CLEAN WATER SERIES

Tracking the Source: Where is all this pollution coming from?

As surfers and beach goers who care about the environmental health of our beaches and oceans, we are becoming increasingly aware of water quality issues that affect our favorite beaches. Our coastal towns are growing. This development brings not only more homes and businesses to our neighborhoods, but also more sources of pollution. Coastal watersheds are affected by failing septic systems, sewage leaks, pet waste, agriculture, large populations of birds and other wildlife.

Since the passage of the national BEACH Act in 2000, most states have developed water quality monitoring programs that predict the risk to human health from exposure to polluted water. Decisions, based on a measurement of bacteria that indicate the presence of illness-causing pathogens, are made by local health departments to issue swimming advisories or close beaches. Once a beach closure sign goes up at a beach or water quality data are posted on the internet, however, the responsibility of most health agencies ends leaving local citizens to ask "Where is all this pollution coming from?"

The difficulty with determining the sources of beach water pollution is that the indicator bacteria that are measured, typically *Enterococcus sp*. in marine waters, are present in the gut of all warm-blooded animals. The methods approved by the Environmental Protection Agency (EPA) for beach monitoring do not differentiate between bacteria from an animal source, such as cow manure or pet waste, from human-based sources such as leaking sewer systems. Most watersheds are stressed by multiple sources of fecal pollution, making it very difficult to take action to clean up our waterways without knowing where to focus our attention.

Fortunately, the scientific research community has recognized this need and has been very busy over the last decade developing technologies to distinguish the sources of fecal pollution in a watershed. Microbial source tracking methods can be separated into four groups of related technologies.

Genetic methods are based on identifying a genetic 'fingerprint', or distinct DNA pattern, of the fecal bacteria from a known source in the watershed and comparing it to the bacteria in polluted water samples. To perform a source tracking study, samples of fecal matter from human and animal sources throughout the watershed are taken, and distinct genetic fingerprints are isolated from the bacteria from each source. The bacteria present in the receiving coastal waterbodies are then compared to the known sources.

Genetic fingerprinting not only identifies the sources of fecal pollution, but it also determines the percentage that each source is contributing to the pollution problem. For instance, a study performed in the Tualatin River Basin in Oregon revealed that in nearly all of the tested sites, birds were responsible for 50% of the pollution. Other sources were identified as rodent 16%, dog 13%, human 4%, wildlife 6%, cat 1%, and 9% of the pollution was from an unknown source. As a result of this study, the local government

decided to pursue an aggressive public education program to make people aware of the consequences of feeding ducks and other birds and to get them to change their behavior (Clean Water Services, 2005).

Other source tracking methodologies are based on comparing the physiological differences that bacteria have acquired from different animal hosts. For instance, the bacteria present in humans have developed a greater resistance to antibiotics than those from animals. Researchers can identify the source of fecal pollution by comparing the antibiotic resistance of bacteria from water samples to known sources of pollution. This test is not as specific as those based on genetic fingerprints, but it can usually differentiate between pollution from human, livestock, and wildlife sources and can be very helpful in focusing pollution control strategies.

Other types of methodologies look for human viruses or the presence of chemicals such as caffeine or laundry detergent to indicate human sources of pollution. These methods are most useful in urban areas to identify sewer leaks and failures.

So you might be asking, why then, if the technology is available, are more coastal cities not tracking the sources of pollution in their watersheds? The answer is pretty simple. Microbial source tracking is expensive. Most methods require expensive equipment and a high level of technical expertise. The methods are also still under development and are not yet approved by the EPA for standard monitoring programs.

This shouldn't discourage chapters who want to become involved in solving water quality problems at their local beaches. Several chapters have had very successful involvement in source tracking efforts. After a source tracking study of a section of the inter-coastal waterway near Charleston, SC pointed the finger at domestic pet waste as the major source of fecal pollution, the Charleston Chapter obtained a small grant from the City of Folly Beach to make and install plastic bag dispensers at beach access points for dog owners' use. The Chapter's "Love Dogs, Hate Poop" campaign includes an education element and has led to the design of the *Dog Rocket* (patent pending). Chapter volunteers continue to maintain the plastic bag dispensers. Read more at http://surfrider.org/charleston/projects.php#water

In response to high bacteria counts and beach closures at Stinson Beach in California, the Marin County Chapter partnered with the County Water Board to commission a source tracking study to identify the source of water pollution. The study showed that the National Park Service Golden Gate Recreation Area was discharging wastewater into the ocean. The chapter was very active in raising public awareness of this issue in the local papers and has continued to work with the Water Board to convince the National Park Service to upgrade the onsite septic systems in the Park.

Further down the coast, the San Luis Bay Chapter noticed an interesting trend when they evaluated three years of water quality testing data from Pismo Beach. The results show that Pismo Beach has higher levels of bacteria during the dry summer months than during the winter when storm water is more likely to flush pollutants from the landscape. The

Chapter brought this to the attention of the City, who responded very favorably by forming a Pismo Beach Water Quality Group. This Group has already improved the public notification system of beach closures at Pismo Beach and has applied for a state grant to fund a source tracking study.

The Newport Chapter in Oregon has a similar story. They approached the City of Newport with their BWTF data demonstrating a problem with bacterial pollution at Nye Beach and in Nye Creek. The City formed an ad-hoc committee, and by working with this committee, the Chapter was able to improve public notification and signage. Nye Beach was also included in the State of Oregon's Beach Monitoring Program for the first time. The Chapter has now formed its own research committee to seek collaboration and match funding to pay for a source tracking study in the Nye Creek Watershed.

Those interested in learning more should follow the below link to a workshop held in 2002 that brought the top researchers in the field together to discuss and evaluate the emerging technologies used to track the sources of water pollution.
http://www.sccwrp.org/tools/workshops/source_tracking_agenda.html

References

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