

Galveston Bay Indicators Project

Executive Summary



PREPARED IN COOPERATION WITH THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY AND THE U.S. ENVIRONMENTAL PROTECTION AGENCY

The preparation of this report was financed through grants from the U.S. Environmental Protection Agency through the Texas Commission on Environmental Quality

Contract Number 582-3-53330

Prepared By:

Geotechnology Research Institute
Houston Advanced Research Center
4800 Research Forest Drive
The Woodlands, Texas 77381



Principal Investigator
L. James Lester, PhD.

Project Manager
Lisa A. Gonzalez

Prepared for:

Galveston Bay Estuary Program
Texas Commission on Environmental Quality
711 West Bay Area Boulevard, Suite 210
Webster, Texas 77598



Contract Manager
Steven R. Johnston
Regional Monitoring Coordinator
Galveston Bay Estuary Program

May 2005

Introduction

As human activities increasingly impact natural systems, resource managers, decision makers, and the public need the capability to assess how those impacts alter ecosystem processes and resources. A great amount of money and effort are spent over long periods of time collecting information on a variety of chemical, physical and biological parameters. Large databases exist consisting of hundreds of parameters describing the quality of water and sediment, the health of fisheries resources, the volume of freshwater inflows, and the concentrations of contaminants in seafood. Effective and sustainable environmental resource management necessitates development of policies based on sound scientific assessment. However, the complexity of monitoring information makes understanding the response of the system to human stressors very difficult. Properly developed indicators are a way to facilitate understanding for decision making.

Indicators assess specific conditions that are related to and representative of the health of a system. There are many types of indicators: biological, chemical, physical, social, and economic. Effective indicators must be: relevant, conceptually sound, reliable, feasible, readily available and understandable. When chosen properly, indicators can provide valuable insight into processes, spatial and temporal trends, effects of specific impacts, and the effectiveness of implemented policy. For many years indicators have been used to describe aspects of national, regional and local society; including but not limited to the economy and educational system. More recently, sustainability indicators have been developed to describe social, environmental, and economic conditions at the community level.

The purpose of the Galveston Bay Indicators Project is to identify quantitative measures that meet certain criteria and summarize significant portions of the data relevant to the health of Galveston Bay. The information on Galveston Bay is voluminous. However, the relationships among different parameters are not well documented and the relative significance of different parameters to the viability of the bay's ecological systems is not well understood. These gaps need to be filled to provide measures that will indicate for managers and policy makers the progress, or lack thereof, toward a healthy and sustainable Galveston Bay system.

Relationship to *The Galveston Bay Plan*

The Galveston Bay Estuary Program (GBEP) of the Texas Commission on Environmental Quality (TCEQ) was established in 1989 to develop a comprehensive conservation management plan (CCMP) for the Galveston Bay Ecosystem. The CCMP for the Galveston Bay area is called *The Galveston Bay Plan (The Plan)*. *The Plan* provides a framework for a series of goals and relates a set of specific initiatives to the identified problems in Galveston Bay.

The Galveston Bay indicator framework reflects the management priorities of *The Galveston Bay Plan*, the GBEP, the Galveston Bay Council, and its subcommittees:

- Water and sediment quality,
- Habitat loss,
- Fish and wildlife populations,
- Physical conditions of the bay, and
- Human uses of bay resources.

Methodology

The project began with a literature and Internet survey reviewing the last fifteen years of work on ecological and sustainability indicators. The literature search compiled a list of possible indicators relevant to a system like the Lower Galveston Bay Watershed. The literature review resulted in an annotated bibliography and a list of nearly 350 indicators used in other regions. The list was used as the basis for an indicator workshop convened in December 2003. Workshop participants were chosen based on their particular field of expertise and their knowledge of Galveston Bay resource issues. Workshop participants used a list of proposed assessment questions and the list of indicators from the literature review to form the preliminary indicator framework.

Indicator refinement occurred through statistical analyses with a focus on variables with sufficient records to ensure statistical soundness. Three agency data sets were employed as the basis for development of the Galveston Bay Indicator Framework. They included the TCEQ's Surface Water Quality Monitoring (SWQM) database, the Texas Parks and Wildlife Department's Coastal Fisheries Resources database, and the Texas Department of State Health Services seafood tissue contaminant and bacteriological data sets. Additional agency databases were acquired and utilized as needed.

