Ripple Marks

The Story Behind the Story

BY CHERYL LYN DYBAS

Canyon "Ghost" Critical to Stream Ecosystems: Cougars Act as Guardians of Fish, Frogs

The ghost cat, it's been called, this feline that roams backcountry from the Yukon to Chile. It has dozens of names, from panther, to puma, to mountain lion. But its best descriptor, perhaps, is cougar.

The word comes from a term meaning "false deer," an ancient phrase coined by the Tupi. These long-ago Amazonians, according to Jerry Kobalenko in his book *Forest Cats of North America*, had an instinctive understanding of a modern scientific idea: a predator evolves to blend into the habitat of its prey.

Nowhere is that truer than in the burnished canyon country of Utah's Zion National Park. Here in the recesses of Zion's redrock ravines, cougars hunted mule deer. By doing so, the cats, it turns out, served as sentinels of Zion's aquatic life. But that was once upon a time.

The cougars have been chased away. Increasing numbers of human visitors at Zion ran the cats out of territory they once claimed.

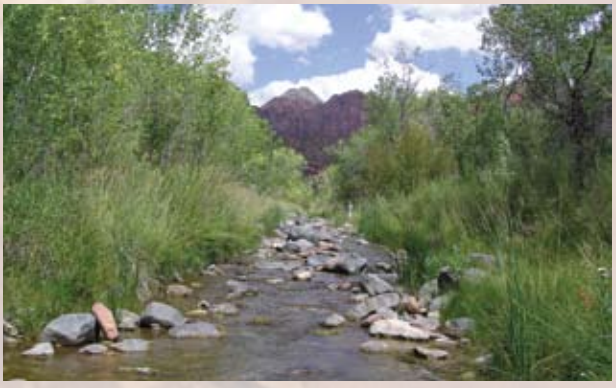
"The loss of a predator such as the cougar affected a range of other species," says ecologist William Ripple of Oregon State University (OSU). Along with Robert Beschta, also of OSU, Ripple conducted research on the importance of Zion's cougars. "'What cougars?' we should ask," says Ripple. "The entire two years we were out there, we didn't so much as glimpse a cougar. We always felt like one might be watching us, though, from somewhere we couldn't view. Maybe that was wishful thinking."

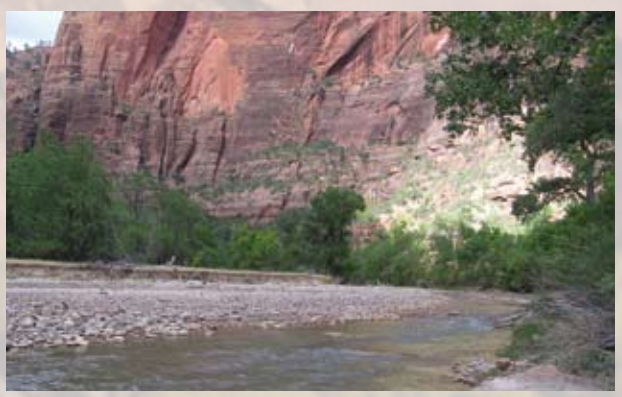
The scientists' study showed that cougars not only have direct effects on populations of animals such as deer and elk, but also indirectly affect entire ecosystems.

Without cougars, deer dramatically increased, leading to loss of the riparian cottonwood trees deer love to nibble on. Lack of cottonwoods, which serve as river-bank anchors, resulted in extensive erosion. Biodiversity in Zion's waterways plummeted.

It's known as "the ecology of fear."

When cougars aren't around to strike fear into the hearts of deer, the deer venture into open spaces. In Zion, says Ripple, deer are eating young cottonwood trees almost as





fast as the trees can sprout. Floodplains have disappeared, and with them fish, amphibians, butterflies, wildflowers, and countless other animals and plants.

"It's the old adage we learned in our first ecology class: everything is connected to everything in nature," says biologist Howard Quigley, an expert on cougars and director of Western Hemisphere Programs for Panthera, an organization whose mission is to protect the world's 36 known species of wild cats. "The presence of carnivores like cougars has impacts we're just now scratching the surface of."

Ripple and Beschta compared a canyon in the national park itself—Zion Canyon—with one in a nearby roadless watershed. The "other canyon," called North Canyon, is far off the beaten path. Zion Canyon receives some three million human visitors each year; North Canyon, only a few stray hikers.

