Statistically-Based Monitoring in Texas

2008 Texas Water Quality Inventory and 303(d) List (March 19, 2008)

Texas has historically relied on targeted monitoring as the primary tool in evaluating the status of water quality in the state. This type of monitoring provides invaluable information about site-specific water quality issues. However, the data provided by targeted monitoring is of limited use in contributing to resolving large scale water quality issues such as:

- What is the current extent of ecological resources in Texas, and how are they distributed geographically?
- What proportion of the resources is currently in acceptable ecological condition?
- What proportions are degrading or improving, in what regions, and at what rates?
- Are these changes correlated with patterns and trends in environmental stresses?
- Are adversely affected resources improving in response to control and mitigation programs? i.e., are our water quality management strategies working?

These types of issues can only be resolved by implementing a statistically designed monitoring network using probability-based sampling of explicitly defined resource populations. Implementation of this type of approach for evaluating status and trends of water quality at the national level was begun at the U.S. Environmental Protection Agency (EPA) with the establishment of the Environmental Monitoring and Assessment Program (EMAP) in the late 1980's.

The Texas Commission on Environmental Quality (TCEQ) is currently evaluating the utility of probability-based sampling as a component of the existing Surface Water Quality Monitoring (SWQM) Program to contribute data toward addressing large scale water quality issues in Texas. As a part of this process, the TCEQ SWQM Program is participating in national scale probability-based sampling implemented by the EPA to address these issues at the national level.

In 2004, the TCEQ SWQM Program participated in the National Wadeable Streams Assessment (WSA), the first nationally consistent, statistically valid study of the nation's wadeable streams. Wadeable streams were defined as those streams which fall in the 1st through 4th Strahler stream order range. To conduct the WSA, States, Tribes, and the EPA collected chemical, physical, and biological data at more than 1,392 wadeable streams in the United States. Complete results for this study at the national scale can be found at the following web address: http://www.epa.gov/owow/streamsurvey/

Approximately 39 streams, selected according to a probability-based sample design, were sampled in Texas as a part of this study in the summer and early fall of 2004 (see Figure 1). Due to the enormous size of the state and the diversity within each level II ecoregion, this project required participation by several entities both within and outside the TCEQ. The TCEQ's SWQM Program coordinated the project with agency personnel in the central office in Austin, Texas and with biologists in the TCEQ regional offices. The cooperation between the TCEQ central office SWQM team and regional biologists to complete the NWSA sampling in Texas represents the initial pilot application of the "virtual biological monitoring team" (VBAT) as a mechanism to achieve large scale SWQM projects in Texas.

The NWSA was the initial phase of the overall goal of applying a statistically valid sample regime to all surface waters in the nation. Over 1250 lakes and reservoirs across the continental US were sampled during the summer and early fall of 2007 as part of the next phase, the National Lakes Assessment (NLA). The TCEQ SWQM team coordinated Texas' participation in the NLA. Forty-two reservoirs were sampled in Texas for the NLA by the TCEQ VBAT with five quality assurance re-visits for a total

of 47 sample events (see Figure 2). This sample set should provide a statistically valid estimate of water quality in Texas reservoirs.

The next phase involves sampling in large rivers, greater than order 4 as well as in smaller streams to provide a statistically valid sample set for all flowing waters in the continental U.S. The TCEQ central office SWQM team will coordinate efforts of VBAT to complete sampling in 30 rivers (with two quality assurance re-visits), larger than fourth order, across the state as a part of the national effort. Sampling in approximately 26 of smaller streams (with two quality assurance re-visits), smaller than fourth order, is expected to be completed by an EPA contractor. Combined, these samples should provide a statistically valid estimate of water quality in flowing waters in Texas.

The NWSA and the NLA have set the stage for future developments in large-scale approaches to monitoring such varied and often difficult to reach waters in the state. The EPA will coordinate national-level studies of wetlands in future years, which, when combined with data from the flowing waters and lakes surveys, will provide statistically valid estimates of water quality in all surface waters in the continental US. After a period of five years, each ecosystem type will be revisited, using the same methods to assess changes. As these studies are carried out on a national level, states such as Texas will be able to build capacity for carrying out state-level assessments based on a probabilistic design. Additionally, the number of samples collected in Texas in the lakes survey, as well as in the flowing waters survey, will allow state-level statistical estimates for a variety of water quality parameters.

More information, data, and the final report on the EPA's NWSA may be found at:
http://www.epa.gov/owow/streamsurvey/

