

5. Data Dissemination: Status and Trends Internet Access

One of the goals of the Galveston Bay Estuary Program is to make information describing the well-being of the Galveston Bay Estuary more available to resource managers, researchers, and the general public. A primary tool used to achieve this goal is the Status and Trends Project.

The data analyses and maps completed by the Status and Trends Project in years 2002 and 2003 will be made available to GBEP partner organizations and the public through a website located at <http://trendstat.harc.edu/>. Data are organized by major category: water quality, sediment quality, fisheries resources, colonial nesting birds, freshwater inflows, oil spills and seafood safety. Requests can be made to the [Status and Trends Project Manager](#) or the [GBEP Monitoring Coordinator](#) for specific analyses or data not currently included on the Status and Trends website.

6. Discussion

6.1 Data Quality

All of the data employed in the Status and Trends Project are non-direct in that they are obtained from the agencies or organizations that made the direct measurements. The entire project is limited by the data initially collected and stored in databases maintained by resource agencies and monitoring programs. Every monitoring program differs in the quantity and quality of procedural documentation, metadata, and Quality Assurance/Quality Control (QA/QC) practices.

All data are accepted from source agencies, but are subject to a validation process (see Figures 3.1.1 and 3.1.2). Additionally, Status and Trends Project staff members work with contributing agencies and organizations to determine limitations of the data. When applicable, limitations are noted in the final report and in all web-based deliverables. The Status and Trends Project will obtain the following quality assurance documentation when available from the source agencies:

- Approved QAPPs
- Established QA/QC procedures
- Agency-specific procedural documentation
- Metadata in a standard format

Data sets fall under one of three qualitative confidence levels: HIGH, MODERATE, and LOW based on the availability of the above documentation. When three or four of the documents exist, the data set is determined to be of HIGH quality. When two or three of the documents exist, the data set is determined to be of MEDIUM quality. When less than two of the documents exist, the data set is determined to be of LOW quality.

TCEQ Surface Water Quality Monitoring Program

HIGH. The TCEQ Surface Water Quality Monitoring Program maintains QAPP, Quality Assurance/Quality Control (QA/QC) procedures manuals and agency specific procedural documentation in the form of:

- *The Surface Water Quality Monitoring Procedures Manual* (TNRCC, 1999a)
- *The Surface Water Quality Monitoring Data Management Reference Guide* (TCEQ, 2003)
- *The Receiving Water Assessment Procedures Manual* (TNRCC, 1999b)

The TCEQ also makes metadata files available describing the agency's database file structure, sampling station locations, and parameter/storet code descriptions. Metadata files are available via the Surface Water Quality Monitoring Program website:

<http://www.tnrcc.state.tx.us/water/quality/data/wqm/index.html#guidance> .

Texas Clean Rivers Program

HIGH. Local agencies submitting water and sediment quality data to the CRP and the H-GAC must maintain approved QAPPs. CRP agencies follow the quality assurance

guidance documents of the TCEQ mentioned above. Since the CRP database follows the same structure as the TCEQ database, metadata provided by the TCEQ at the website given above describe the CRP database as well. The H-GAC maintains information describing sampling station locations and makes them available to those who request the CRP data.

TPWD Coastal Fisheries Resources

HIGH. The agency maintains a field and laboratory procedures guide, the *Marine Resource Monitoring Operations Manual* (TPWD, 2001). The agency uses a system of data quality reviews that require field data to be evaluated by local field office, regional and Austin headquarters personnel prior to data entry into the fisheries independent monitoring database. The TPWD maintains metadata descriptors of the database that are available to those who request data from the agency.

The only item that may detract from the quality of the TPWD data set is the fact that the TPWD maintains no formal QAPP. The QAPP is a document required by federal agencies and local agencies/projects under such federal agencies (e.g. the US EPA). One must, therefore, keep in the mind the TPWD is not required to maintain a QAPP for its monitoring program unless it involves a special project under another agency that requires one.

National Coastal Assessment (NCA)

HIGH. The NCA maintains extensive metadata that is furnished with the data. The agency also maintains an EPA-approved QAPP and field and laboratory procedural documentation.

Agencies with Uncertain Data Quality

The Status and Trends Project will postpone its opinion regarding quality of data for three source agencies. The Status and Trends Project wants to examine further availability of documentation such as QAPPs, metadata and field and laboratory procedural documentation for the Texas Department of Health, the Texas General Land Office, and the US Army Corps of Engineers.

6.2 Needs for Additional Monitoring

The Status and Trends Project hopes to provide the GBEP and readers with answers regarding the well-being of the Galveston Bay Estuary, but in doing so, very often more questions are revealed. One of the purposes of the Status and Trends Project is to assist the GBEP Monitoring Subcommittee in determining areas and parameters for which additional monitoring may be necessary. Resource agencies are usually limited in terms of manpower and funds available for their monitoring activities. As a result, some areas or parameters may go unsampled for a substantial period of time, resulting in data and knowledge gaps.

