Chapter 6

Public Health Protection

Priority Problem

The Galveston Bay Estuary is the state's largest source of seafood, and is one of the major oyster producing areas in the country. Commercial and recreational fishing represents a nearly one-billion dollar industry, and molluscan shellfish (e.g., oysters) and other seafood (e.g., crabs, shrimp, and finfish) harvested from Galveston Bay are consumed by millions of individuals. Maintenance of adequate public health standards within estuarine seafood is important for the protection of the general public, and is also critical for the long-term stability of the fishing industry.

The Texas Department of Health has controlled the harvest of shellfish from Galveston Bay for approximately 40 years, and the quality of produced molluscan shellfish has been maintained at a level which has posed a minimal risk of illness. However, limited funding is available for this shellfish program, and accordingly, shellfish closures are believed to be larger than would be necessary with a greater frequency of field sampling. To address this problem, an expansion of the shellfish sampling program, including more frequent sampling, is recommended.

Galveston Bay receives the largest total amount of industrial and municipal effluent of all Texas estuaries, and also receives significant amounts of contaminants from non-point sources via stormwater runoff. Loading estimates for a large number of metals and organic chemicals are incomplete, and insufficient data are available regarding the distribution of potentially toxic compounds within estuarine waters and sediment. Fish and shellfish from Galveston By are not routinely sampled for toxic contaminants, nor are consumer risks routinely assessed by any government entity and communicated to the public. To address this situation, the Public Health Protection Task Force of GBNEP recommends additional research to establish risk-based standards for toxic contaminants within seafood. Based on established standards, the implementation of a seafood sampling, analysis, and risk communication program is recommended to safeguard the quality of seafood produced form the Galveston Bay Estuary.

Management Goals and Objectives

Public Health Protection Task Force members considered objectives for the Public Health portion of the Galveston Bay Plan. During Round 4 Task Force meetings, Task Force members established the following high-priority management goals:

- Reduce potential health risk resulting from consumption of seafood contaminated with toxic substances,
- Reduce oyster reef harvest closures,
- Minimize risk of water-borne illness resulting from contact recreation.

These initial management objectives were further modified and are now the three public health protection objectives and three actions set forth in the Galveston Bay Plan :

Objective 1	By the year 2000, reduce the risk of consumption of Galveston Bay seafood containing tissue concentrations of toxic substances above risk level standards established by the TDH.
Action PH-1	Develop a seafood consumption safety program
Objective 2	Increase oyster reef areas open to harvest by 25% on a spatial and temporal basis by 31 August 1995, as compared to a 1988 baseline
Action PH-2.	Enhance the TDH shellfish sanitation program
Objective 3	By the year 2000, establish a contact recreation advisory program in all areas of the estuary commonly used for contact recreation
Action PH-3.	Develop a contact recreation advisory program

Data Information Needs

Because it is not feasible to measure all environmental parameters, a limited set of indicator parameters were identified as candidate monitoring parameters for the public health component of the regional monitoring program and are briefly discussed in this chapter.

Plan Objective 1 is to reduce potential health risks resulting from the consumption of seafood contaminated with toxic substances. Information needed to assess this management objective include:

- Identification of contaminants of concern (COCs),
- Identification of species of concern for tissue sampling,
- Status and trends in the concentration and distribution of COCs in commercial and recreational fish and shellfish,
- Status and trends in fish and shellfish consumption rates for specific human populations around Galveston Bay , and
- Specific criteria to assess fish and shellfish toxicity.

Fecal coliform monitoring for the National Shellfish Sanitation Program (NSSP) determines harvest closures for Galveston Bay oyster reefs. Objective 2, enhancement of the NSSP monitoring program, was developed under suggestions by TDH that with more frequent monitoring reef closures could be reduced. Because of the special regulatory requirements for this monitoring program the GBRMP will not develop a monitoring strategy to address this objective. The GBRMP fecal monitoring program can provide useful information for general assessment of water quality but it cannot be used by the NSSP to evaluate shell fish monitoring areas. The Monitoring Steering Committee will work with the TDH to assist in the accomplishment of this goal.

Plan Objective 3 attempts to minimize the risks of water-borne illness resulting from contact recreation. Information needed to assess this management objective include:

- Infectious disease reports for Galveston Bay,
- Relationship between water-borne illness and indicator organism concentration
- Status and trends in the magnitude and distribution of indicator organisms,

The status and trends in abundance of indicator organisms are needed to characterize pathogen levels in Bay waters and to assess whether these levels pose a risk to human populations. Trend data are needed to assess whether progress is being made toward minimizing health risks due to water-borne pathogens.

