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# Estuary Use Support Assessment



*Shrimp boat in the Intracoastal Waterway*

# Estuary Use Support Assessment

For the 2000 report, 49 estuaries (46 classified; 3 unclassified) encompassing 1993.4 square miles (mi<sup>2</sup>) were surveyed and at least one designated beneficial use was assessed in each water body. The surveyed mi<sup>2</sup> represent 86.7 percent of the area covered by estuarine waters along the Texas Gulf Coast (Figure 18). Five more estuaries covering 2.7 mi<sup>2</sup> were surveyed in 2000 than in 1996, the year of the last full statewide assessment by the TNRCC. The increase in surveyed mi<sup>2</sup> is due to additional monitoring of small side bays and harbor areas.

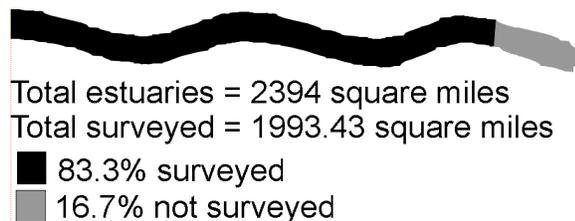


Figure 18. Estuary Square Miles Surveyed

About 62 percent of the assessed 1,993.4 mi<sup>2</sup> fully support all their designated uses (Figure 19). Some form of pollution impairs the remaining 38 percent of assessed estuary mi<sup>2</sup>. The framework, indicators, and criteria used to assess designated uses in estuaries are described in the “Surface Water Assessment Methodology” section and are shown in Tables 18-28.

Figure 20 indicates the causes and sources of pollutants that impair (i.e., prevent from fully supporting designated uses) estuary mi<sup>2</sup>. Causes that contribute most to overall use impairment of designated uses in estuaries include elevated fecal coliform densities (contact recreation use) and depressed dissolved oxygen concentrations (aquatic life uses). The sources of pollution for most estuaries are presently unknown (Figure 20). Natural sources (sluggish tidal activity, warm water temperatures, high salinity) account for the largest category of known pollution sources, contributing to about eight percent of impaired assessed mi<sup>2</sup>. Industrial point sources (6%), urban runoff (4%), and municipal point sources (4%) are also identified as known sources of pollution that contribute to impairment of designated uses in estuaries.



## Aquatic Life Use Support

Individual use support information provides additional detail about water quality problems in estuaries. Approximately 1,993.4 mi<sup>2</sup> were surveyed to determine support of the aquatic use. Sufficient data were available to provide assessment of 1,232 mi<sup>2</sup> (62% of surveyed mi<sup>2</sup>) (Table 56).

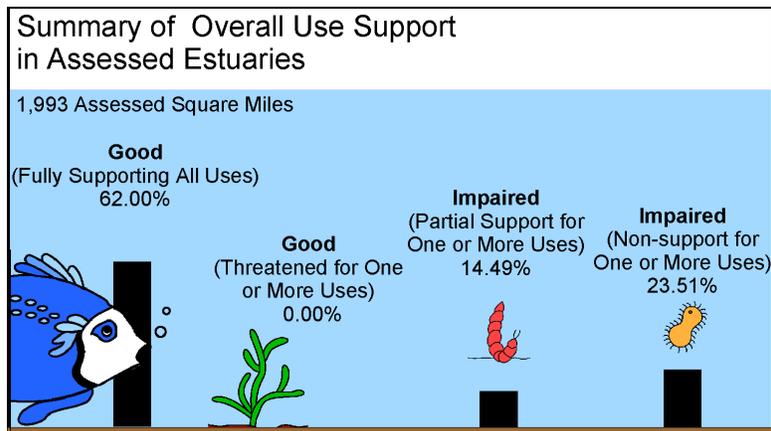


Figure 19. Summary of Use Support in Assessed Estuaries

Of these assessed  $\text{mi}^2$ , about 83 percent fully supported the aquatic life use, 16 percent partially supported the use, and one percent failed to support the use. Depressed instantaneous (grab sample) dissolved oxygen concentrations was the most common indicator used to assess support of the aquatic life use (Table 57). Of the 1,232  $\text{mi}^2$  assessed (61.8% of surveyed  $\text{mi}^2$ ) by dissolved oxygen, approximately 84 percent supported aquatic life uses, 16 percent partially supported the use, and less than one percent failed to support the use. The aquatic life use in estuaries was also evaluated in 79.9  $\text{mi}^2$  (4% of surveyed  $\text{mi}^2$ ) by metals in water data (acute and chronic exposure to aquatic life) and 80 percent supported the use, while 20 percent failed to support the use. For the remaining six indicators (24-hour dissolved oxygen, organic substances in water, sediment and water toxicity tests, and macrobenthos and fish community structure analyses) data were so insufficient that less than one percent of estuary  $\text{mi}^2$  were assessed by each indicator.

The most common cause of impaired aquatic life use in estuaries and bays is depressed dissolved oxygen concentrations. Low dissolved oxygen concentrations cause partial support of the aquatic life use in five bay areas and the Texas City Ship Channel (Table 58). Conn Brown Harbor near Aransas Pass is the only bay area in which depressed dissolved oxygen concentrations cause nonsupport of the aquatic life use. The cause of low dissolved oxygen concentrations in the estuarine waters is probably due to natural factors. The dissolved oxygen criteria are set relatively close to saturation. As the coastal waters warm to elevated temperature and become more saline due to reduced freshwater inflows in the summer months, they lose their ability to retain dissolved oxygen. Assimilation of even minor point and nonpoint source pollutant loads can result in depression of dissolved oxygen below the criteria.

The aquatic life use is not supported in West Bay (Segment 2424) and Lower Galveston Bay (Segment 2439) due to elevated average copper concentrations in water which exceed criteria to protect aquatic life from chronic exposure. The sources of the copper in the two bays are unknown.

