

Public Health and Aquatic Life Concerns



*Fish Kill at E.V. Spence Reservoir Caused by
Prymnesium parvum Bloom*

Public Health and Aquatic Life Concerns

Water pollution threatens public health by contaminating seafood, drinking water supplies, and recreational waters with toxic substances, as well as viruses and bacteria which cause disease. Aquatic organisms tend to tolerate most bacteria and viruses that are harmful to humans. Many aquatic organisms, however, are more sensitive to toxic substances than humans are.

Public Health Concerns

Some toxic pollutants in water, such as mercury, PCBs, and some pesticides have been linked to human birth defects, cancer, neurological disorders, and kidney ailments. Once discharged to surface waters, some toxic pollutants are persistent and accumulate in sediments or in organisms throughout the aquatic food chain. Humans can be exposed to toxic substances in water by ingestion of contaminated drinking water supplies, fish, or shellfish. Swimmers in contaminated recreational waters may also ingest toxic substances or absorb toxic pollutants through skin exposure. Edible fish and shellfish contaminated with toxic substances pose a greater threat to human health than contaminated drinking water. Fish and shellfish may bioconcentrate toxic substances in their tissues up to one million times the concentration of toxicants in the surrounding water.

The TCEQ and CRP monitor a large number of toxic substances in water, sediment, and fish tissue in streams and rivers, reservoirs and lakes, estuaries, and ocean waters suspected of potential contamination. Parametric coverage includes toxic substances with numeric criteria in the TSWQS (Table 13-1). For the 2002 report, water bodies with impaired aquatic life uses (due to acute or chronic exposure to metals and organic substances in water, ambient water and sediment toxicity tests), fish consumption uses (issuance of advisories and closures and exceedance of human health criteria for metals and organic substances in water) or concerns due to elevated toxic substances in fish tissue are identified and discussed separately in the streams and rivers, reservoirs and lakes, estuary, and ocean waters sections of this report. Public drinking water supplies that are threatened or impaired due organic substances in finished drinking water are also identified in each of the water body sections of the report. Impairments are also highlighted on the water body fact sheets in Volumes 2 and 3.

Table 13-1. Toxic Substances with Numerical Criteria in the
Texas Surface Water Quality Standards

Toxicants with Criteria to Protect Aquatic Life:	
Aldrin	Guthion
Aluminum	Heptachlor
Arsenic	<i>gamma</i> -Hexachlorocyclohexane (lindane)
Cadmium	Lead
Carbaryl	Malathion
Chlordane	Mercury
Chlorpyrifos	Methoxychlor
Chromium (trivalent)	Mirex
Chromium (hexavalent)	Nickel
Copper	Total PCBs
Cyanide	Parathion
DDT	Phenanthrene
Demeton	Pentachlorophenol
Dicofol	Selenium
Dieldrin	Silver
Diuron	Toxaphene
Endosulfan I & II	Tributyltin
Endosulfan sulfate	2,4,5-Trichlorophenol
Endrin	Zinc
Toxicants with Human Health Criteria to Protect Human Consumption of Surface Water and Fish:	
Aldrin	N-Nitrosodi-n-butylamine
<i>alpha</i> -Hexachlorocyclohexane	PCBs
Arsenic	Pentachlorobenzene
Barium	2,4-D
Benzene	Danitol
Benzidine	Dibromochloromethane
Benzo(a)anthracene	1,2-Dibromoethane
Benzo(a)pyrene	Dieldrin
<i>beta</i> -Hexachlorocyclohexane	p-Dichlorobenzene (1,4-dichlorobenzene)
Bis(chloromethyl) ether	1,2-Dichloroethane
Cadmium	1,1-Dichloroethylene
Carbon tetrachloride	Dicofol
Chlordane	Dioxins/furans (TCDD equivalents)
Chlorobenzene	Endrin
Chloroform	Flouride
Chromium	<i>gamma</i> -Hexachlorocyclohexane (lindane)
Cresols	Heptachlor
Crysene	Heptachlor epoxide
Cyanide	Hexachlorobenzene
DDD	Hexachlorobutadiene
DDE	Pentachlorophenol
DDT	Pyridine
Hexachloroethane	Selenium
Hexachlorophene	1,2,4,5-Tetrachlorobenzene
Lead	Tetrachloroethylene
Mercury	Toxaphene
Methoxychlor	2,4,5-TP (silvex)
Methyl ethyl ketone	2,4,5-Trichlorophenol
Mirex	Trichloroethylene
Nitrate nitrogen	1,1,1-Trichloroethane
Nitrobenzene	TTHM (total trihalomethanes)
N-Nitrosodiethylamine	Vinyl chloride