Alternative candidate indicator parameters for pathogens have been suggested. Task Force members agreed that until other indicator organisms had been tested and approved, fecal coliform bacteria would remain the indicator organism for human pathogens. Members highly recommend that the use of other indicators of human pathogens (e.g., *Enterococcus, E. coli*) be investigated and considered for inclusion into the regional monitoring program at a later date.

The following monitoring objectives were used to design the regional monitoring program for Galveston Bay:

- To make bay-wide estimates; in terms of areal extent (±10%), and temporal trend, in terms of areal extent and magnitude, of exceedences in State human health numerical criteria for toxics.

- To make bay-wide estimates; in terms of areal extent (±10%), and temporal trend, in terms of areal extent and magnitude, those waters in violation of state criteria for fecal coliform bacteria.

Assessments of risks to public health will be based on the weight of evidence from several indicator parameters. From identified Plan objectives and information needs, it is clear that the public health component of the regional monitoring program must provide local and bay-wide status and trend data .

Programmatic Monitoring

Lines of responsibility for all Public Health objectives are clearly drawn. The TDH as the state agency with responsibility for all public health related issues is responsible for implementation of the Public Health Action Plan. *The Plan* specifically identifies the TDH as having responsibility for development and implementation of programs to reach the stated goals of the plan. *The Plan* designates the TDH as the agency responsible for developing a risk assessment methodology including development of standards and a monitoring program for toxics in tissues.

The Galveston Bay Program will closely monitor progress within the TDH, of programs leading to the accomplishment of the plan goals. Intermediate and ultimate information to be tracked to assess plan success are:

- Development of applicable standards for tissue monitoring program,
- Progress in obtaining funding for each of the programs,
- Increases in TDH sampling events for the NSSP,
- Increases in oyster reef areas open for harvest,
- Progress in development of alternative indicators for human pathogens,
- Tracking TDH reportable disease records for Galveston Bay

Environmental Monitoring

Monitoring activities must provide information to evaluate whether progress toward management objectives is being made. The public health protection component of the regional monitoring program must provide data to assist in:

- Development of a Seafood Consumption Safety Program in Galveston Bay,
- Evaluating alternative actions to reduce fecal coliform loads to the Bay,

No State agencies conduct routine ambient monitoring of toxic contaminant levels in fish tissues in Galveston Bay. (Tetra Tech, 1994b). Both the TNRCC and the TDH do collect and sample tissues on an episodic basis, in response to spills, toxic leaks, and other known accidental releases to the Bay. The focus of each agency is different. The TNRCC effort is in support of water quality monitoring while the primary concern for the TDH effort is human health risk.

Two federal monitoring programs have tissue monitoring sites within the bay. A fairly extensive tissue sampling effort has been conducted as part of the USEPA Environmental Monitoring and Assessment Program (EMAP) and Regional-EMAP programs. From 1991-1993 data is available for approximately 15 annual EMAP sites. EMAP has compiled contaminant levels of pesticides, heavy metals, and polychlorinated biphenyls (PCBs) in edible fish and shellfish tissues for three species groups: Atlantic croaker (*Micropogonias undulatus*), commercial shrimps (*Penaeus aztecus* and *Penaeus setiferus*) and marine catfish (*Arius felis, Bagre marinus,* and *Ictalurus furcatus*) (U.S. EPA, 1994). The R-EMAP data is from 32 sites in the bay but it is only a one time survey. The NOAA Status and Trends Mussel Watch Program samples six sites in Galveston Bay every two years. The

data from this program is too sparse to provide detailed information on ambient conditions within Galveston Bay but it is valuable as an external data set for substantiating general trends.

As previously discussed, responsibility for development of the Seafood Consumption Safety Program falls to the TDH. TDH is currently developing a fish consumption risk assessment program (the Aquatic Life Survey Program), for application throughout Texas, for freshwater fish, saltwater fish, and shellfish (Table 6-1). Tissue concentrations of a large group of COCs, including 69 volatile and 70 semi-volatile organic compounds, 8 PCB aroclors, 25 pesticides, and 4 metals are recommended for monitoring (Table 6-2). This program will incorporate a regular ambient sampling effort to monitor trends in contaminant levels in seafood and the potential health risks associated with long-term fish consumption (Tetra Tech, 1994b).

Tissue sampling and analysis programs are costly and time consuming. For these reasons the Monitoring Work Group will work with the TDH to maximize the comparability of tissue collections in the Bay. TDH and TNRCC currently have similar protocols for collection and preparation of samples. The TDH laboratory performs, or supervises contract laboratories in, the analyses of all toxic contaminants in fish and shellfish tissue collected in Galveston Bay. USEPA recommended analytical methods are used for all tissue analyses.