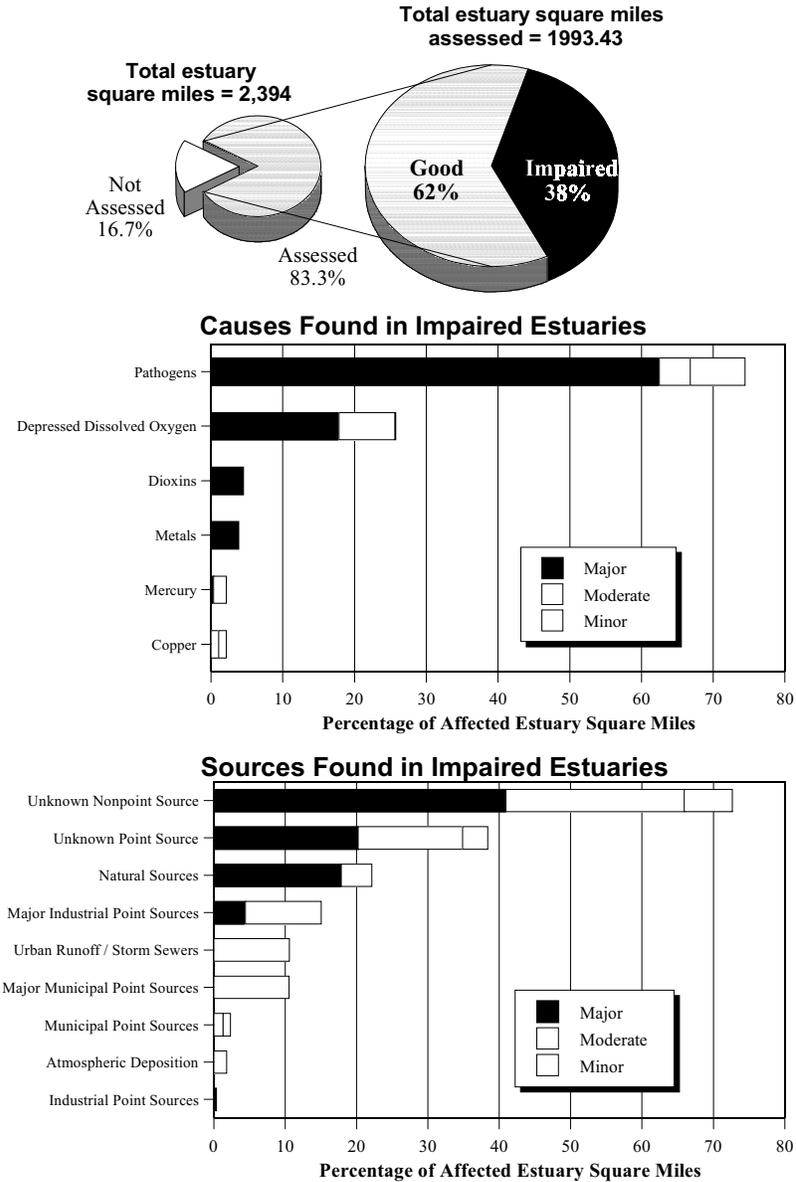
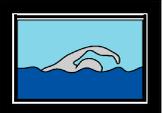


Figure 20. Causes and Sources of Impaired Estuary Square Miles

Table 56. Individual Use Support in Estuaries

Designated Use	Square Miles Surveyed	Square Miles Assessed	Percent of Square Miles Assessed	Percent of Assessed Square Miles			
				Good (Fully Supporting)	Good (Threatened)	Fair (Partially Supporting)	Poor (Not Supporting)
 Aquatic Life Support	1,993.43	1,232.00	61.80	83	0	16	1
 Fish Consumption	1,993.43	1,008.40	50.59	95	0	0	5
 Oyster Waters	1,970.80	1,624.70	82.44	64	0	10	26
 Contact Recreation	1,988.21	1,976.11	99.39	100	0	X*	< 1
 Noncontact Recreation	5.22	4.32	82.76	100	0	X*	0
 General Uses	1,993.43	1,557.02	78.12	100	0	0	0

X\* - Category not applicable

Table 57. Individual Use Support Indicators for Aquatic Life, Fish Consumption, and General Uses in Estuaries

Designated Use	Square Miles Surveyed	Square Miles Assessed	Percent of Square Miles Assessed	Percent of Assessed Square Miles			
				Good (Fully Supporting)	Good (Threatened)	Fair (Partially Supporting)	Poor (Not Supporting)
 <b>Aquatic Life Support</b>							
Instantaneous Dissolved Oxygen	1,993.43	1,232.00	61.80	84	0	16	< 1
24-hour Dissolved Oxygen	1,993.43	0.00	0.00	0	0	0	0
Metals in Water	1,993.43	79.90	4.01	80	0	0	20
Organics Substances in Water	1,993.43	15.70	0.79	100	0	0	0
Water Toxicity	1,993.43	0.00	0.00	0	0	0	0
Sediment Toxicity	1,993.43	8.90	0.45	100	0	0	0
Macrobenthos Community	1,993.43	0.00	0.00	0	0	0	0
Fish Community	1,993.43	0.00	0.00	0	0	0	0

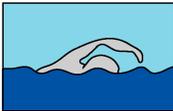
Table 57. Individual Indicators of Assessment of Aquatic Life, Fish Consumption, and General Uses in Estuaries (Continued)

Designated Use	Square Miles Surveyed	Square Miles Assessed	Percent of Square Miles Assessed	Percent of Assessed Square Miles			
				Good (Fully Supporting)	Good (Threatened)	Fair (Partially Supporting)	Poor (Not Supporting)
 <b>Fish Consumption</b>							
Advisories / Closures	1,993.43	1,007.50	50.54	96	0	0	4
Human Health Criteria	1,993.43	69.00	3.46	80	0	0	20
 <b>General Uses</b>							
Water Temperature	1,993.12	1,557.02	78.12	100	0	0	0
pH	1,993.12	1,557.02	78.12	100	0	0	0

X\* - Category not applicable

Table 58. Estuaries and Bays with Partially Supported and Nonsupported Aquatic Life Uses Due to Depressed Dissolved Oxygen Concentrations

Segment Number	Water Body	Level of Aquatic Life Use Support	
		Partial	Nonsupport
2437	Texas City Ship Channel	✓	
2451	Matagorda Bay/Powderhorn Lake	✓	
2452	Tres Palacios Bay/Turtle Bay	✓	
2453	Lavaca Bay/Chocolate Bay	✓	
2483A	Conn Brown Harbor (unclassified)		✓
2485	Oso Bay	✓	
2491	Laguna Madre	✓	
<b>Totals</b>		<b>6</b>	<b>1</b>



### Contact Recreation Use Support

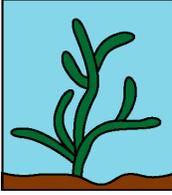
Contact recreation use is assigned to most estuaries, except those used for heavy ship and barge commerce. Fecal coliform data were sufficient to provide assessment of contact recreation use in nearly all (99.9% of surveyed mi<sup>2</sup>) the areas surveyed. Of the 1,976 mi<sup>2</sup> assessed, 99.9 percent fully supported the contact recreation use.