Viral and bacterial pollutants in water may also cause serious human illness and death. Waters that receive inadequately treated sewage may contain organisms that cause dysentery, gastroenteritis, cholera, and infectious hepatitis. Bacteria and viruses may be ingested by humans that swim or have contact with contaminated water or through ingestion of contaminated drinking water or improperly cooked shellfish. Water bodies with impaired contact recreation use (elevated fecal coliform, *E. coli*, and enterococci densities) are identified in each of the water body sections of the report. Coastal waters with impaired oyster waters (elevated fecal coliform densities) are identified in the estuary section of the report. The bacterial impairments are also highlighted and discussed on the water body fact sheets in Volumes 2 and 3.

There have been no closures of drinking water systems due to contamination of the raw water supply by toxic substances in the last five years. The state drinking water program that protects the health of citizens is discussed in its own section of this document.

Aquatic Life Concerns

The number of fish kills provides a limited indication of pollutant impacts on aquatic life because fish kills do not always result from pollution. Natural conditions (drought, low flow, hot and cold water temperatures), bacteria and disease, and toxic algal blooms often cause fish kills. Discharge of organic pollutants which deplete dissolved oxygen is a leading cause of fish kills. Low dissolved oxygen concentrations may also result from natural conditions related to low stream flow in streams and rivers, sluggish tidal activity in estuaries, and poorly mixed headwater regions of reservoirs. The construction of dams and dead-end canals, which reduce circulation, also cause depression in dissolved oxygen that may lead to fish kills.

Many aquatic organisms are sensitive to toxic pollutants. In severe cases of contamination, toxic pollutants kill aquatic life; in less severe cases, toxic pollutants may eliminate some species from the aquatic community. Toxic pollutants directly affect aquatic biota by increasing their susceptibility to disease, interfering with their reproduction, or reducing viability of their young. In some cases, toxic pollutants may cause physical abnormalities (tumors, skin lesions, fin damage, skeletal anomalies) in fish.

In many cases investigators cannot determine if pollution, natural causes, or both contributed to the fish kill. In many cases there is little evidence at the site or it may have been swept away by the currents before the investigation began. The exact location of the fish kill may also be difficult to determine, because currents in streams and rivers carry dead fish downstream from the source.

An estimated 83,447,857 fish were killed in Texas water bodies in 358 separate events over the five-year period considered in this report (September 1996 through August 2001) (TPWD, 2002). The majority of the fish kills were small, involving less than 500 fish for each event. However, 14 massive kills, involving 1,000,000 or more fish, occurred during this time period. All of these large fish kills occurred in bays, tidal portions of inflowing rivers, or man-made canals associated with coastal waters. The three largest freshwater kills, responsible for a combined total of 1,250,425 dead fish, occurred in the Brazos River Basin and were attributed to blooms of the toxic golden alga, *Prymnesium parvum*. The majority of

