 feet, making Crater Lake the nation's deepest body of water. In 1902, the lake and the surrounding rim were protected as a national park. In 1984, Congress established an ongoing research program to ensure that the lake would be maintained in its natural condition.

When the project began, Buktenica — then a graduate student studying trout in the lake — became the first research scientist dedicated to the study of the lake.

"Crater Lake happens to be one of the largest clear lakes in the world, and also one of the better protected, both politically and geographically, from pollution," Buktenica said. "And because it's so pristine, it has tremendous scientific value."

A self-described generalist with a detailed knowledge of the lake, Buktenica has conducted research on everything from water quality to the abundance of zooplankton.

In 1995, the National Park Service expanded the operation and hired another scientist, Scott Girdner. Buktenica and Girdner

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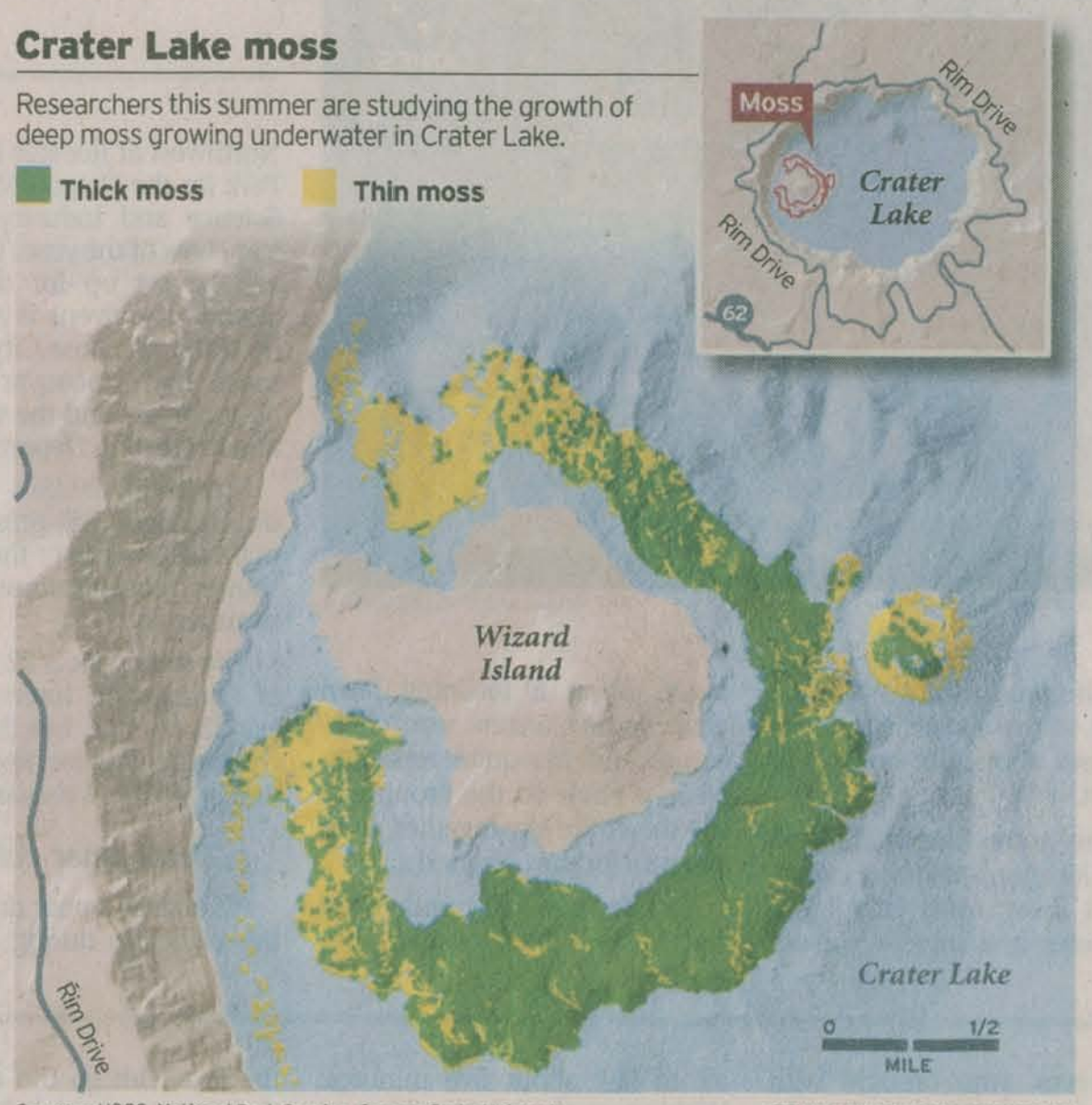
BEN LARSON/THE OREGONIAN

Biologist Mark Buktenica, with technicians Collin Christianson and Siana Wong, steadies a sensor package before deploying it in Crater Lake. The metal frame holds instruments that measure temperature and other water properties. Other sensors, on a weather buoy in the middle of the lake, monitor atmospheric conditions.



