

systems, reshuffling key food webs. For instance, it weakened currents that deliver nutrients from the subarctic to the mid-Pacific. There, the nutrients normally help fuel phytoplankton blooms in a feature known as the transition zone chlorophyll front, creating a lush feeding ground for marine life. But the front has moved 240 km farther north than usual, leaving relatively barren waters where species usually gather to feed.

Closer to shore, The Blob's warmer and therefore less dense surface water has formed a cap that, together with the changing winds, keeps cooler, more nutrient-rich waters from reaching the surface, says physical oceanographer Kris Holdiered of NOAA's Kasitsna Bay Laboratory in Homer, Alaska. That means that surface-dwelling phytoplankton, a key food source for marine animals, may not be getting the nutrients they need to thrive. Already, scientists have documented an overall drop in populations of copepods, tiny crustaceans that graze on phytoplankton, off the Oregon coast. At the same time, they've seen an unprecedented jump in tiny sea creatures that normally live in the tropics—even in the Gulf of Alaska.

"It's fun to see some new animals I don't know," says Bill Peterson of NOAA's Northwest Fisheries Science Center in Seattle, who has rerouted some of his research cruises to study The Blob. But he and other researchers fear that the loss of phytoplankton, and the fact that some of the newly arrived plankton have relatively low nutritional value, could be contributing to a wave of die-offs further up the food chain. Some blame The Blob for deaths of thousands of seabirds called Cassin's auklets along the Pacific coast this past winter, as well as the starvation of thousands of sea lions along the California coast. "Evidence of hardship is mounting," says retired oceanographer Frank Whitney, who lives outside Victoria, Canada.

A growing concern is the fate of the multibillion-dollar Pacific salmon fishery. Juvenile salmon heading out to sea from their birth rivers "may have nothing to eat" if The Blob doesn't dissipate, Peterson says.

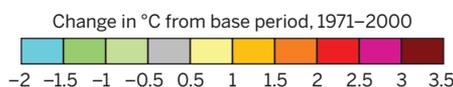
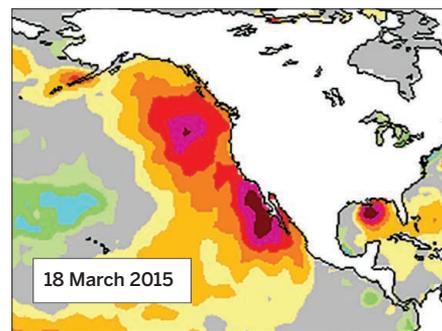
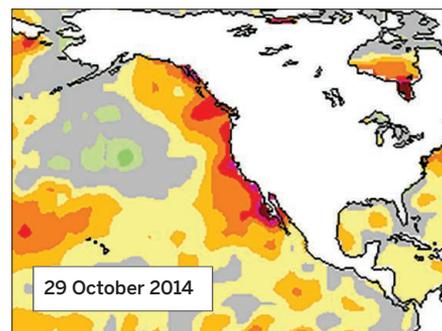
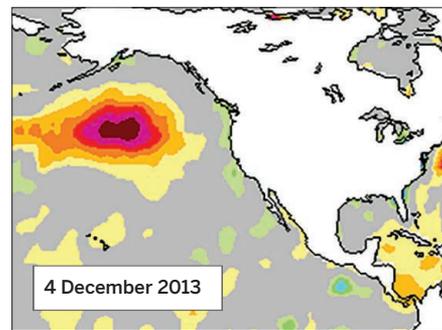
Several modeling teams are planning to convene early next year to share results of their Blob studies. A key question is whether the warming planet is responsible. Several recent papers have concluded it is not: The high-pressure ridge that birthed The Blob is a result of natural variability, researchers believe, not human-caused climate change. And the relatively modest climate-driven warming of the oceans seen so far probably isn't a major factor, adds James Overland, a NOAA climate scien-

tist at the Pacific Marine Environmental Laboratory in Seattle. "But you can't rule out a small global warming component to The Blob, or that in the future we won't see more phenomena like this," he says. Long-lasting atmospheric features, such as the persistent high-pressure ridge that spawned The Blob, may be more likely in the future, he says.

One thing is clear to oceanographer Russell Hopcroft of the University of Alaska, Fairbanks: The Blob provides a window into the kind of changes that could occur in the Pacific's warmer future. "What we're seeing now," he says, "is what we expected [to see] in a few decades." ■

In hot water

Since appearing off the coast of Alaska (top), a pool of unusually warm surface waters has stretched south (middle) and then broken in two (bottom).