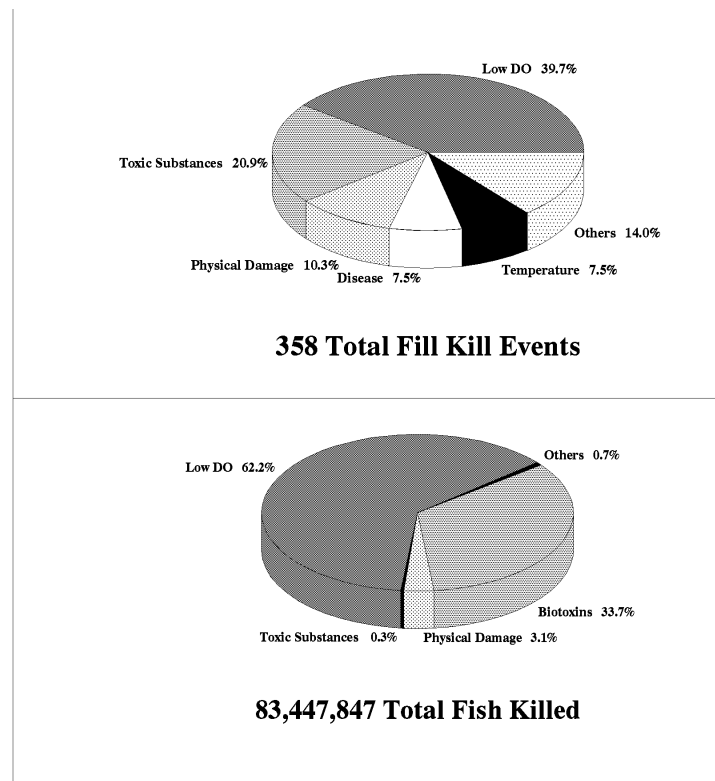


Figure 13-1. Comparison of Total Fish Kill Events and Total Fish Killed

fish kills were reported from coastal bays (63 kills; 17.6%), and the Trinity River (59 kills; 16.5%) the Brazos River (42 kills; 11.7%), and the Colorado River (33 kills; 9.2%) basins. Approximately 71% of the 358 fish kills have been attributed to one of three causes: depressed dissolved oxygen concentrations (39.7%), toxic substances (20.9%), and physical damage or trauma (10.3%)(Figure 13-1). More fish (52,019,389) were killed by dissolved oxygen than any other cause. Biotoxins, produced during red tides and golden algal blooms, also were responsible for killing large numbers of fish (28,194,726).

The depletion of dissolved oxygen by various sources accounted for 142 (39.7%) of the fish kills. Bacterial decay of organic materials, sewage bypasses, decreased stream flow, dead-end canals, and excessive aquatic plant growth that leads to anoxia are some examples of sources which contributed to the depressed dissolved concentrations.

Toxic substances caused the second largest number of kills (75; 20.9%) statewide, resulting in an estimated 233,391 dead fish (Figure 13-1). Spills of crude oil, gasoline, kerosene and other petroleum products accounted for the largest number (19 kills; 25.3%) of toxic related fish kills (Table 13-2). Substantial numbers of toxic substances-related kills (11 kills; 13.4%) also resulted from chlorine discharges at domestic wastewater treatment plans (18; 24.0%), miscellaneous contaminants (9 kills; 12.0%) such as dairy or poultry wastewater, fire-fighting foam, and hydrogen peroxide, and pesticide applications (6 kills; 8.0%). Table 13-3 provides a complete listing of toxic related fish kills.

Table 13-2. Causes of Toxic Substance Related Fish Kills

Cause	Number of Kills	Percent of Kills
Petroleum Products	19	25.3
Chlorine	18	24.0
Others	9	12.0
Pesticides	6	8.0
Acids/Bases	5	6.7
Brines	5	6.7
Unknowns	5	6.7
Fertilizers	4	5.3
Ammonia	3	4.0
Hydrogen Sulfide	1	1.3

Of the remaining fish kills, some were the result of physical damage or trauma caused by activities such as seismic explosions, entrapment, and culling by-catch from shrimp nets (37 kills; 10.3%). Other kills were caused by bacterial and viral diseases (27 kills; 7.5%) (Figure 13-1), temperature (extremes in weather or thermal pollution from effluents; 27 kills; 7.5%) or unknown causes (18 kills; 5.0%).

Table 13-3. Toxic Substances Related Fish Kills

Segment Number	Start Date	Event ID	Location	Fish Killed	General Cause	Specific Cause	Contaminant
0101	6/24/98	19982A1629	Dixon Creek - downstream of Phillips 66 Refinery near Borger, Texas	3392	Inorganic compound	Hydrogen sulfide	See Specific Cause
0409	1/2/97	19973A330	Gray's Creek -	21	Organic compound	Other	kerosene
0504	10/4/96	19963A308	Mill Creek and Socagee Creek	12897	Inorganic compound	Brine	See Specific Cause
0505	1/29/97	19973A338	Hawkins Creek	917	Organic compound	Crude oil	See Specific Cause
0505	3/24/97	19973A646	Prarie Creek - HWY 135 No of Kilgore to rt on 2207 to lft on Cole Bottom Rd	1	Organic compound	Crude oil	See Specific Cause
0506	7/28/01	20013A7962	Hawkins, TX , Rogers Creek from HWY 14 to County Road 2659	2585	Pollutant	Crude oil	See Specific Cause
0507	3/10/00	20002A7808	Caddo Creek - 4 miles west and 2 miles north of Greenville, Texas	28	Pollutant	Gasoline	See Specific Cause
0601	1/1/00	20004B4675	Neches River and HWY 347	500	Pollutant	Ammonia	See Specific Cause
0611	2/2/00	20003A1722	Unnamed tributary of West Mud Creek - Loop 323 at Paluxy Drive in Tyler.	57	Pollutant	Diesel	See Specific Cause
0805	6/1/99	19992A7332	trib. Elm Fork Creek - Dallas, Texas at Irving and Inwood.	90	Pollutant	Diesel	See Specific Cause
0805	11/22/97	19982A1583	Floyd Branch Creek - 13500 N. Central Expressway in Dallas, Texas	2	Inorganic compound	Other	Sulfuric Acid

