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KATHY WENDOLKOWSKI USED TO MAKE CANDY IN HER SPARE TIME. FOR THE past year and a half, this mother of three from Gaithersburg, Md., has been spending two to three hours a day on the Web site Old Weather (www.oldweather.org). There she transcribes temperature, pressure and wind-speed records from the logbooks of HMS *Foxglove*, a British minesweeper that patrolled the South Pacific in the years following World War I. It was a friend, a naval historian, who told her about the site soon after its launch in October 2010, Wendolkowski says. She quickly got hooked—not by the actual weather data but by the narrative of the *Foxglove's* journey and crew, a story that played out alongside the thermometer readings in each day's logbook entries.

Old Weather is one of a handful of online endeavors that marshal volunteers to help researchers, relying on thousands of “citizen scientists” to comb through data that would otherwise be impractical to mine, explains British paleoclimatologist Philip Brohan, the project's lead scientist. Brohan, who estimates that it would take a professional transcriber 28 years to complete the work Old Weather volunteers finished in the project's first six months, says that those transcriptions are invaluable to researchers like him, who scrutinize data from the past to help predict what we will see in the future. “Every time there's a big storm, people ask, ‘Would this have happened in the absence of human impact on the climate?’” Brohan says. “Is it new or unusual, or is it the sort of thing that's happened before? If we want to answer that question, we need to know how the weather has varied in the past.”

Archives around the world contain expansive weather records from ships, scientific expeditions and colonial research sta-

tions, but extracting those data—which are often scrawled in archaic penmanship that is difficult for computers to read—has long been considered an all but impossible task. In 2009, however, Brohan met astronomer Chris Lintott, one of the founders of Galaxy Zoo, a pioneering online effort that, in its original incarnation, recruited Web surfers to classify hundreds of thousands of images of galaxies as either elliptical (football-shaped) or spiral (whirlpool-like). They both realized that the citizen science approach that had worked for astronomy could also be used for climate science. They secured funding from the U.S. government, and Old Weather was born.

The site launched with 4,000 logbooks—about 250,000 days' worth of data—from 256 British Royal Navy vessels that sailed during and after World War I, a period chosen in part because of its scarcity of weather data (the war disrupted weather recording). Visitors to the site log in, select a ship and are shown a single page. They transcribe the data into neat pop-up boxes,

IN BRIEF

Citizen science projects marshal lay volunteers to help researchers carry out labor-intensive studies. Volunteers might report species sightings, assist in categorizing images or analyze data.

The Old Weather project is a collaboration among scientists, including British paleoclimatologist Philip Brohan, and thousands of nonexperts who are helping him plug holes in the planet's climate record.

Brohan's volunteers comb through the digitized logbooks of World War I-era ships, which would be difficult for a computer to read, and enter weather data into the project's Web site.

NOAA will add the collected information to its records in the U.S. A task that might have taken one professional transcriber 28 years took volunteers just six months to complete.

6

H.M.S. "Foxglove", Thursday 05 day of January, 1921.

From _____ To _____ or At _____

Hour	Patent Log	Pressure Barometer	Standard Compass Courses	Magnetic Compass Courses	Direction of Wind	Force of Wind	Direction of Surface Current	Force of Surface Current	Direction of Underway Current	Force of Underway Current	Temperature Air	Temperature Sea	Temperature Wet Bulb	Direction of Swell	Force of Swell	Direction of Tides	Force of Tides	Height of Barometer and Attached Thermometer	Position S.O. 50 m. N. 10 m.	Latitude	Longitude	REMARKS	
																							State of Sky
1																							
2																							
3																							
4																							
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REMARKS: 6.00 Made fast in - Spent clear. 7.00 Breakfast. 8.00 Breakfast. 9.00 Breakfast. 10.00 Breakfast. 11.00 Breakfast. 12.00 Breakfast.

Decoding history: Kathy Wendolkowski has spent more than a year transcribing weather-related entries from HMS *Foxglove* logbooks like this one.

much like filling out an online form, click "finish" and, more often than not, go on to the next day's log. Each page is transcribed by three different users to cull and eliminate errors. The completed data set will be added to records kept by NOAA in the U.S. and made available to scientists worldwide. "If we have a comprehensive picture of the weather over the past 200 years, we can put current weather into context," Brohan says. "And we can test the big models we build to predict climate change in the future."

Although Old Weather models itself on earlier projects, such as Galaxy Zoo, the effort is far more complex for the individual user. Galaxy Zoo, for instance, originally required a volunteer to simply look at an image and click a button to classify a galaxy as spiral or elliptical, a task that a computer can accomplish with just 80 percent accuracy. Old Weather, on the other hand, asks users to record the date, the ship's location and seven different bits of weather data that have generally been recorded half a dozen times throughout the day. While the galaxy-labeling task may take just a few seconds, deciphering a page of a ship's log takes even an experienced transcriber two or three minutes—considered a long stretch in Web time. Luckily, there is also more to keep them drawn in. Brohan estimates that about 11,000 individual volunteers have contributed to Old Weather so

far. Few of them are motivated by a concern about climate change; most are drawn by the stories of the ships. The site's designers capitalized on that pull by devising an incentive system by which users move up in rank, from cadet to lieutenant and, finally, to captain, depending on the number of pages they have transcribed. They created extended forums for users to discuss the goings-on of their ships (burials at sea and the 1918–1919 influenza epidemic are among dozens of discussion threads). And they partnered with the Web site Naval-History.net to make good use of the extensive non-weather-related information that the volunteers' transcriptions were turning up.

All of it was irresistible to Wendolkowski, who purposely chose an obscure ship she hoped other transcribers would pass by. "Everybody's going to go for the big battleships," she says. "I chose one that's just sort of puttering around." Wendolkowski started transcribing logbooks from mid-1921. By the spring she had worked her way through 1923 and become the *Foxglove's* virtual captain. Wendolkowski has contacted experts at the British Embassy and at the nearby U.S. Naval Academy in Annapolis to help her translate antiquated acronyms and identify passing vessels she could not find in the historical record. Still, it is mostly the soccer and cricket matches, outings to the cinema, and the occasional man-overboard tragedy described in the narrative log that appears alongside the weather records that keep her logging in. That and the ranking system,

which adds an element of competitiveness (another forum topic: obsession). "I'm number 92 on the list of transcribers," says Wendolkowski, who, despite completing close to 5,000 logbook entries, lost the *Foxglove's* top job to another volunteer. "I want to move up that list."

She will have her chance. With the original logbooks nearly complete, the Old Weather team are adding hundreds of new logbooks, many from early Arctic expeditions. Forums on polar bear attacks and falls through the ice may soon follow. ■

MORE TO EXPLORE

Citizen Science: People Power. Eric Hand in *Nature*; published online August 4, 2010. www.nature.com/news/2010/100804/full/466685a.html

Philip Brohan's climate-related publications: www.brohan.org/philip/publications

The Old Weather project: www.oldweather.org

Galaxy Zoo: Hubble. Citizen scientists view NASA Hubble Space Telescope images and help astronomers classify galaxies by shape: www.galaxyzoo.org

SCIENTIFIC AMERICAN ONLINE



Scientific American is hosting its own citizen science project and has links to many others. The SA project, a partnership with Zooniverse, focuses on how pilot and killer whales communicate. Volunteers for the Whale Song Project (<http://whale.fm>) listen to and match whale calls online. This activity helps marine biologists understand the diversity of their sounds.