North Canyon is home to a thriving cougar population, hence has fewer mule deer. In contrast to Zion Canyon, says Ripple, "rivers in North Canyon have 50 times more young cottonwood trees—and lots of the water-loving plants that stabilize streambanks, provide food-web support, and protect floodplains."

Restoring the cougar population to Zion Canyon might—in time—rebalance its ecosystem.

Then a phantom cat would again stand guard over rushes and willows, red-spotted toads and cardinal flowers—and us.

LEFT. Cougar: canyon country sentinel. *Photo credit: S. Winter/Panthera*
RIGHT. (top) Stream channel and floodplain conditions along North Creek in 2005, an area in North Canyon where cougars are common, and (bottom) the North Fork of the Virgin River in Zion Canyon, an area where cougars are rare. North Creek is well vegetated with stable banks, while the North Fork of the Virgin River has a lack of bank vegetation and a wide active channel with banks continuing to erode. *Photos credit: William Ripple*
BACKGROUND. Cougar in canyon. *Photo from ThundaFunda.com*

"Wavelet" Math Translates Whale Song into Art

Wavelets, they're called, but they're not the kind that gently lap onto shore. These wavelets create a kind of science-art, one that depicts the haunting songs of whales and dolphins.

In this setting, wavelets are mathematical functions that parse data into different frequencies. "They have advantages over other methods of analyzing signals with sharp spikes," says Mark Fischer. Such spikes, he says, are characteristic of whale and dolphin music.

Fischer should know. An expert in marine acoustics, he owns a San Francisco company called AguaSonic Acoustics. Through AguaSonic, Fischer has produced strikingly beautiful ocean art that comes not from a paintbrush, but from cetacean songs. Using wavelets, the engineer, who once developed software for the Navy, translates whale and dolphin communication into illustrations that look like starbursts and solar flares.

"Wavelets capture intricate detail without losing the larger picture," says Fischer. "When you show them in a circular form, patterns become very clear. Certain sounds are unique to different species of whales and dolphins. Wavelets allow us to create an auditory fingerprint."

TOP. Echo-location clicks made by an orca recorded by Paul Spong in Johnstone Strait (Vancouver Island, BC, Canada). Each radial is the actual click. MIDDLE. Clicks made by a white-beaked dolphin recorded near Iceland. BOTTOM. Depicted is about a quarter-second of the enigmatic "boing" made by a minke whale. BACKGROUND. One of the lower 'rumbles' made by a humpback. *Courtesy of Mark Fischer, AguaSonic Acoustics*

To visualize the clicks and whistles of whales and dolphins, marine scientists usually develop spectrograms, graphs of the frequencies of vocalizations over time. "But spectrograms are created with what's known as Fourier methods," says Fischer, "better suited to repetitive, continuous sounds like whirring propellers than to staccato cetacean harmonies."

Ten years ago, he traveled with researchers in Baja California to take a closer look at whales' intricate underwater communication. The trip was a springboard for his now decade-long project. "I'd like to bring scientists and the public into a world they might otherwise never experience," says Fischer.

The US Navy was one of his first targets. "They were interested in knowing whether beaked whales were in a certain area," says Fischer, "so I created 'soundprints' of the whales in that region. The soundprints were used to make a map of likely whale locations."

Mandalas, Fischer calls the prints, from the Sanskrit for concentric diagrams.

Take his spiky mandala named "Rasmussen albirostris." It shows sounds from a white-beaked dolphin off the coast of Iceland. "Each spoke on the wheel is an individual click," says Fischer, "captured in extraordinary precision."

Another mandala, "Minke punaluu," is made up of kaleidoscopic whorls upon whorls. They represent the song of a minke whale northwest of Hawaii. "Open-ocean fishermen often heard these whales' eerie cries," says Fischer. "Although they knew the sounds came from a 'fish' of some kind—they called it the 'guitarfish'—no one ever saw what was doing the strumming." Scientists eventually identified it as a minke whale.

"With the fancy structure of whales' and dolphins' music, there must be more to it than simple messaging," says Fischer. "Cetaceans are always inventing new songs, so something's going on. Unlike us, maybe their 'ornamentation' is inside rather than outside."

