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BST

Bacterial Source Tracking





The Need

There are 273 bacterially impaired water bodies in Texas. Identifying and assessing sources of these bacteria — *E. coli*, *Enterococcus*, fecal coliforms — is critical to properly determining risk to water recreation, developing effective watershed restoration strategies such as watershed protection plans (WPPs) and total maximum daily loads (TMDLs), and efficiently targeting management measures.

Options for Bacterial Source Identification and Advantages of BST

Bacterial sources are extensive and include all birds, wildlife, livestock, pets and humans. Source surveys, computer models and bacterial source tracking (BST) are the primary methods for identifying predominant bacterial sources in impaired waters. BST offers distinct advantages over computer modeling and source surveys. Source surveys, which estimate the numbers and distributions of animals and humans in a watershed, are not capable of assessing most wildlife species or how bacteria from sources are transported to the impaired waters. Computer modeling addresses the issues with transport; however, because wildlife populations are rarely known, models are unable to adequately assess

Proper evaluation of nonpoint sources is needed to accurately assess risk to water recreation, target best management practices and develop effective watershed restoration strategies.

contributions from wildlife. BST is able to evaluate wildlife, along with other major sources, and the impacts of transport because BST uses instream water samples for its assessment. However, best results are generally achieved when used in conjunction with the other methods.

BST Technologies

The premise behind BST is that DNA fingerprinting and other molecular targets can identify bacterial strains specific to each animal species since each species has different diets and digestive system conditions that select for distinct strains of bacteria. This distinction allows the original source of the fecal contamination to be identified.

Numerous BST methods are available. Based on a multi-year study initiated in 2002, Texas selected the two-method approach using ERIC-PCR and RiboPrinting, as this approach was found to be the most accurate and cost-effective. Because it provides a direct link with water quality standards, *E. coli* is used as the target bacteria. Using these methods required development of a DNA fingerprint library.

About the Texas BST Library

The Texas BST Library currently contains more than 1,500 *E. coli* isolates obtained from more than 1,300 different domestic sewage, wildlife, livestock and pet fecal samples. These isolates, which represent more than 50 animal subclasses, were selected after screening several thousand isolates from more than a dozen different studies throughout Texas.

Currently, Dr. George Di Giovanni at the University of Texas School of Public Health – El Paso Regional Campus and Dr. Terry Gentry at the Texas A&M University Soil and Aquatic Microbiology Laboratory oversee and maintain the Texas BST Library, continuously testing its accuracy and refining its composition.

BST accuracy is best when identifying broad source categories and decreases as the sources are more specifically identified. As such, 3-way (wildlife, human, domestic animals), 5-way (non-avian wildlife, avian wildlife, pets, livestock, human), and/or 7-way (non-avian wildlife, avian wildlife, pets, cattle, other non-avian livestock, avian livestock, human) categorizations are typically reported (Fig. 1).

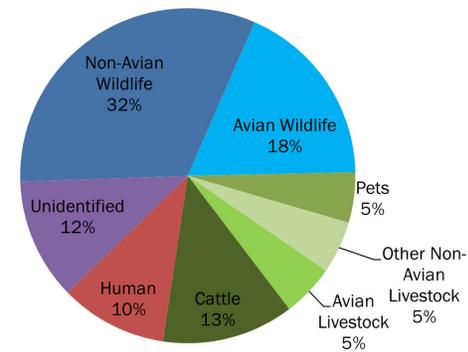


Figure 1. Average 7-way categorization based on 7 studies conducted in Texas

Moving Forward

The technologies used for BST are continuously evolving and improving. In addition to expansion and refinement of the Texas BST Library, library-independent molecular methods are being explored, as recommended by the Bacterial Total Maximum Daily Load Task Force. Library-independent tools provide an alternative for those waters impaired due to *Enterococcus* or fecal coliforms. They can also be successfully used in combination with library-dependent methods as demonstrated by the Buck Creek and Lake Granbury BST projects.

For future WPPs and TMDLs, a “toolbox” approach is recommended. The assessment phase should include targeted monitoring of suspected pollution sources, use of library-independent and -dependent methods to identify the presence of domestic sewage pollution and screening of water isolates from the new watershed against the existing library to determine the need for collecting local source samples and expanding the library.

BST has been tremendously helpful in identifying significant bacterial sources throughout Texas. The state BST laboratories can provide guidance and assistance with performing BST for watersheds. For more information, visit texasbst.tamu.edu.