Bacterial densities of indicator organisms (fecal coliform) are typically low in estuarine waters along the Texas coast except during periods of high sustained inflow from freshwater tributaries. The contact recreation use is not supported in only two bay systems (Tabbs Bay; Segment 2426 and Scott Bay; Segment 2429) due to elevated fecal coliform densities.



### Noncontact Recreation Use Support

The Texas City Ship Channel (Segment 2437), Bayport Channel (Segment 2438), Corpus Christi Inner Harbor (Segment 2484), Brownsville Ship Channel (Segment 2494), and Victoria Barge Canal (Segment 1701) are the only estuaries designated for noncontact recreation use. The use is assigned to these estuaries due to heavy ship and barge traffic and not due to poor water quality. Although these ship channels are assigned noncontact recreation use, they must meet more stringent contact recreation criteria. Fecal coliform data were sufficient to provide assessment of the noncontact recreation use in 4.3 mi<sup>2</sup> (83% of surveyed mi<sup>2</sup>)(Table 56). Of the 4.3 mi<sup>2</sup> assessed, all fully supported the noncontact recreation use.



## General Use Support

Field measurements of pH and water temperature are assigned to classified estuaries and used to determine support of general water quality uses. The framework used to assess the general use category for estuaries is shown in Table 18. Together, water temperature and pH data were sufficient to provide assessment in 1,557 mi<sup>2</sup> (78% of surveyed mi<sup>2</sup>)(Table 56). All of the assessed mi<sup>2</sup> fully supported general uses based on water temperature and pH measurements (Table 57).



## Fish Consumption Use

Approximately 1,993 mi<sup>2</sup> of estuarine waters were surveyed to determine support of the fish consumption use. Sufficient data were available to provide assessment of 1,008 mi<sup>2</sup> (51% of surveyed mi<sup>2</sup>)(Table 56). Of the assessed mi<sup>2</sup>, 95 percent fully supported the fish consumption use and five percent failed to support the use. Issuance of consumption advisories and aquatic life closures by the TDH and evaluation of human health criteria for water were two indicators that were used about equally to assess the fish consumption use (Table 57). Of the 1,008 mi<sup>2</sup> assessed (51% of surveyed mi<sup>2</sup>) by issuance of advisories and closures, approximately 96 percent fully supported the fish consumption use, while four percent failed to support the use. About the same general area was assessed by human health criteria and 80 percent of the assessed mi<sup>2</sup> fully supported the use, while 20 percent were impaired.

The TDH issued in September 1990 a restricted consumption advisory for the general population and a no-consumption advisory for restricted sensitive subpopulations (children and women of child bearing age) for the Upper Galveston Bay system. The advisories were issued due to elevated dioxin concentrations in catfish and blue crabs. The fish consumption use is not supported due to issuance of the no-consumption advisory and encompasses Upper Galveston Bay (Segment 2421), Tabbs Bay (Segment 2426), San Jacinto Bay (Segment 2427), Black Duck Bay (Segment 2428), Scott Bay (Segment 2429), Burnett Bay (Segment 2430), Barbour's Cut (Segment 2436), and the Bayport Channel (Segment 2438).

The fish consumption use is not supported in Lavaca Bay (Segment 2453) due issuance in April 1988 by the TDH of an aquatic life closure. The closure was issued due to elevated mercury concentrations in fish and crabs. The source of the mercury was from an industrial point source. The closure prohibits the taking of all fish species and crabs from the affected area. The fish consumption use is also not supported in the same general area as the closure due to an elevated average mercury concentration in water which exceeds the human health criterion.



## Oyster Waters Use Support

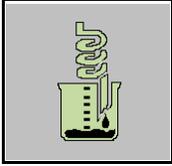
Contaminated shellfish pose a public health risk particularly to consumers of raw shellfish. Shellfish such as oysters, clams, and scallops extract their food (plankton) by filtering water over their gills. In contaminated water shellfish accumulate bacteria and viruses in their gills, fleshy mantle, and digestive tracts. If shellfish grown in contaminated water are not cooked properly, consumers may ingest bacteria and viruses.

To protect public health, the TDH administers the National Shellfish Sanitation Program (NSSP) in Texas. The TDH routinely monitors shellfish growing areas, called oyster waters in the TSWQS, for bacterial contamination (fecal coliform densities) and restricts shellfish harvesting in contaminated waters. Not all estuaries are assigned the oyster water use due to water quality conditions, lack of oyster reefs, or no active monitoring of the area. Approximately 1,988 mi<sup>2</sup> were surveyed to determine support of the oyster waters use (Table 56). Sufficient data were available to provide assessment of 1,625 mi<sup>2</sup> (82.4% of surveyed mi<sup>2</sup>). Of these assessed mi<sup>2</sup>, 64 percent fully support the oyster waters use, 10 percent partially support the use, and 26 percent failed to support the use.

Assessed areas in Bastrop Bay, Christmas Bay, Drum Bay, Keller Bay, Espiritu Santo Bay, Mesquite Bay, and South Bay fully support the oyster water use (Table 59). Portions of eight bays partially support the use, and portions of 21 bays fail to support the use. The entire area of Sabine Lake and Sabine Pass are not assessed due to insufficient data.