Humans, he says, are far from the only artists on the planet.

Fischer's mandala soundprints may be experienced at http://aguasonic.com.

Fire in the Sky, Smoke in the Water: Queen of American Lakes Under Siege from Fireworks Displays?

A few Sundays from now, Americans across the nation will look skyward, awed by Fourth of July fireworks displays. If those fireworks explode over lakes, rivers, and other waterways, the scene might not be so pretty.

What goes up must come down. And it's coming down laden with chemicals like perchlorate, a propellant used in fireworks. While most of the perchlorate combusts, all of it does not, with perchlorate raining over the land—and water. The water may be where the problem lies.

"Health and environmental concerns have been linked to perchlorate and other chemicals used in fireworks," says Walter Lender, executive director of the Lake George Association (LGA) in Lake George, New York.

Lake George is a 32-mile-long glacial lake in New York's Adirondack Mountains. Thanks to its pristine waters, the lake has been known for more than a century as the "Queen of American Lakes."

The Queen, however, is under siege from several water-quality threats; among the newest, perhaps, is perchlorate. Her waters are sprinkled with the substance every July 4th. But the potential harm doesn't end with Independence Day. Every Thursday night in summer, fireworks burst into color above the lake. The result may affect not only Lake George itself, but humans in the area.

"Perchlorate is absorbed by the thyroid gland in place of iodine," says Emily DeBolt, a scientist at LGA. It can interfere with the production of thyroid hormone, essential to metabolism and brain function.

There are no federal or New York State drinking water standards for perchlorate, however, a particular concern for Lake George. Residents of nearby towns and villages get water straight from the lake for drinking, bathing, cooking, and other uses.

"Part of the problem," says DeBolt, "is that there isn't much agreement on what is or isn't a safe amount of perchlorate."

In January, LGA issued a report on preliminary research it conducted in Lake George: *An Initial Study Into the Effects of Fireworks on the Water Quality of Lake George.*

LGA scientists collected sediment and water samples at six sites in the lake, three near Lake George Village where fireworks had rocketed into the sky. Although DeBolt and Lender expected that perchlorate concentrations would be higher immediately following a fireworks display, baseline water samples as well as weekly post-fireworks samples showed no measurable perchlorate. "Since there wasn't evidence of perchlorate in the water," says DeBolt, "we tested sediment to see if it was settling out." Concentrations of the chemical were present there, but at low levels.

"Research conducted in other lakes, however," says DeBolt, "has found significant changes in perchlorate levels associated with fireworks."

Perchlorate-free fireworks are available, but at a higher cost than traditional fireworks. "Since perchlorate has implications for human health, a switch to perchlorate-free fireworks could be considered," says Lender.

An e-mail message to the LGA from Todd Earl, president of the Adirondack School Counselor Association, reflects a growing concern among Lake George residents. "I understand and appreciate the tourism-driven economy of our community," he writes, "but I've long felt that this is an overlooked burden on our beautiful resource, and that the impact should be evaluated."

While more research takes place, LGA suggests that the region develop a registration form for fireworks companies producing a show anywhere in the Lake George watershed. Jeff Alonzo, owner of Alonzo Fireworks, which puts on most of Lake George's large fireworks displays, agrees that such a form seems reasonable, according to the LGA report.

"Lake George is far from the only water body dealing with balancing fireworks for entertainment with water-quality concerns," says DeBolt. A recent study, for example, of a lake near Ada, Oklahoma, found that the perchlorate concentration after a fireworks display increased by a factor of 1,000. For the lake's water to return to normal, it took 20 to 80 days.

The 80-plus days between Memorial Day and Labor Day are Lake George's busiest time of year. For the Queen of American Lakes, if fireworks turn out to be an issue, her summer season may go up in smoke.