When analyzing data, the trends the Status and Trends Project requires at least ten of years of data for a given parameter in a sub-bay or tributary grouping (see Table 2.1.2).

In creating the graphical trend products, the extent to which areas and parameters are sampled becomes apparent. Areas and parameters for which there are known ecological or human health problems tend to garner the most attention. As an example, areas such as the Houston Ship Channel have an abundance of water and sediment quality data collected throughout the period of record. Areas with less development and associated concerns may receive less consideration in terms of agency monitoring strategies. Fisheries species of commercial and recreational importance often receive more attention than small species that may still be important in term of trophic relationships and the overall understanding of the ecological process of the Bay.

6.2.1. Water and Sediment Quality

Water Quality

Of the 70 water quality trend analyses completed, eleven (16%) contained less than ten years of data. Of the new areas studied, the Trinity River and the East Intracoastal Waterway had the greatest occurrence of insufficient data determinations. Conventional water quality sampling for water temperature, pH, nutrients, etc. demonstrated the best data coverage. Data describing metals and organic contaminants in water is lacking in almost all areas of Galveston Bay.

Sediment Quality

Of the 126 sediment quality trend analyses completed, 70 (56%) contained less than ten years of data. In terms of metals in sediment, a good amount of data were collected in the Christmas Bay/Bastrop Bayou Complex, West Bay, and the Upper and Lower Houston Ship Channel. Data were often lacking, however, for the Galveston Channel, Intracoastal Waterway East, and Trinity River.

Organic contaminants are most sampled in the Upper Houston Ship Channel. Some data exists for the Lower Houston Ship Channel and West Bay. Areas receiving little attention in terms of concentrations of organics in sediment include the Christmas Bay/Bastrop Bayou Complex, Galveston channel, Intracoastal Waterway East, and the Trinity River. In general, there appears to be more data describing concentrations of metals. Data describing concentrations of organics seems to be lacking overall.

6.2.2. Fisheries Resources

Of the 235 trends analyses completed for fisheries resources collected with bag seine, shrimp trawl, gill net and oyster dredge, spatial coverage was good. There were no areas or species analyzed by the Status and Trends Project that lacked sufficient data. This is most likely due to the TPWD's randomized sampling design. While some sample stations are located at the mouths of tributaries and bayous (see Figure 2.2.2.1), the TPWD Coastal Fisheries Program largely focuses its monitoring program on bay waters. Since the tributaries and bayous are the water bodies most influenced by human development, it would be interesting and relevant to obtain additional data describing fisheries abundances in the upper reaches of those bodies of water.

6.3 Conclusions on Status and Trends of the Conditions and Resources of Galveston Bay

The TCEQ monitors the concentrations of nutrients in water and contaminants in the sediment to determine the extent to which they are assimilated, removed from, or accumulated within the system. This study looked at the data from areas of the Bay that were not examined in the 2002 Status and Trends study (please visit <http://trendstat.harc.edu> for results of the 2002 study). The seven parameters related to nutrients and productivity responses were examined for trends in five areas. Enough data existed for 33 trend analyses of which 15 decreasing trends were documented. This is consistent with earlier analyses showing a general decline in nutrients and phytoplankton in the Bay.

TCEQ monitoring of fecal coliforms documented declines in two of five new study areas. The long term fecal coliform data from TDH extends into the time period prior to the Clean Water Act and gives a clear indication of the amount by which clean water regulations have reduced the health risk from public waters. Analysis of the TDH coliform data support the validity of the TDH management system based on area restrictions and temporary closures after precipitation events.

Sediment quality monitoring is related to chemical analysis of the concentrations of metals and organic compounds that are insoluble or have limited solubility. Concentrations of eight metals in the five new areas and the subdivided upper and lower reaches of the Houston Ship Channel were examined. There was sufficient data for 36 trend analyses. Eight of those showed significant decreasing concentrations of the metal measured.

Sediment concentrations of five pesticides, three breakdown products from them and total PCBs were considered for trend analysis. In most of the new areas there was insufficient data for trend analysis. Only the reaches of the Houston Ship Channel and West Bay had enough data. In those cases, two decreasing trends were observed in the Houston Ship Channel.

In several cases, data sets from two agencies were examined together to assess the consistency of the monitoring programs. Sediment quality data collected by the U.S. Army Corps of Engineers in conjunction with approval of dredging projects was examined in the context of TCEQ sediment quality data. The USACE data is episodic, but concentrations appear to be consistent with the TCEQ data from the same area. The National Coastal Assessment (NCA) Program has monitored the conditions in Galveston Bay during summer field efforts since 2000. Data were available from 2000 and 2001. NCA monitors many parameters. The Status and Trends Project examined the relationship between seafood contamination data from the NCA program and from TDH Seafood safety Division. There were some inconsistencies between the two data sets. It is difficult to determine whether the differences are the result of methodologies or sample locations.