The GBRMP will collect monitoring information which could be useful in development of the TDH monitoring program. Comparisons of water quality monitoring results to state human health water quality criteria will provide information with respect to status and distribution of toxics in the system. Texas state water quality criteria for protection of human health are risk- based criteria developed to prevent contamination of fish and other aquatic life and to ensure that they are safe for human consumption. These criteria were derived from information gathered from the USEPA Integrated Risk Information System (IRIS). Numerical human health criteria were derived from the general procedures and guidance found in the USEPA document, *Technical Support Document for Water Quality-based Toxics Control;* and *Guidance Manual for Assessing Human Health Risks from Chemically Contaminated Fish and Shellfish* (USEPA, 1988). Monitoring elements to provide the necessary data needed for evaluations of objectives 2 and 3 are the GBRMP fecal coliform (FC) sampling data (see Chapter 10) and the NSSP fecal coliform data set as collected by the TDH. GBRMP samples are based on TNRCC methodology which utilizes the membrane filter technique. TDH uses the multiple-tube most probable number technique (Jensen and Su, 1992) . *Standard Methods* indicates that the two methods are equivalent, however the NSSP only recognizes the MPN procedure. As a result the FC data collected by the GBRMP cannot be utilized by the TDH to supplement the NSSP. However, both data sets will be utilized for monitoring status and trends for FC in the Bay.

Bay waters may be deemed unacceptable for recreation if fecal coliform levels exceed EPA and State of Texas water quality criteria, 200 colonies/ml for contact and non-contact recreation. Likewise, Bay waters may be deemed unacceptable for

TABLE 6-1. RECOMMENDED INDICATOR SPECIES FOR TDH AQUATIC LIFE SURVEY PROGRAM

Freshwater Fish	**Saltwater Fish and Shellfish**
Largemouth Bass	Black Drum*
White Bass	Red Drum*
Striped Bass	Speckled Trout
White Crappie	Sand Trout*
Black Crappie	Alligator Gar
Channel Catfish	Southern Flounder*
Blue Catfish	Sea Catfish
Flathead Catfish	Gafftopsail Catfish
Common Carp	White Shrimp
Smallmouth Buffalo	Brown Shrimp
River Carpsucker	Blue Crab*
Spotted Gar	Stone Crab
Longnose Gar	American Oyster*
Grass Carp	Sheepshead
	Atlantic Croaker*
	Tripletail

* These species are recommended by NEP Task Force to be used as indicators for toxic contamination levels in edible tissue.

shellfish harvesting if fecal coliform levels exceed, 14 colonies/ml, the TNRCC water quality criteria for shellfish growing waters.

The GBRMP FC monitoring element will also provide important information in support of the Contact Recreation Advisory Program to be developed by TDH. As stated in the plan this program will utilize either the TNRCC fecal coliform standard or an alternative indicator parameter to be developed by TDH. The Regional Monitoring Committee will work with the TDH in establishing stations and monitoring protocols for this program when it is developed.

TABLE 6-2. PROPOSED CONTAMINANTS OF CONCERN FOR TDH AQUATIC LIFE SURVEY PROGRAM

Volatile Organic Compounds:	**(ppb)**
Chloromethane	47
Bromomethane	47
Vinyl Chloride	47
Dichlorodifluoromethane	47
Trichlorofluoromethane	19
1,1-Dichloroethene	19
Methylene chloride	19
Carbon disulfide	19
1,2-Dichloroethene (trans)	19
1,2-Dichloroethene (cis)	19
1,1-Dichloroethane	19
Methyl-t-butyl ether	19
Bromochloromethane	19
2,2-Dichloropropane	19
Chloroform	19
Tetrahydrofuran	19
1,2-Dichloroethane	19
1,1,1-Trichloroethane	19
Benzene	19
Carbon tetrachloride	19
1,1-Dichloropropene	19
1,2-Dichloropropane	19
Dibromomethane	19
Trichloroethene	19
Dichlorobromomethane	19
Methyl methacrylate	19
Methyl isobutyl ketone	19
1,2-Dichloropropene (trans)	19
1,2-Dichloropropene (cis)	19
1,1,2-Trichloroethane	19
1,3-Dichloropropane	19
Toluene	19
Ethyl methacrylate	19
2-Hexanone	19
Dibromochloromethane	19
1,2-Dibromoethane	19
Tetrachloroethene	19
1,1,1,2-Tetrachloroethane	19
Chlorobenzene	19
Ethyl benzene	19
Bromoform	19
Styrene	19
1,1,2,2-Tetrachloroethane	19
Bromobenzene	19
1,2,3-Trichloropropane	19
Isopropylbenzene	19
n-Propylbenzene	19
2-Chlorotoluene	19
4-Chlorotoluene	19
1,3,5-Trimethylbenzene	19
T-Butylbenzene	19
1,2,4-Trimethylbenzene	19
Sec-Butylbenzene	19
1,3-Dichlorobenzene	19
1,4-Dichlorobenzene	19
P-Isopropyltoluene	19
1,2-Dichlorobenzene	19
N-Butylbenzene	19
1,2-Dibromo-3-chloropropane	19
1,2,4-Trichlorobenzene	19
Naphthalene	19
1,2,3-Trichlorobenzene	19
1,2,3-Trichlorobenzene	19
Hexachlorobutadiene	19
Total xylenes	56
Methyl ethyl ketone	94
Acetone	94
Acrylonitrile	94
2-Chloroethoxy-ethene	187