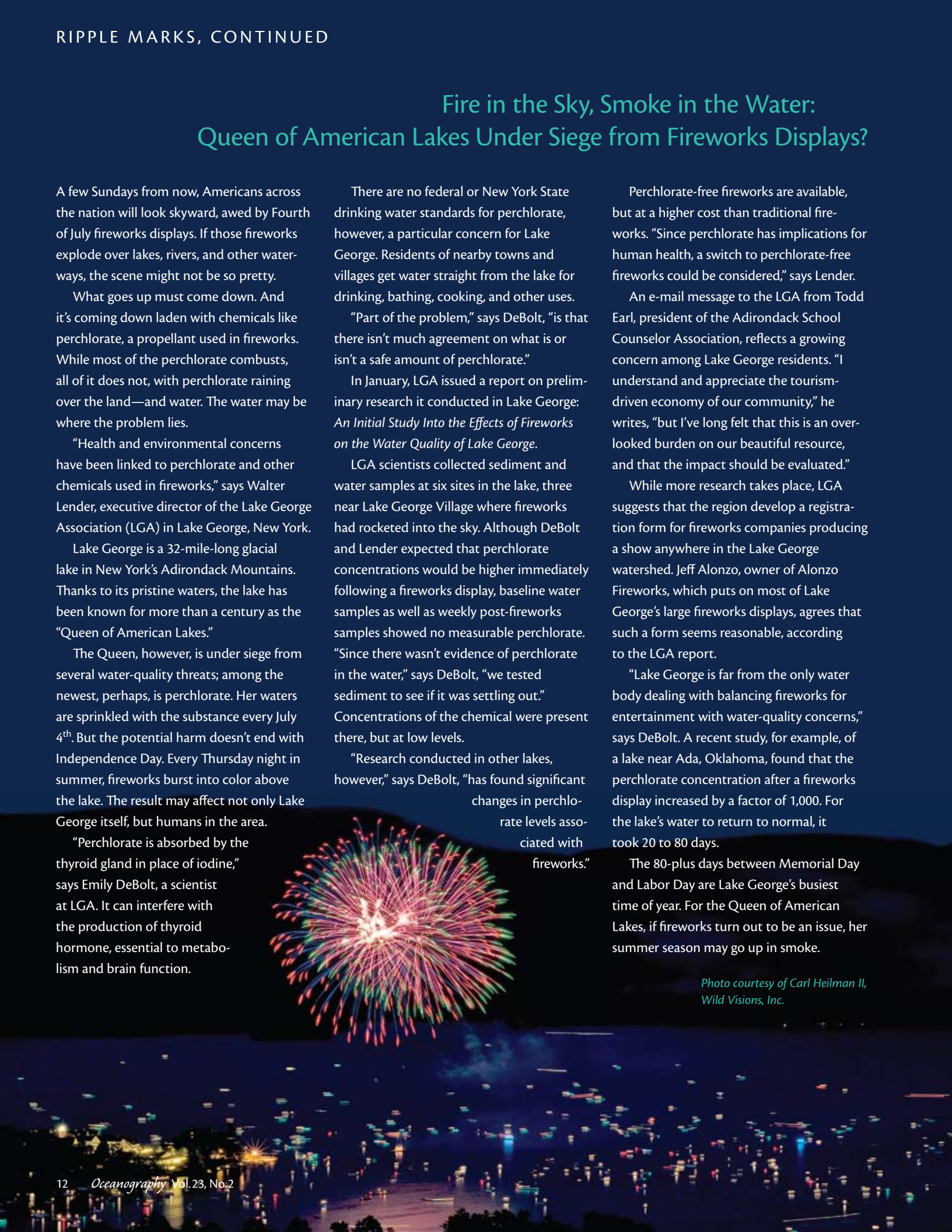


Photo courtesy of Carl Heilman II, Wild Visions, Inc.

Jellyfish "Blooms" Signal Ailing Seas Ahead: Jellywatchers Help Scientists Track Locations

Once a month, on the darkest nights near the new moon, otherworldly beings emerge from Pacific Ocean depths and drift onto the beaches of Hawaii. Hundreds, sometimes thousands, of these quivering masses of jelly float in with the night tide. Near shore, time grows short to complete their mission: to reproduce, leaving behind miniature versions of themselves fastened with a glue-like substance to reefs and rocks in the shallows.

Box jellyfish, the invaders are called. They come in with unbelievably precise timing, and when they do, they're in a frenzy to reach their destination. Most jellies just float along, but box jellyfish actually swim. Like the rabbit in *Alice in Wonderland*, they seem to be saying, "I'm late, I'm late."

More and more box jellies are in the waters around Hawaii. The question, say marine scientists, is where are all these jellies coming from, and why now?