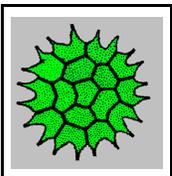
## Estuary Concerns Assessment

The TNRCC and CRP have developed screening levels to identify estuaries with elevated nutrient and chlorophyll *a* concentrations in water, elevated toxic substances in sediment, and elevated fish tissue contaminants. Water quality criteria have not been developed by the TNRCC in the TSWQS for these indicators. Water quality concerns are identified when greater than 25 percent of samples exceed the screening levels. The framework, indicators, and criteria for evaluation of water quality concerns in estuaries are discussed in the “Surface Water Assessment Methodology” section and are shown in Tables 29-33. Estuaries with identified concerns are targeted by the TNRCC and CRP for increased fixed station monitoring or special studies to identify possible causes and sources.



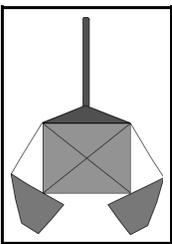
### ***Nutrient Concerns***

Approximately 1,993 mi<sup>2</sup> were surveyed to identify areas of concern caused by elevated concentrations of ammonia nitrogen, nitrite plus nitrate nitrogen, orthophosphorus, and total phosphorus (Table 60). Sufficient data were available to provide assessment of about 1,300 mi<sup>2</sup> (about 65% of surveyed mi<sup>2</sup>) for each nutrient indicator. Of the mi<sup>2</sup> assessed, water quality concerns were identified in two percent or less for ammonia nitrogen, orthophosphorus, and total phosphorus. Nitrite plus nitrate nitrogen was the nutrient indicator with the highest percentage of assessed mi<sup>2</sup> (21%) with concerns. Nine estuaries were identified with concerns for ammonia nitrogen, 12 for nitrite plus nitrate nitrogen, six for orthophosphorus, and seven for total phosphorus (Table 61).



### ***Chlorophyll a Concerns***

Approximately 1,993 mi<sup>2</sup> of estuaries were surveyed to identify areas of concern caused by elevated chlorophyll *a* concentrations. Sufficient data were available to provide assessment of 1,306 mi<sup>2</sup> (65% of surveyed mi<sup>2</sup>)(Table 60). Of the assessed mi<sup>2</sup>, 14 percent were identified with elevated chlorophyll *a* concentrations. Six estuaries were identified with concerns for elevated chlorophyll *a* concentrations (Table 61). Clear Lake, Burnett Bay, San Antonio Bay, and the Laguna Madre were also identified with concerns for at least one of the nutrient indicators, suggesting that nutrient loading may be responsible for stimulation of algal growth in these estuaries.



### ***Sediment Concerns***

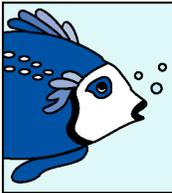
Like in streams and rivers and reservoirs and lakes, sediment sampling data are very limited in estuaries due to excessive laboratory costs. Most of the limited sampling is targeted to estuaries where industries are sited nearby or ship and barge traffic is heavy. Of the 1,993 mi<sup>2</sup> surveyed for elevated sediment contaminant concentrations, sufficient data were available to provide assessment in only 90.9 mi<sup>2</sup> (4.6% of surveyed mi<sup>2</sup>)(Table 62). Of the assessed mi<sup>2</sup>, only one percent were identified with sediment concerns. Elevated metals in sediment were identified as cause for concern in five estuaries (Table 63).

Table 59. Use Support of Oyster Waters

Segment Number	Segment Name/ Area (sq mi)	Use Supported % (sq mi)	Use Partially Supported % (sq mi)	Use Not Supported % (sq mi)	Use Not Assessed % (sq mi)
2411	Sabine Pass (2.1)				100 (2.1)
2412	Sabine Lake (68.7)				100 (68.7)
2421	Upper Galveston Bay (108.2)	26.0 (28.1)	19.0 (20.6)	55.0 (59.5)	
2422	Trinity Bay (130.1)	16.9 (22.0)	13.8 (17.9)	69.3 (90.2)	
2423	East Bay (52.1)	77.9 (40.6)		22.1 (11.5)	
2424	West Bay (69.3)	64.8 (44.9)		35.2 (24.4)	
2432	Chocolate Bay (7.6)			100 (7.6)	
2433	Bastrop Bay (3.9)	100 (3.9)			
2434	Christmas Bay (8.9)	100 (8.9)			
2335	Drum Bay (1.7)	100 (1.7)			
2439	Lower Galveston Bay (139.6)	46.6 (65.1)	9.9 (13.8)	43.5 (60.7)	
2441	East Matagorda Bay (59.1)	72.7 (43.0)	24.7 (14.6)	2.6 (1.5)	
2442	Cedar Lakes (6.9)			100 (6.9)	
2451	Matagorda Bay (261.7)	90 (235.6)	1.7 (4.4)	8.3 (21.7)	
2452	Tres Palacios Bay (14.7)		51.0 (7.5)	49.0 (7.2)	
2453	Lavaca Bay (54.8)	28.2 (15.4)	37.7 (20.7)	34.1 (18.7)	
2454	Cox Bay (2.9)	73.8 (2.1)		26.2 (0.8)	
2455	Keller Bay (7.5)	86.6 (6.5)			13.4 (1.0)
2456	Carancahua Bay (19.0)	51.6 (9.8)		48.4 (9.2)	
2461	Espiritu Santo Bay (60.8)	99.0 (60.2)			1.0 (0.6)
2462	San Antonio Bay (119.5)	40.6 (48.5)	50.9 (60.8)	8.5 (10.2)	
2463	Mesquite Bay (12.6)	95.0 (12.0)			5.0 (0.6)
2471	Aransas Bay (87.8)	92.2 (81.0)		7.8 (6.8)	
2472	Copano Bay (65.2)	79.4 (51.8)		20.6 (13.4)	
2473	St. Charles Bay (13.1)	48.5 (6.4)		51.5 (6.7)	
2481	Corpus Christi Bay (123.1)	87.0 (107.1)		13.0 (16.0)	
2482	Nueces Bay (28.9)			100 (28.9)	
2483	Redfish Bay (28.8)				100 (28.8)