Sources: USGS, National Park Service, Oregon State University

STEVE COWDEN/THE OREGONIAN

Crater Lake: Moss grows in narrow range below surface

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form the backbone of a research operation that not only conducts fundamental research on lake ecology but also attracts specialists from all over the United States.

Visiting scientists bring their expertise to bear on specific aspects of lake ecology that remain poorly understood, such as the moss colony. The guest researcher on the recent expedition, Bruce Hargreaves, is a specialist in optics from Lehigh University in Pennsylvania.

Plenty of questions

One of the moss study's goals is to figure out how the moss contributes to the organic matter in the lake. "It's all still very exploratory. We just don't have a clue, because we've never had a tool to look at it before," said Hargreaves, who brought with him an array of optical techniques to help answer that question.

The moss grows in a narrow range between 100 and 460 feet deep. The submerged platform around Wizard Island falls squarely within this band, and lush fields of moss cover the watery terrain. A bed of moss consists of a soft green layer, 3 to 6 feet thick, set atop a layer cake of peatlike moss that can extend down as far 20 feet.

Spread throughout the moss beds are cryptic circular pits the size of large tree trunks that may be caused by warm water rising from hot springs below.

But this theory has some holes of its own, Collier concedes. "We're in a very unconstrained thinking space."

Collier will bring in bottom-penetrating sonar and several types of coring samplers from around the world. His goal is to develop a more detailed picture of the interior of the strange green community.

Such exotic techniques are necessary because the depth of the moss prevents scientists from using conventional methods. Scuba divers can get to the top of the moss with just enough air to last about five minutes. Without costly submersible operations, most of the samples come from camera tows that entangle the moss when they collide with it.

The nutrient and carbon contents of the widespread colony are issues of paramount importance to lake ecology.

"If there's this moss down there that's maybe 50 times the biomass of every other living thing in the lake, it's obviously going to have an important role," Buktenica said.

Scientists are not all questions. They have hypotheses about several of the interesting features. In particular, the growth pattern of the moss may have something to do with the lake's trademark clarity.

Because Crater Lake has low biological productivity, sunlight penetrates into the cobalt-blue water deeper than any other place in the world. Other more productive lakes come equipped with a natural sunscreen: bits of particulate and dissolved organic matter that absorb damaging ultraviolet rays.

Without this protection, moss in Crater Lake may not be able to withstand the intense sunshine in the shallow reaches of the lake. But go too deep, and there's not enough light.

"Undoubtedly, there's a lot of nutrient recycling and nutrient generation going on in that moss," Buktenica said. "Nitrogen-fixing algae grows in the moss; the biomass of earthworms is tremendous. Zooplankton, aquatic insects — it's a whole community."

Lightning exit

As the crew of the Neuston prepares to dunk an array of sensors into the water, a tangible excitement fills the air. It's the first time Hargreaves will deploy some of his optical devices in the cool mountain waters.

But a lightning strike rips through the sky, and thunder rumbles over the lake. Buktenica, Girdner and their team move with a dexterity bred from years of experience. Within minutes, they've packed up their operation and are cruising away from the danger zone.

Not all experiments rely on fair weather. Last summer, Buktenica put a mooring in the water loaded with sprigs of moss at regular intervals over the entire depth range of the moss. He plans to use digital recognition software on pictures of the moss to measure its growth rate, which may be mind-numbingly slow.

Speculation is that the moss may double once a year — a snail's pace compared with other types of algae that double once a day.

Normally, scientists use naturally occurring radioactive carbon isotopes to measure how fast a plant grows. But most of the Crater Lake carbon comes from geothermal fluids pumped in at the lake bottom. This "old carbon" no longer contains the radioactive isotopes necessary for growth rate measurements, Buktenica said.

Scientists frequently must tap into their ingenuity to study a system that is anything but ordinary. Even the lake itself can be used as a scientific instrument.

"The whole lake acts like one big leaky rain gauge," said Girdner, explaining how lake height recorded the drought during the Dust Bowl of the 1930s.

Techniques have come a long way from the old days when a black and white disc was used to measure optical properties of the lake. Researchers back then lowered the disc until it disappeared, then recorded the distance as the depth of light penetration.

"The real sophisticated stuff started in the early '90s," said Hargreaves, who uses optical measurements taken continuously throughout the water column to determine the abundance of chlorophyll, organic matter and certain types of bacteria.

After the lake chased them off their last site, Hargreaves and the rest of the Neuston crew found themselves on a quiet patch of water exactly where they wanted to be: over the sprawling fields of moss around Wizard Island.

Once again, they prepared to lower their package of sensors into the water and this time the lake cooperated. After bringing the package back on deck, Hargreaves downloaded the data to his computer and looked at the signal indicating concentration of dissolved organic matter

"If the signal increases close to the moss, then the moss could be a source of organic matter," he said.

But the signal is flat, and the lake has concealed its secrets for another day.

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