gines to the songs of marine mammals (see p. 143). NOAA oceanographers have a particular interest in catching eruptions along a line of volcanoes called the Juan de Fuca Ridge, which lies off the coast of Oregon, Washington, and southern British Columbia. Until this summer, however, NOAA's lab in Newport received the information two weeks after it had been collected, reducing the chances of detecting an eruption in progress.

In late June, NOAA researchers arranged to receive the signals directly, with no delay. "We got the system operational on Tuesday, June 22, and I honestly expected to spend many months or perhaps years looking for the opportunity to find an underwater eruption. But we installed it on Tuesday and the eruption occurred on Saturday," says NOAA's Christopher Fox.

That day, the hydrophone array picked up distinctive earthquake tremors caused by magma moving upward through the crust. The rumblings, which measured as much as magnitude 3.5, came from the Juan de Fuca Ridge, about 400 kilometers west of Astoria, Ore. Only the Navy's system could detect such weak quakes, which would not register on land seismographs, Fox says.

After locating the tremors, Fox and his colleagues alerted a Canadian research group cruising near that part of the ridge. Led by oceanographer Rick Thomson of the Department of Fisheries and Oceans, the group detoured to measure the water near the site of the tremors. The Canadians searched without success for two and a half days before finding a huge plume of water warmed by the eruption.

On July 9, a NOAA ship visited the scene and lowered a remotely piloted robot 2,500 meters to the seafloor to photograph the area and collect samples. Pictures taken by the robot revealed freshly hardened, glassy basalt with 50°C water seeping out from cracks in the newly erupted rock.

The Juan de Fuca Ridge forms a border between two of the tectonic plates that make up Earth's outer shell. The vast Pacific plate lies to the west of the ridge while the tiny Juan de Fuca plate lies to the east. Eruptions along the ridge occur when the two plates separate, allowing molten rock from the mantle to rise to the surface to form new crust. Over time, this process of seafloor spreading carries older crust away from the ridge.

Oceanographers worked out the general principles of seafloor spreading in the 1960s, but they have since struggled to understand important details, such as how often spreading occurs at any one spot and how much new crust forms at one time. Because the eruptions release heat and chemicals into the water, researchers also want to determine how this process affects the ocean and its denizens.

Even more than the actual detection of an eruption, their access to Navy data and the promise of more discoveries have electrified oceanographers. "It's tremendously important. The mid-ocean ridge system is the biggest volcanic system on the Earth, and we've never had a way of monitoring what's going on," says G. Michael Purdy of the Woods Hole (Mass.) Oceanographic Institution.

Embley and his colleagues are not the first to catch a mid-ocean ridge volcano in action. In 1991, oceanographers on board the Alvin submersible chanced upon an eruption while studying a portion of the East Pacific Rise 1,000 km southwest of Acapulco, Mexico (SN: 12/7/91, p.372). Several pieces of evidence, including still-living animals partially covered with lava, led the scientists to conclude that the eruption had occurred within weeks or days. It may even have been going on when the Alvin was down there, says Rachel M. Haymon of the University of California, Santa Barbara.

While Haymon and others praise the NOAA work, they say the discovery will probably widen rifts among research groups studying different parts of the mid-ocean ridge system. NOAA and other agencies advocate focusing attention, including a planned observatory, on the nearby Juan de Fuca Ridge. Haymon and others push for continued work on the East Pacific Rise, where eruptions occur more frequently and scientists have already mapped sections in detail.

— R. Monastersky

For distance, eyes see like ears hear

We take for granted our ability to judge the depth and distance of objects. To do that, the brain needs both eyes, so it can compute these measurements based on slight differences in how each eye perceives the object. A simple test, holding up a finger and looking at it first with one eye closed and then with the other closed, reveals that this angular difference, or disparity, does indeed exist, as the finger will seem to shift depending on the viewing eye.

Neurobiologists studying visual processing in the barn owl *(Tyto alba)* now report that the owl's brain perceives depth using the same computations it uses to determine the location of sounds.

To locate a sound, the brain assesses the difference in the time the sound takes to reach each ear. The brain pairs a signal from one ear with that from the other, and specific nerve cells respond depending on the length of the delay between the two signals. Consequently, each of these so-called characteristic delay cells winds up firing most vigorously when that sound comes from a particular place relative to the head. These cells create an auditory spatial map that helps the brain pinpoint sounds, says Hermann Wagner of the Max Planck Institute for Biological Cybernetics in Tübingen, Germany.

Though a hearing researcher, Wagner wanted to test whether what held true for ears also worked for eyes. So he and Barrie Frost of Queen's University in Kingston, Ontario, created visual signals that paralleled the audio signals — tones and noise — used to demonstrate how auditory processing occurs. These signals consisted of regular or irregular black-and-white stripe patterns. Wagner and Frost projected moving patterns in front of the owl and placed a prism over one of its eyes to create the illusion of depth or distance. At the same time, the researchers monitored the electrical impulses from 58 sites in the part of the owl's brain analogous to the visual cortex in other animals.

Different nerve cells there do respond to specific angular differences between two visual signals, Wagner and Frost report in the Aug. 26 NATURE. The owl brain contains visual cells with "characteristic disparity" just as auditory nerve cells have characteristic delays, Wagner says. Thus holding the finger 30 inches away would cause one of these nerve cells to fire, while a finger 10 inches away would set off a different one, thereby creating a three-dimensional view of the world.

Bob Gress

In barn owls, eyes and ears work alike

The experiments help resolve a question that vision researchers have grappled with for years, says Curtis L. Baker Jr. of McGill University in Montreal. "The interdisciplinary aspect of making an analogy to the auditory system in order to get an idea for a new visual experiment shows the value of studying more than one subspecialty," he adds.

In addition, "We speculate that the brain uses similar algorithms to solve similar problems," says Wagner, citing hints that the brain may use this approach in memory, for matching.

— E. Pennisi