Semi-Volatile Organic Compounds:	**(ppm)**
Phenol	2
2-Chlorophenol	2
2-Nitrophenol	2
2,4-Dimethylphenol	2
2,4-Dichlorophenol	2
3-Methyl-4-chlorophenol	2
2,4,6-Trichlorophenol	2
2,4,5-Trchlorophenol	2
2,4-Dinitrophenol	4
4-Nitrophenol	4
4,6-Dinitro-2-cresol	4
Pentachlorophenol	4
n-Nitroso-n-dimethylamine	1
Pyridine	1
n-Nitrosodiethylamine	1
n-Nitrosodibutylamine	1
Aniline	1
Bis(2-chloroethyl) ether	1
1,3-Dichlorobenzene	1
Benzyl alcohol	1
1,4-dichlorobenzene	1
1,2-dichlorobenzene	1
o-cresol	1
bis(2-chloroisopropyl) ether	1
m&p-cresol (coelute)	1
Hexachloroethane	1
n-Nitroso-di-n-propylamine	1
Nitrobenzene	1
Benozic acid	1

TABLE 6-2. PROPOSED CONTAMINANTS OF CONCERN FOR TDH AQUATIC LIFE SURVEY PROGRAM (CONTINUED)

Semi-Volatile Organic Compounds:	**(ppm)**
Isophorone	1
Bis(2-chloroethoxy)methane	1
1,2,4-trichlorobenzene	1
Naphthalene	1
4-chloroaniline	1
Hexachlorobutadiene	1
2-Methyl naphthalene	1
1,2,3,5-Tetrachlorobenzene	1
Hexachlorocyclopentadiene	1
2-Chloronaphthalene	1
Total nitroanilines	1
Acenaphthylene	1
Dimethyl phthalate	1
2,6-Dinitrotoluene	1
Acenaphthene	1
Dibenzofuran	1
2,4-Dinitrotoluene	1
Fluorene	1
4-Chlorodiphenyl ether	1
Diethyl phthalate	1
n-Nitrosodiphenylamine	1
Diphenyl hydrazine	1
4-Bromodiphenyl ether	1
Hexachlorobenzene	1
Phenanthrene	1
Anthracene	1
Di-n-butyl phthalate	1
Fluoranthene	1
Pyrene	1
Bis (2-ethylhexyl) adipate	1
Butylbenzl phthalate	1
Benz(a)anthracene	1
Chrysene	1
Bis (2-ethylhexyl) phthalate	1
Di-n-octyl phthalate	1
Benzo(b)fluoranthene	1
Benzo(k)fluoranthene	1
Benzo(a)pyrene	1
Indeno(1,2,3-cd)pyrene	1
Dibenzo(a,h)anthracene	1
Benzo(g,h,i)perylene	1

Metals:	**(ppm)**
Arsenic	0.04
Copper	0.4
Lead	0.4
Mercury	0.02
Zinc	0.4

Pesticides:	**(ppb)**
DDT	10
DDD	10
DDE	5
Aldrin	2
Dieldrin	6
Endrin	6
Chlordane	10
Heptachlor	2
Heptachlor Epoxide	4
Methoxychlor	30
Toxaphene	100
Hexachlorobenzene	2
Malathion	20
Ethyl Parathion	10
Methyl Parathion	10
Diazion	10
Chloropyrifos	10
Endosulfan	10
Endosulfan sulfate	10
Alachlor	8
Dacthal	3
Alpha BHC	2
Beta BHC	2
Delta BHC	2
Lindane	2

PCBs	**(ppb)**
Aroclor 1016	40
Aroclor 1221	40
Aroclor 1232	40
Aroclor 1242	40
Aroclor 1248	40
Aroclor 1254	40
Aroclor 1260	40
Aroclor 1262	40