Populations of jellyfish are exploding in seas and oceans around the world, says Steve Haddock of the Monterey Bay Aquarium Research Institute, raising concerns about the health of marine ecosystems. Off the coast of France, aggregations of jellyfish have sunk 500-pound fishing nets. In Japan, jellies have clogged the water intakes of nuclear power plants. In the Gulf of Mexico, Haddock has found, jellyfish are competing with humans for the larvae of commercially important species such as shrimp. One gulf shrimp boat captain says that in some places, the jellies are so thick "you can almost walk across the water on them."

In recent decades, humans' expanding influence on the ocean has begun to cause changes. "Blooms" of jellyfish may be occurring in response to these impacts. Jellyfish compete for prey with adult and young fish. When fish are removed from the equation, jellyfish are likely to move in. If overfishing continues, according to some scientists, fishing boats could soon be chasing jellyfish instead of fish.

What's a fisher, boater, or beachgoer to do? Who ya gonna call?

Jellywatch, say Haddock and Katherine Elliott, a student at Olin College of Engineering. Jellywatch is a new Web site they developed for tracking jellyfish sightings.

The site, http://www.jellywatch.org, combines marine biology and social networking in an attempt to trail jellyfish spotted in waters and on beaches worldwide. Visitors can post photos and information about sightings, and compare their stories with those of others around the globe.

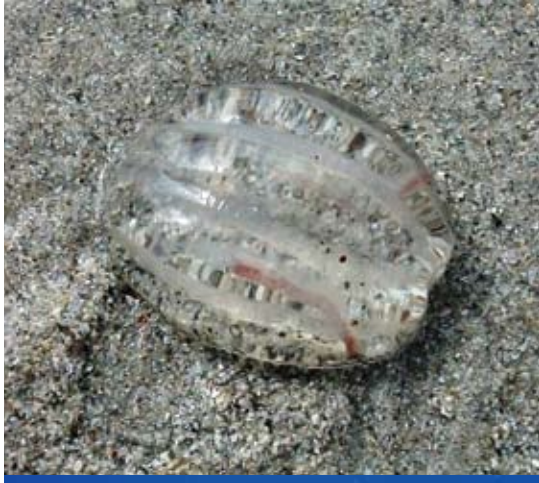
"People have been talking about jellyfish blooms increasing, but we don't really have a lot of data," says Haddock. "It's hard to know how local these events are—or aren't. We created this Web site so everyday people can get involved in an important ocean research project. Their eyes are the most important instruments in the study."

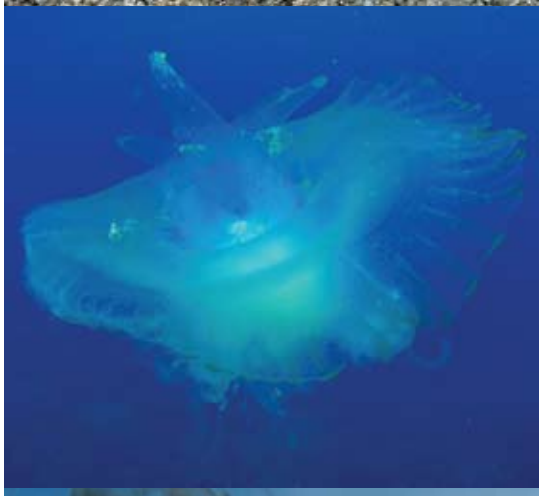
After fewer than two months in operation, Jellywatch has collected dozens of sightings. From British Columbia to South Africa, reports have washed in from almost every continent.

For example, a recent spate of sightings of *Velella velella*, the by-the-wind sailor, has appeared on the site. Reports of these jellies have come from California, Hawaii, Chile, and Spain. "The first three make sense," says Haddock. "These sail-topped jellyfish are at the mercy of spring [and in the Southern Hemisphere, fall] onshore winds. But Spain? We haven't figured that one out yet."

Jellywatchers have posted sightings from places Haddock never expected: Saudia Arabia, Turkey, the Red Sea, the Arctic Ocean. "I'm not sure how people in these areas knew about Jellywatch," he says, "but it's great that this citizen science approach is working."

Still ahead, though, is Jellywatch's final frontier: Antarctica.





Photos provided by Steven Haddock, Jellywatch

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