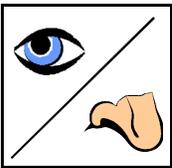
Table 59. Use Support of Oyster Waters (Continued)

Segment Number	Segment Name/ Area (sq mi)	Use Supported % (sq mi)	Use Partially Supported % (sq mi)	Use Not Supported % (sq mi)	Use Not Assessed % (sq mi)
2485	Oso Bay (7.2)			100 (7.2)	
2491	Laguna Madre (347.4)	38.8 (134.8)		5.2 (18.1)	56.0 (194.5)
2492	Baffin Bay (49.8)				100 (49.8)
2493	South Bay (7.8)	100 (7.8)			
<b>Totals</b>	<b>Numbers of Water Bodies</b>	<b>23</b>	<b>8</b>	<b>21</b>	<b>8</b>
<b>Totals</b>	<b>Area = 1,970.8 mi<sup>2</sup></b>	<b>1037.2 mi<sup>2</sup></b>	<b>160.3 mi<sup>2</sup></b>	<b>427.2 mi<sup>2</sup></b>	<b>346.1 mi<sup>2</sup></b>



### ***Fish Tissue Concerns***

Of the 1,993 mi<sup>2</sup> surveyed, only eight mi<sup>2</sup> (0.4% of surveyed mi<sup>2</sup>) were assessed for contaminants in fish tissue. The high cost associated with laboratory preparation and analytical determination of toxicants in tissue limits the statewide coverage of fish tissue sampling. No fish concerns were identified in eight mi<sup>2</sup> where data were sufficient to provide assessment (Table 62).



### ***Narrative Concerns***

Examples of narrative concerns include such categories as floating debris and surface oil sheens, suspended solids and excessive foam, odor producing substances, dramatic changes in color or turbidity, and excessive algal blooms. No narrative concerns were identified in all 1993 mi<sup>2</sup> of estuary area assessed (Table 62).

Table 60. Individual Nutrient and Chlorophyll *a* Concerns

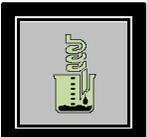
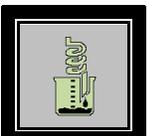
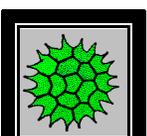
Concern parameter	Square Miles Surveyed	Square Miles Assessed	Percent of Square Miles Assessed	Percent of Assessed Square Miles	
				No Concern	Concern
 <p>Ammonia</p>	1,993.43	1,412.13	70.84	99	1
 <p>Nitrate + Nitrite</p>	1,993.43	1,338.78	67.16	79	21
 <p>Orthophosphorus</p>	1,993.43	1,306.13	65.52	98	2
 <p>Total Phosphorus</p>	1,993.43	1,314.13	65.92	98	2
 <p>Chlorophyll <i>a</i></p>	1,993.43	1,306.13	65.52	86	14

Table 61. Estuaries and Bays with Nutrient and Chlorophyll *a* Concerns

Segment Number	Estuary or Bay	Nutrient				Chl <i>a</i>
		NH <sub>3</sub> -N	NO <sub>2</sub> + NO <sub>3</sub> -N	Ophos	Tphos	
1701	Victoria Barge Canal	✓	✓			
2421	Upper Galveston Bay		✓			
2422	Trinity Bay		✓			
2425	Clear Lake		✓	✓	✓	✓
2426	Tabbs Bay	✓	✓	✓	✓	
2427	San Jacinto Bay	✓	✓	✓	✓	
2428	Black Duck Bay					✓
2429	Scott Bay	✓	✓	✓	✓	
2430	Burnett Bay	✓	✓	✓	✓	✓
2437	Texas City Ship Channel	✓				
2442	Cedar Lakes		✓			
2452	Tres Palacios Bay/Turtle Bay	✓				
2453B	Lynns Bayou Basin	✓	✓			
2456	Carancahua Bay			✓	✓	
2462	San Antonio Bay/Hynes Bay/Guadalupe Bay				✓	✓
2484	Corpus Christi Inner Harbor	✓	✓			
2491	Laguna Madre		✓			✓
2492	Baffin Bay/Alazan Bay/Cayo del Grullo/ Laguna Salada					✓
<b>Totals</b>		<b>9</b>	<b>12</b>	<b>6</b>	<b>7</b>	<b>6</b>

Table 62. Overall Concerns for Fish Tissue Contaminants, Sediment Contaminants, and Narrative Criteria

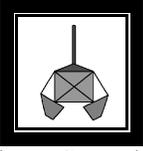
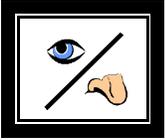
Concern parameter	Square Miles Surveyed	Square Miles Assessed	Percent of Square Miles Assessed	Percent of Assessed Square Miles	
				No Concern	Concern
 Fish Tissue Contaminant	1,993.43	8.00	0.41	100	0
 Sediment Contaminant	1,993.43	90.93	4.56	47	53
 Narrative Criteria	1,993.43	1,993.43	100.00	100	0

Table 63. Estuaries and Bays with Sediment Concerns

Segment Number	Water Body	Pollutant
1111	Old Brazos River Channel	Barium, copper, nickel, and zinc
2453	Lavaca/Chocolate Bay	Chromium, manganese, nickel, and selenium
2454	Cox Bay	Arsenic, barium, lead, and mercury
2455	Keller Bay	Arsenic
2484	Corpus Christi Inner Harbor	Cadmium, copper, lead, selenium, and zinc

**Toxic substances of concern are defined in Tables 30 and 31**

## The Galveston Bay Estuary Program

The Galveston Bay Estuary Program, formerly the Galveston Bay National Estuary Program, 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* was developed in three phases over a five year period: Identification and Agreement of Priority Problems; Scientific Characterization of those problems; and Development of Solutions. *The Plan* outlines a series of goals (Table 64) and links a set of specific initiatives (Table 65) to the identified problems in Galveston Bay. These solutions were developed over three years by 16 task forces.