Stakeholder input was obtained throughout the duration of the project. The Galveston Bay indicator framework was refined over the period of one year with input from the Galveston Bay Estuary Program's (GBEP) Galveston Bay Council and subcommittees. A final Galveston Bay indicator workshop was convened in December 2004 to obtain stakeholder input on the final Galveston Bay indicator framework.

To become an indicator, a parameter is assessed using a three-tiered approach. The top level of the indicator framework consists of the general assessment questions, or the questions that the indicators must answer. The second level consists of the indicators themselves. The third and most detailed level of the indicator framework is the data that form the foundation of the indicators.

Results and Next Steps

The Galveston Bay indicator framework consists of 16 assessment questions and 28 indicators. Indicators describing particular aspects of the Lower Galveston Bay Watershed's physical environment are included in the *Media* category. Indicators describing the state of human uses of bay resources are placed in the *Uses* category. The indicator framework follows the structure:

- Media
 - Water & Sediment Quality (4 indicators)
 - Biological Resources (6 indicators)
 - Physical characteristics (2 indicators)
 - Social & Economic (2 indicators)
- Uses
 - Seafood (2 indicators)
 - Fisheries (2 indicators)
 - Water (3 indicators)
 - Shipping (1 indicator)
 - Boating (1 indicator)
 - Other Recreation (3 indicators)
 - Valuation (2 indicators)

As evidenced by the developed indicators, the state of the Galveston Bay Estuary and the associated watershed show both improvements and declines. Water quality indicators show a general improvement since the 1970s and the inception of the Clean Water Act. However, certain subbays and tributaries still show contamination problems. Additionally, indicators show that some areas of the bay previously thought to be free of water quality problems have reports of contamination that are a cause for concern. Some areas and contaminants can not be assessed due to gaps in the data. Contamination of seafood is a cause for concern in the area of the bay near the Houston Ship Channel, Trinity Bay and, surprisingly, in some western portions of the bay system. The problem in the Houston Ship Channel has been recognized by issuance of seafood consumption advisories.

Indicators of biological resources suggest that fishery resources show no decline and no cause for concern. Records of colonial nesting water birds yield an indicator that shows widespread decline of wading bird nesting colonies and cause for concern. Indicators of habitat change have been developed, but can not be assessed until the completion of comparative studies in the future.

Physical characteristics are represented by indicators of freshwater inflow and salinity. Using the available freshwater inflow data which is limited in spatial coverage, the analysis indicates no problem at this time. Salinity patterns show changes over decadal time periods, but no indication of deleterious effects.

Indicators based on changes in human population and land use in the watershed have been developed, but not assessed due to the need for comparative land use data and qualitative evaluation.

None of the indicators developed to determine the sustainability of uses have been employed in a qualitative assessment. Due to the existence of competing uses and a diversity of opinions, indicators are presented for the interpretation by the reader.

Seafood consumers may have concern about the expansion of seafood consumption advisories. However, the area of the bay open to shellfish harvest remains relatively stable. The bay appears to be sustaining recreational and commercial fisheries although the number of commercial licenses is declining.

Indicators describing the ability of the watershed to sustain the demand for clean freshwater are mixed. The indicator that is based on the analysis of water demand by the Region H Water Planning Group shows a freshwater deficit in the future. Another indicator that is based on the deficit of annual flows compared to the estimated freshwater quantities required to support bay productivity shows no problem in the last decade. However, an indicator based on changes in the stream segments listed on the State of Texas List of Impaired Waters [the 303(d) list] may be cause for concern.

Assessment of the data from the shipping industry shows little cause for concern. The rate of spills and incidents is low. Recreational boating appears to be sustained because the number of pleasure boat licenses is stable. Efforts to reduce the impact from these boats, i.e. marina pump-outs, are also stable in number and located in appropriate areas. In general, the area appears to be able to sustain a variety of tourism activities as indicated by destination spending. Some recreational activities appear to be in decline, e.g. the number of waterfowl stamps sold to hunters in the watershed.

In general, the value of the bay for the surrounding communities is increasing, although it is difficult to compare the economic impact of the different uses due to the way value is reported. In addition, the attitude of citizens in the region continues to favor protection of wetlands and sensitive areas and spending for habitat conservation.

The analysis found many data gaps that could inhibit application of some indicators. Also, some important assessment questions can not be answered with the available data sets. Future data needs are discussed. In conclusion, the suite of indicators developed will have a positive impact on our ability to assess the condition of the Galveston Bay system, but could be improved with better monitoring and reporting of relevant parameters.