

MARINE AND COASTAL SCIENCE

Faster Test for Detecting Contamination of Recreational Waters

Swimmers and surfers face the risk of contracting gastrointestinal illnesses from exposure to water contaminated with human sewage. The current method for monitoring fecal indicator bacteria (FIB) in recreational waters requires collecting water samples, then culturing and counting microbes in the laboratory, a process that takes 24 hours. This delay may expose swimmers to tainted water or, conversely, unnecessarily close beaches that are no longer contaminated. Now engineers at the University of California, Los Angeles (UCLA) have designed a better rapid-detection method that directly analyzes FIB onsite in recreational waters in less than 1 hour.

Called the covalently linked immunomagnetic separation/adenosine triphosphate (Cov-IMS/ATP) technique, the portable process uses magnetic beads linked covalently to antibodies that bind FIB. The bead-captured FIB are ruptured and treated with an enzyme (luciferase) that catalyzes a light-emitting reaction powered by ATP. A luminometer measures the amount of light emitted, which correlates with bacterial concentrations.

UCLA's Jennifer Jay, an associate professor of civil and environmental engineering, graduate student Christine Lee, and coworkers collected ocean samples from a California beach and from freshwater streams that flow into the beach area. They checked for two common FIB—*Escherichia coli* and *Enterococcus*. The Cov-IMS/ATP method correctly identified 87% of *E. coli* and 94% of *Enterococcus* in the samples, producing results similar to standard culture-based methods performed for comparison. Moreover, the new method detected FIB at limits below what the U.S. Environmental Protection Agency deems

healthy for recreational waters. The findings were published online 24 December 2009 ahead of print in the *Journal of Applied Microbiology*.

Other efforts to develop rapid tests for recreational water quality are based on the quantitative polymerase chain reaction (for example, see *EHP* 114:24–28 [2006]). A field test based on Cov-IMS/ATP would be easier to use, according to Mark Gold, president of Heal the Bay, an environmental group in Santa Monica, California, that monitors aquatic habitats. That's because quantitative polymerase chain reaction takes about 3 hours and requires cumbersome equipment, plus samples must be transported to a laboratory.

Now the UCLA team is adapting the method to identify *Bacteroidales* species, microbes that can be definitively linked specifically to human fecal pollution. "*E. coli* and *Enterococcus* are not ideal fecal indicators because they do not tell you the source of the fecal pollution, and they grow naturally in the environment," says Jay. In contrast, bacteria in the *Bacteroidales* family grow only in the intestines of warm-blooded animals, with different species targeting different animals. These bacteria also do not replicate well in the environment. So the detection of *Bacteroidales* signals recent fecal pollution. "Even more important," says Jay, "you can tell whether *Bacteroidales* comes from humans or an animal to target cleanup efforts." The team's measurements of FIB in freshwater streams to test whether the method could track beach pollution to a particular storm drain will be submitted for publication separately.

The Cov-IMS/ATP method could potentially become a tool for beach managers to analyze water samples in the morning and post public health warnings within a few hours. Gold says, "This would protect public health better than the current system, where beaches are closed based on yesterday's results."

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Left to right: Raymond Gehman / © Corbis; © Darren Greenwood/Design Pics/Corbis

factors including overcrowded housing and lack of clean drinking water and affordable nutritious food as primary factors in the disparity; many Inuit communities also lack access to quality medical care. They called on the Canadian government to develop a national strategy specific to the Inuit that provides culturally relevant solutions that address living conditions for Canadian Inuit.

e-Waste Laws for India

By early May 2010, the Indian Ministry of Environment and Forests expects to approve rules putting responsibility for the disposal of Indian-made electronic products on their manufacturers. The rules were proposed in 2009 by a coalition of environmental advocacy groups and the Indian Manufacturers' Association for Information Technology. India produces more than 300,000 tons of e-waste annually, a figure that may triple by 2020, according to a recent UNEP report. The new regulations would prohibit the cottage industry of dismantling electronics and recovering the valuable metals they contain, but informal recyclers could still find employment by assisting in the collection of e-waste.

Animals en Masse

Livestock in a Changing Landscape, a two-volume report released in March 2010 by a multi-institution collaborative including the FAO, documents how animal production is causing widespread effects on the environment and human health. Livestock worldwide has tripled

over the last 30 years. According to the report, 1.7 billion head of livestock currently occupy more than one-fourth of the land on Earth, and one-third of the Earth's arable land is devoted to crops used to feed these herds. The report reviews several options for more sustainable animal production. "We want people engaged in the livestock industry to look closely at the report and determine what improvements they can make," said report co-editor Harold Mooney.