On December 14, 1994, the Policy Committee of the Galveston Bay National Estuary Program (GBNEP) voted to accept the final draft of *The Galveston Bay Plan* for submission to the EPA for final approval. That approval, which came from EPA Administrator Carol Browner in late March 1995 after review of *The Plan* by 17 federal agencies, signaled the transition from a federal estuary program of research and planning to a state program geared to implementation.

The TNRCC, as the state agency responsible for the management of aquatic and marine ecosystems and for federal Water Quality Act programs, is the lead agency responsible for administering the Program. The GBEP was jointly managed by TNRCC and GLO between 1996 and 1998 however; in 1999 the Texas Legislature passed the Texas Estuaries Act and appropriated 1.1 million dollars to the TNRCC to manage the Program and implement *The Plan*.

The GBEP, located in the bay area, has a program manager and six employees with varying expertise in wetlands and estuarine habitats, coastal resource conservation, nonpoint source pollution issues, water quality, public health, and public participation and education.

The functions of the Program are to oversee, facilitate and coordinate implementation of *The Plan* by:

- acquiring, managing, and dispersing funds to implement *The Plan* with emphasis on encouraging partnerships to leverage local and state dollars with federal and private source dollars;
- providing a forum for coordination and communication among state and federal resource agencies for the many cross-jurisdictional initiatives, which allows for cost-effective expansion of existing efforts.

Table 64. Goals in *The Galveston Bay Plan*

Priority Level	Water/Sediment Quality Improvement	Habitat/Living Resource Conservation	Balanced Human Uses
<b>Very High</b>	<p>Reduce urban NPS pollutant loads.</p> <p>Reduce toxicity and contaminant concentrations in water and sediments.</p> <p>Eliminate wet-weather sewage bypasses/overflows.</p>	<p>Increase the quantity and improve the quality of wetlands for fish and wildlife.</p> <p>Eliminate or mitigate the conversion of wetlands to other uses caused by human activities.</p>	<p>Ensure beneficial freshwater inflows necessary for a salinity, nutrient, and sediment loading regime adequate to maintain productivity of economically important and ecologically characteristic species in Galveston Bay.</p>
<b>High</b>	<p>Eliminate pollution problems from poorly operated wastewater treatment plants.</p> <p>Restore and/or compensate for environmental damage (injury) resulting from discharges of oil or the release of hazardous substances.</p> <p>Eliminate illegal connections to storm sewers, which result in introduction of untreated wastes directly to bay tributaries.</p> <p>Increase dissolved oxygen in problem areas.</p> <p>Reduce agricultural NPS pollutant loads.</p>	<p>Acquire existing wetland habitats and provide economic incentives for conservation.</p> <p>Reverse the declining population trend for affected species of marine organisms and birds, and maintain the populations of other economic and ecologically important species.</p>	<p>Reduce potential health risk resulting from consumption of seafood contaminated with toxic substances.</p> <p>Reduce negative environmental consequences to the bay (i.e., human-induced erosion) from shoreline development.</p>
<b>Moderate</b>	<p>Reduce industrial NPS pollutant loads.</p> <p>Reduce marina water quality degradation associated with sewage.</p> <p>Reduce marina/dockside NPS loads.</p>	<p>Selectively moderate effects of erosion on the bay and associated shorelines.</p> <p>Increase productivity of oyster reefs in West Bay.</p> <p>Restore deteriorated colonial bird nesting islands to usefulness and create new islands for birds where nesting habitat is inadequate.</p>	<p>Reduce oyster reef harvest closures.</p> <p>Ensure that alterations to circulation do not negatively affect productivity and overall ecosystem health.</p>
<b>Low</b>	<p>Reduce construction NPS pollutant loads.</p> <p>Reduce the impact from spills on the natural environment.</p> <p>Eliminate illegal dumping.</p> <p>Eliminate waterborne debris.</p>	<p>Eradicate or reduce the populations of exotic/opportunistic species which threaten desirable native species, habitats, and ecological relationships. Prevent the introduction of additional exotic species.</p>	<p>Reduce risk of waterborne illness resulting from contact recreation.</p> <p>Increase environmentally compatible public access to bay resources.</p>