SCIENTIFIC PUBLISHING

Hoax-detecting software spots fake papers

Springer jumps into sham submissions arms race

By John Bohannon

It all started as a prank in 2005. Three computer science Ph.D. students at the Massachusetts Institute of Technology—Jeremy Stribling, Max Krohn, and Dan Aguayo—created a program to generate nonsensical computer science research papers. The goal, says Stribling, now a software engineer in Palo Alto, California, was “to expose the lack of peer review at low-quality conferences that essentially scam researchers with publication and conference fees.”

The program—dubbed SCiGen—soon found users across the globe, and before long its automatically generated creations were being accepted by scientific conferences and published in purportedly peer-reviewed journals. But SCiGen may have finally met its match. Last week, academic publisher Springer released SciDetect, a freely available program to automatically detect automatically generated papers.

SCiGen uses a “context-free grammar” to create word salad that looks like reasonable text from a distance but is easily spotted as nonsense by a human reader. For example:

After years of compelling research into access points, we confirm the visualization of kernels. Amphibious approaches are particularly theoretical when it comes to the refinement of massive multiplayer online role-playing games.

SCiGen also generates impressive-looking but meaningless data plots, flow charts, and citations. SCiGen's first victim was the World Multi-Conference on Systemics, Cybernetics, and Informatics (WMSCI), a meeting that the trio suspected of not properly vetting submissions. Indeed, WMSCI accepted two of their nonsense papers.

The trio then put SCiGen online as a free service, encouraging researchers to “auto-generate submissions to conferences that you suspect might have very low submission standards.” And submit they did. Over the past decade, researchers have pulled

numerous pranks on journals and conferences that claim to use human peer reviewers. Variations on SCiGen have appeared for other fields, from mathematics to post-modern theory. (This author continued the tradition by using a different fake paper-generating method [*Science*, 4 October 2013, p. 60].)

The bad publicity for publishers mounted in 2013, when 85 SCiGen papers were found in the published proceedings of 24 different computer science conferences between 2008 and 2011. More were soon discovered, and 122 nonsense conference papers were ultimately retracted by Springer, the academic publishing giant based in Heidelberg, Germany, and by the Institute of Electrical and Electronic Engineers, based in New York City.

Rather than being created as pranks, many of the fake papers seemed to be coming from China, where they were “bought by academics and students” to pad their publication records, says the lead researcher behind the investigation, Cyril Labbé, a computer scientist at Joseph Fourier University in Grenoble, France. Later that year, an investigation by *Science* uncovered an underground market for fake academic credentials, in which some peddlers may have used SCiGen to save themselves the effort of writing “authentic” fake papers by hand (*Science*, 29 November 2013, p. 1035).

In the wake of that public relations nightmare, Springer approached Labbé for help. He agreed, for a price—enough to fund a 3-year Ph.D. student, Springer says. Labbé’s method for finding the nonsense papers was sophisticated, requiring a statistical technique similar to spam e-mail detection, but based on grammatical patterns rather than on keywords like “Viagra.”

The result is SciDetect, a program to automatically detect papers created with SCiGen and similar programs. Its purpose, according to Springer, is to “ensure that unfair methods and quick cheats do not go unnoticed.”

But some think publishers may be more interested in avoiding embarrassment than in raising standards. “Anyone with a modicum of English language proficiency should be able to detect a paper written by SCiGen or similar software,” says Philip Davis, an independent researcher who consults for the publishing industry. “To me, this appears to be a move by a publisher to protect itself against the unwillingness of journal editors to weed out these fraudulent papers themselves.” Or as Paul Ginsparg, who founded arXiv, the physics preprint archive, puts it, “It’s wonderful that Springer has moved to eliminate articles generated by software that intentionally produces nonsense, but what about unintentionally nonsensical articles produced by human authors?”

In an e-mail exchange with *Science*, the Springer representative wrote, “We agree with what Cyril Labbé says in his quote [in a 23 March press release]: ‘Software cannot replace peer reviews and academic evaluation, but SciDetect lends publishers an additional hand in the fight against fraud and fake papers.’ ” She added that no SCiGen gibberish articles have been submitted to Springer conferences or journals since the 2013 retractions.

As for the pranksters, they will just have to work harder, says Stribling, the SCiGen creator. “I’m willing to bet if someone wanted to declare an arms race, they could come up with another way to generate papers that would fool [SciDetect] again for a while.” ■



IMAGE: SARACIN/ISTOCKPHOTO.COM

An automated paper-writing program has met its match in an automated detection system.