Water and sediment contamination is more likely to exhibit a linear pattern in either a spatial or temporal analysis than the abundance of animals. Significant trends were much rarer in the monitoring data sets on living resources from TPWD. However, some of the trends described in this report may be indicators of important changes in the Bay system and deserve further study.

In the 2002 status and trends report, a significant decline in blue crab numbers in two sub-bays was documented. In 2003, the Status and Trends Project found that the lesser blue crab exhibits significant increases in bag seine samples taken in Galveston and Christmas Bays. There may be a competitive interaction between these species that could impact commercial fishing for the larger species. Also found in bag seine data, a significant decline in Gulf killifish. The killifish is a resident of fringing marshes, and a possible indicator of quantity of fringing wetlands.

White shrimp, brown shrimp, and blue crabs are the most valuable crustacean species in the estuary. Two additional crustacean species showed surprising increasing trends in the shrimp trawl data. Seabob and pink shrimp both showed rising abundance in Galveston Bay.

Spotted seatrout and black drum are important recreational species. They are collected as adults by gill net. In the gill net data, both species show significant increases in West Bay.

Following the examination of single species data for trends that met the Status and Trends criterion, the data were used for analysis of variance. These large data sets provide the opportunity to ask questions about large scale temporal and spatial effects on the abundance of species. The three collection methods, bag seine, shrimp trawl and gill net, give different answers about this issue. Seven species were studied for effects of location and decadal time period on abundance. Of fourteen potentially significant effects, three temporal effects and one spatial effect on abundance were found. Using shrimp trawl data for seven common species, three significant location effects and three effects from abundance change over decades were found. Gill net data on only five species showed 80 % of the location tests were significant and 40% of the temporal effects. This implies that adult fishes are more habitat selective than juvenile fishes and epibenthic crustaceans. It also implies that the abundances of juveniles and short-lived species captured in bag seine are more likely to fluctuate annually in response to no long-term factor.

In this study, the Status and Trends Project has made its first attempt to examine the spatial and temporal distribution of biodiversity in the Galveston Bay system. The issue behind this analysis is whether anthropogenic stressors are impacting the ecological communities in ways that can not be detected with single species analyses. Species richness was estimated by simply counting the number of taxon identification numbers reported in each collection and rejecting those that represented plants, non-aquatic animals or inability to classify the sample.

There was an absence of long term linear trends in the species richness data. It did appear that the gill net data reflected a major change in regulation of coastal fishing. The bag seine data decreased in variation over the time period. Understanding this record and explaining the patterns of species richness will require more study. However, the species richness information yielded some clear patterns from analysis of variance and comparison of means tests. The seasonal pattern of changes in species numbers in collections is quite striking. Winter collections have significantly lower numbers of species. This emphasizes how many of the species in the Bay are transients there. Also, these analyses point out the importance of the Gulf of Mexico as the source of biodiversity in the Bay. Those sample areas closest to the Gulf tend to have higher species richness in the bag seine and gill net collections. Shrimp trawl data is different and shows higher species numbers in the largest sub-bays in the system.

How does all of this information relate to the health of the Bay?

- Galveston Bay as a whole is not endangered by eutrophication. While some areas of the watershed (urbanized bayous) have some eutrophication issues; overall, nutrient concentrations are falling.
- Galveston Bay is not rapidly degrading in terms of increasing concentrations of pollution. Rather, trends in pollution are mixed. Concentrations of contaminants are falling in the most polluted areas, but some are rising in other areas. Concern needs to be targeted to specific areas and contaminants.
- In general, consumption of seafood taken from the Galveston Bay estuary is not considered to be a serious risk to healthy individuals. Most seafood species have non-detectable levels of contaminants according to data supplied by the Texas Department of Health and the National Coastal Assessment. That does not mean, however, that all areas of the Galveston Bay watershed should be considered safe for commercial and recreational seafood harvest. The Texas Department of Health's Seafood Safety Division is the final state authority on the subject; issuing fish consumption advisories and limiting activities in oyster harvest areas when the agency deems that actions to protect the public health are necessary.
- Few aquatic species exhibit significant trends in abundance. Significant increasing and decreasing trends can be found for a few species collected by each gear type. The challenge is to interpret the causation of the trend or determine probable relationships with other species and parameters.
- The biodiversity of the Bay shows seasonal and spatial patterns that will help us to understand its ecological structure. Ultimately the biological community in the Bay is inextricably bound to the larger biological community in the Gulf. What happens in one will directly affect what happens in the other.