Table 65. Galveston Bay Plan Actions

HP-1:	Restore, Create, and Protect Wetlands
HP-2:	Promote Beneficial Uses of Dredged Material to Restore and Create Wetlands
HP-3:	Inventory degraded wetlands and fund remedial measures
HP-4:	Implement a Coordinated System-Wide Wetland Regulatory Strategy
HP-5:	Acquire and Protect Quality Wetlands
HP-6:	Develop Economic and Tax Incentive Programs to Protect Wetlands
NPS-1:	Implement Stormwater Programs for Local Municipalities
NPS-2:	Perform Pilot Projects to Develop NPS Best Management Practices for the Galveston Bay Watershed
NPS-3:	Identify and Correct Priority Watershed Pollutant Problems
NPS-4:	Establish Residential Load Reduction Programs
NPS-5:	Correct Malfunctioning Shoreline Septic Tanks
NPS-6:	Implement NPS Reduction Plan Program for New Development
NPS-7:	Establish Roadway Planning to Minimize NPS Effects
HP-7:	Facilitate Bird Nesting on Existing Sites
HP-8:	Build Nesting Islands Using Dredged Material
PS-1:	Determine Location and Extent of Bypass and Overflow Problems
PS-2:	Eliminate or Reduce Bypass and Overflow Problems
FW-1:	Complete Current Studies to Determine Freshwater Inflow Needs for the Bay
FW-2:	Expand Streamflow, Sediment Loading, and Rainfall Monitoring
FW-3:	Establish Management Strategies for Meeting Freshwater Inflow Needs
FW-4:	Establish Inflow Regulations to Protect the Ecological Needs of the Estuary
FW-5:	Explore Means of Providing Sediment to the Estuary
FW-6:	Reduce Water Consumption
NPS10:	Develop Inventory of Agricultural Non-Point Sources
NPS-11:	Coordinate and Implement Existing Agricultural NPS Control Programs
PS-3:	Regionalize Small Wastewater Treatment Systems
PS-4:	Improve Compliance Monitoring and Enforcement
NPS-8:	Implement NPDES Stormwater Program for Area Industries
NPS-9:	Prevent Degradation of Bay Waters by Groundwater Plumes
NPS-12:	Adopt Regional Construction Standards for NPS Reduction
NPS-13:	Implement Toxics and Nutrient Control Practices at Construction Sites
WSQ-1:	Reduce Contaminant Concentrations to Meet Standards and Criteria
WSQ-2:	Determine Sources of Ambient Toxicity in Water and Sediment
WSQ-3:	Establish Sediment Quality Criteria
WSQ-4:	Perform TMDL Loading Studies for Toxics
WSQ-5:	Support Clean Texas 2000 Pollution Prevention Program
PS-6:	Issue NPDES Coastal General Permit or Eliminate Harm From Oil Field Produced Water Discharge
FW-7:	Evaluate the Effects of Channels and Structures on Bay Circulation,
SP-1:	Implement a Bay-Wide Effort to Strengthen Species Management
SP-2:	Return Oyster Shell to Designated Locations Within the Bay
SP-3:	Promote the Development of Oyster Reefs Using Alternate Materials
SP-4:	Set Aside a Portion of Reef Habitat as Scientific Research Areas or Preserves
SP-5:	Encourage Continued Development of Gear to Reduce Commercial By-Catch
SP-6:	Conduct Educational Programs About Catch and Release
SP-7:	Investigate Potential Measures to Reduce Impingement and Entrainment
SP-8:	Develop Management Plans for Endangered or Threatened Species
SM-1:	Establish a Planning Program for Shoreline Development
SM-2:	Identify Appropriate Residential Shoreline Development Guidelines
SM-3:	Identify Appropriate Commercial and Industrial Shoreline Development Guidelines
SM-4:	Minimize Negative Effects of Structures on Publicly Owned Lands
SD-1:	Promote Planning to Facilitate Natural Resource Damage Assessments
SD-2:	Identify Simplified Damage Assessment Procedures for Small Oil Spills
SD-3:	Facilitate Effective Restoration of Galveston Bay's Natural Resources
PH-1:	Develop a Seafood Consumption Safety Program
SM-5:	Improve Access to Publicly Owned Shorelines
SD-4:	Facilitate Spill Cleanup by Advance Shoreline Characterization
PS-5:	Implement a Dry-Weather Illegal Connection Program
WSQ-6:	Reduce Nutrient and BOD Loadings to Problem Areas
WSQ-7:	Perform TMDL Loading Studies for Oxygen Demand and Nutrients
PH-2:	Enhance the TDH Shellfish Sanitation Program
NPS-14:	Require Sewage Pumpout, Storage, and Provisions for Treatment
NPS-15:	Require Use of Marine Sanitary Chemicals That Can Be Treated in POTWs

Table 65. Galveston Bay Action Plans (Continued)

NPS-16:	Low Priority	Implement Washdown Controls and Containment Measures
HP-9:	Low Priority	Reduce Erosional Impacts on Wetlands and Habitats
SD-7:	Low Priority	Publicize Environmental Harm Caused by Illegal Dumping
SD-5:	Low Priority	Improve Trash Management Near the Shoreline
SD-6:	Low Priority	Screen Trash from Stormwater Discharges
PH-3:	Low Priority	Develop a Contact Recreation Advisory Program

KEY:

High Priority
Medium Priority
Low Priority

FW = Freshwater Inflow and Bay Circulation  
 HP = Habitat Protection  
 NPS = Non-Point Sources of Pollution  
 PH = Public Health Protection  
 PS = Point Sources of Pollution

SD = Spills/Dumping  
 SM = Shoreline Management  
 SP = Species Population Protection  
 WSQ = Water and Sediment Quality Improvement

- reviewing federal, state and local projects for consistency with *The Plan* in coordination with the TGLO staff;
- tracking and reporting on implementation efforts;
- reviewing progress and redirecting implementation strategies, as needed;
- conducting public outreach and education to increase public awareness of *The Plan* and the economic and environmental value of the Galveston Bay Estuary System; and
- advocating the conservation, estuary-wide management, and enhancement of the Galveston Bay Estuary System.

### ***The Galveston Bay Council***

Although the TNRCC is identified as the lead agency for implementation, no single agency can tackle this formidable challenge by itself. In *The Plan*, diverse concerns for habitats and wildlife, competing resource uses, water quality, and human health are regional issues influencing the entire ecosystem. These issues affect many stakeholders, and include the jurisdictions of many agencies. To achieve success, cross-jurisdictional coordination and stakeholder participation are a priority. These key conclusions were detailed in a 1993 evaluation of current bay governance entitled *Framework for Action: Galveston Bay Management Evaluation* (GBNEP-27).

The commissioners of the TNRCC, on November 16, 1995, established the Galveston Bay Council and approved nominated members representing

agencies, industries, government entities, user groups, and private citizens with interests in the bay. The 41-member council advises the TNRCC and the TGLO concerning all activities related to *The Galveston Bay Plan*. The Council, which convenes quarterly, provides a forum for coordination and information sharing among agencies and organizations having jurisdiction in the Bay. It also provides an avenue for collection of data and information relevant to Galveston Bay activities and conditions. This consensus-based approach to management is a continuation of the strategic alliance of bay managers and stakeholders that successfully created *The Galveston Bay Plan*.

## ***Plan Implementation***

Year 2000 marks the GBEP's fifth year of implementation. Significant progress has been made.

**Habitats are being restored.** The trend of habitat deterioration is being slowed as partners under *The Plan* work to demonstrate cost effective ways to use dredged material as a resource in wetlands restoration. A GBEP project along Clear Creek on Reliant Energy's property was nationally recognized for innovative planting techniques and for showcasing the benefits of agency-industry partnerships in leveraging resources and expertise. This successful demonstration project is a model for other coastal estuaries.

**Coastal erosion is being reduced.** In a GBEP demonstration project, severe erosion due to wave action and subsidence is being lessened with innovative technology that combines the use of a constructed oyster reef to break the incoming wave action, and marsh restoration to stabilize the soil. This combination results in a stabilized shoreline and additional habitat for fish and wildlife.