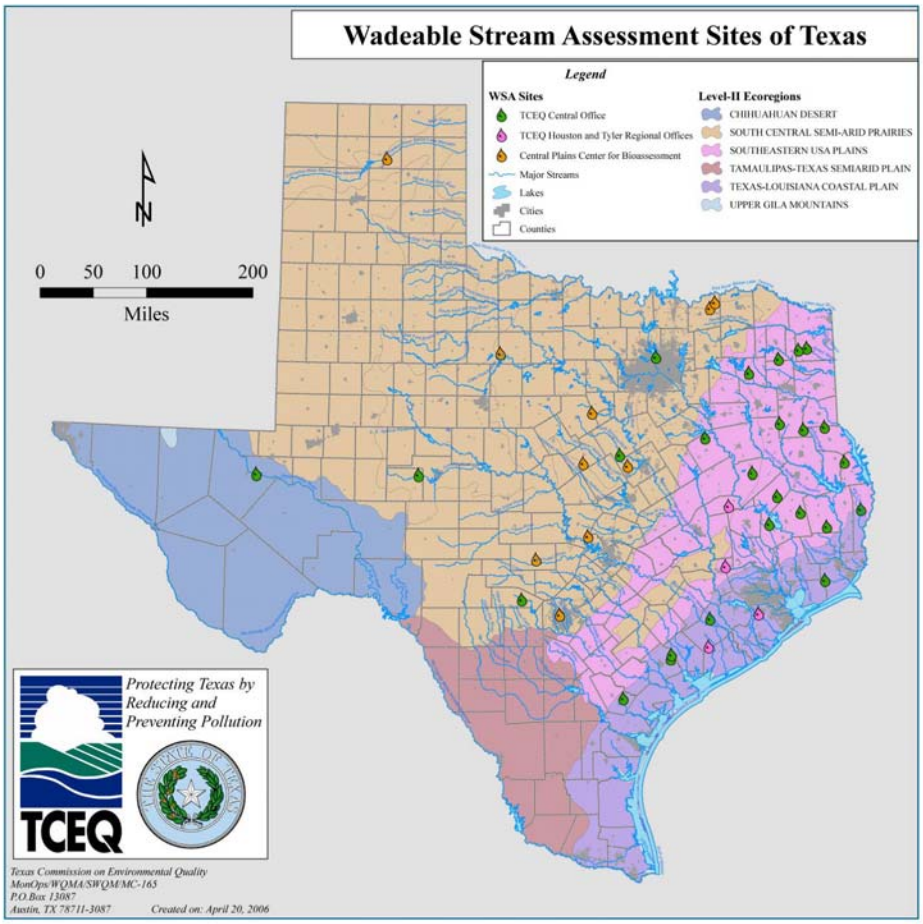

Figure 1. Texas' National Wadeable Stream Sites

More information on the EPA's NLS may be found at:
http://www.epa.gov/owow/lakes/lakessurvey/

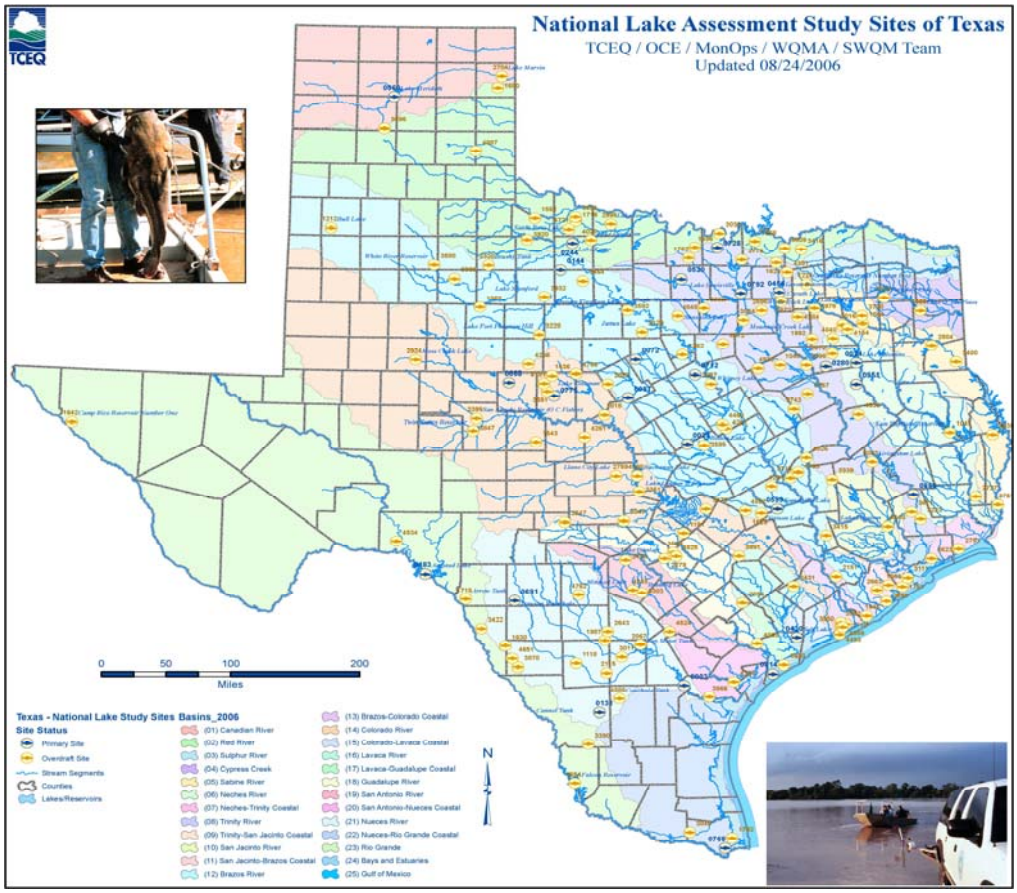

Figure 2. Texas' National Lake Survey Sites

Blank Page