**Tools are being developed to help small cities manage storm water in the urban watershed.** The number one water quality problem in Galveston Bay is polluted runoff. GBEP is developing a model storm water management plan to assist small cities in addressing this priority problem.

**Access to Galveston Bay data and information is provided.** As *The Plan* is implemented, the public must have access to data and information in an understandable format. The Galveston Bay Information Network is maintained as a part of the Galveston Bay Information Center (GBIC) located at Texas A&M at Galveston. The GBIC has worked to serve the data and information needs of the Galveston Bay community for many years, providing specialized research services, archival access, a special Bay Bibliography, and much more. Sponsored by the GBEP, the GBIC

provides timely access to current and historical data and information on-site and through the Internet. Visit the GBEP Web site at <http://gbep.tamug.tamu.edu>

**The “State of the Bay” is monitored and shared with the public.** A comprehensive monitoring program is being developed by the GBEP to routinely compile the information collected by numerous agencies, in an ongoing “State of the Bay” reporting process. This effort began with the first *State of the Bay* report and will be communicated during the biennial State of the Bay Symposium. The event is hosted by the GBEP to provide an opportunity for natural resource managers, scientists, industries, regulators, policy-makers, and the public to interact and share information about Galveston Bay.

**Watershed management is becoming a reality.** Watershed working groups are being formed for critical waterways in the Galveston Bay area and are developing model programs that will be used in other tributaries and in other parts of the coast.

**Septic system problems are being addressed.** A local effort to provide voluntary inspections of septic systems and information to help owners of problems systems, proved successful. A model education program was developed to provide septic system owners with information on proper care and preventive maintenance. Information about low or no interest loans to repair septic systems is also available.

**Pollution prevention assistance is being made available to small businesses.** GBEP partnered with Galveston County Health District to reduce pollution that can be carried from small business sites (such as machine shops, automobile service bays, and marinas) to the Bay, when it rains. On-site environmental assessments for small businesses helped identify areas of operation contributing nonpoint source pollution and improve housekeeping activities.

**More information about the safety of seafood will be made available to the public.** Seafood is being monitored bay-wide through a locally coordinated effort which is pooling federal and state funds to maximize data gathering efficiency and produce a comprehensive view of the safety of seafood in Galveston Bay. Historically, independent studies on small portions of the Bay have offered a more piece-meal approach to the public, which leaves people in doubt and the government subject to criticism. Initiated by the GBEP process, this coordinated effort will produce a definitive “full-scan” bay-wide in order to really answer the public’s question: “Can we eat the fish?”

**Problems for small wastewater treatment plants are being managed.**

Numerous small “package plants” provide wastewater treatment services to some of the urban and suburban areas of the watershed. Many of these plants function improperly because they do not receive the necessary maintenance. To address this problem, this GBEP project with Harris County Pollution Control, provided technical assistance to operators experiencing problems with their treatment plants.

**Shoreline Management Planning is improving.** Along Galveston Bay, many regulatory and governmental entities engage in shoreline management activities related to economic and energy development, facility siting, and shoreline access. Continued near-shore development contributes to shoreline erosion, loss of wetlands, increased point and nonpoint source pollution, and reduced public access to the shore. The main hindrance to effective management of shoreline resources is the fact that no comprehensive model is in place. GBEP sponsored a study to examine shoreline management and develop a model shoreline ordinance to guide local planners and decision-makers.

## **Coastal Bend Bays and Estuaries Program**

In its 1987 reauthorization of the CWA, the U.S. Congress established the National Estuary Program (NEP) to promote long-term planning and management of nationally significant estuaries threatened by pollution, development, or overuse. The Administrator of the EPA was given authority to convene Management Conferences and to award Federal financial assistance grants to approved state programs for the purpose of developing and implementing a CCMP. The Act defines criteria by which Management Conferences are charged with balancing the conflicting uses in target estuaries, while restoring or maintaining their natural character.

The Coastal Bend Bays & Estuaries Program (CBBEP)(formerly the Corpus Christi Bay National Estuary Program) was formally established in October 1992 with committee meetings beginning in late 1993. The CBBEP was one of the first NEPs to use a streamlined approach to the development of a CCMP. The goal of the CBBEP to complete a Preliminary CCMP within 12 to 18 months (from 09/01/94) and a Final CCMP in approximately four years (by September 1998) was achieved.

A State-EPA Management Conference Agreement detailing this and other specific outputs of the four-year program was signed in May 1994 by the Regional Administrator of the EPA and the Chairman of the State lead-agency for the Program, the TNRCC. The Program Office has been established since December 1993, as a program of the TNRCC, with a non-profit organization established in 1999 to lead implementation.

The project area encompasses the estuarine environment of 75 miles of the south-central Texas coastline, and includes the 12 counties of the region known as the Coastal Bend. This 514 square mile area of water includes all bays, estuaries, and bayous in the Copano, Aransas, Corpus Christi, Nueces, Baffin, and upper Laguna Madre bay systems, which together represent three of the seven major Texas estuaries.

The Priority Issues for the CBBEP are:

- Alteration of Freshwater Inflow into Bays and Estuaries
- Condition of Living Resources
- Loss of Wetlands and Estuarine Habitats
- Degradation of Water Quality
- Altered Estuarine Circulation
- Bay Debris
- Selected Public Health Issues

The *Coastal Bend Bays Plan* has been developed to address each of these priority issues under the following categories of action plans: Human Uses; Maritime Commerce and Dredging; Habitat and Living Resources; Water and Sediment Quality; Freshwater Resources; and Public Education and Outreach. The projects selected for implementation under this Cooperative Agreement reflect a combination of priority and readiness or feasibility for implementation. Implementing Partners for other actions of the *Bays Plan* will likewise be called upon to begin and continue to implement their own portions of the Plan. The role of Program staff is multi-faceted, but will include at a minimum the following tasks: (1) acquire, manage, and disperse funds to implement the *Bays Plan*; (2) develop and implement partnership projects with local governments, state and federal agencies, and private organizations; (3) monitor, track, and report on implementation performance by implementing partners, and work to maintain implementation commitments; and (4) coordinate the environmental monitoring and assessment of Plan implementation effectiveness.