Table 13-2. Toxic Substances Related Fish Kills (Continued)

Segment Number	Start Date	Event ID	Location	Fish Killed	General Cause	Specific Cause	Contaminant
0805	8/6/99	19992A7503	Hackberry Cr. - from St. John at Lexington to Armstrong in Highland Park, Tx.	94	Inorganic compound	Chlorine	See Specific Cause
0805	10/14/98	19992A7683	trib. White Rock Creek - 5400 block Harbortown, Dallas, Texas	200	Pollutant	Pesticide	Undetermined
0805	3/14/99	20002A7796	A tributary to Red Oak Creek- Red Oak, Tx	30	Pollutant	Other	See Specific Cause
0806	7/11/98	19982A1631	Little Fossil Creek - At intersection of Long and Broadway in Fort Worth, Texas	7047	Inorganic compound	Other	Lime
0806	9/15/97	19972A1386	Rush Creek - tributary at 4608 S. Cooper Street in Arlington, Texas	196	Inorganic compound	Chlorine	See Specific Cause
0806	4/10/00	20002A7768	Tributary to the West Fork of the Trintiy River- Euless Tx.	13	Pollutant	Unknown	See Specific Cause
0819	2/22/99	20002A7782	Duck Creek - 1250 Digital Drive, Richardson Tx.	1	Pollutant	Other	Cement dust
0820	12/2/99	20002A7713	tributary of Cottonwood Creek - Spring Valley & Mahan streets, Dallas, Tx.	100	Pollutant	Other	Undetermined
0820	3/30/98	19982A1620	Kings Creek - City of Allen, Texas	95	Inorganic compound	Ammonia	See Specific Cause
0822	12/8/96	19972A721	Trinity River- at Indian Creek Golf Course between IH-35 and Hwy 121	5	Organic compound	Pesticide	Not Applicable
0822	9/27/96	19962A546	Hackberry Creek County Club in Irving, Tx.	100	Inorganic compound	Other	Not Applicable

Table 13-2. Toxic Substances Related Fish Kills (Continued)

Segment Number	Start Date	Event ID	Location	Fish Killed	General Cause	Specific Cause	Contaminant
0822	4/3/00	20002A7764	Farmers Branch Creek - Webb Chappel and Valwood in Farmers Branch, TX	60	Pollutant	Fertilizer	See Specific Cause
0822	12/20/99	20002A7715	Hutton Branch - Trinity Mills and Kelly Blvd. In Carrollton, Texas.	400	Pollutant	Chlorine	Volume Undetermined
0823	1/19/97	19982A1628	Stewart Creek - first 1/2 mile above Lake Lewisville	847	Inorganic compound	Chlorine	See Specific Cause
0828	3/20/00	20002A7926	Kee Branch Trib. - Eden Road, Kennedale, TX	86	Pollutant	Diesel	See Specific Cause
0828	5/23/97	19972A1132	Valley Branch - west of FM496 & s of FM1187 near County line.	2	Inorganic compound	Other	sodium hydroxide
0829	1/19/97	19972A738	Kings Creek - at Kings Creek Golf Course in Southwest Fort Worth.	72	Organic compound	Other refined petroleum product	Jet A
0841	2/11/99	20002A7778	Trigg Lake -DFW airport Tarrant County TX	80	Pollutant	Other petroleum products	Jet A
1001	11/22/96	19964A597	San Jacinto River, north of HWY 90 on San Jacinto River near Sheldon, Texas	10	Inorganic compound	Chlorine	See Specific Cause
1007	9/30/96	19974A614	Little Vince Bayou at 1319 Red Bluff (Crown Petroleum)	40005	Organic compound	Crude oil	See Specific Cause
1013	12/28/96	19974A622	White Oak Bayou upstream from 1960	200	Inorganic compound	Chlorine	See Specific Cause
1016	11/6/97	19974B1043	Greens Bayou at Ella Blvd.	1000	Inorganic compound	Brine	See Specific Cause
1016	5/21/00	20004B4670	Halls Bayou at Hardy Toll Road to Mesa Drive	13545	Pollutant	Gasoline	See Specific Cause

Table 13-2. Toxic Substances Related Fish Kills (Continued)

Segment Number	Start Date	Event ID	Location	Fish Killed	General Cause	Specific Cause	Contaminant
1016	11/3/99	19994B3211	Garners Bayou and Lee Rd at Houston Intercontinental Airport	50	Pollutant	Unknown	Undetermined
1017	6/15/00	20004B4716	White Oak Bayou downstream of IH610	100	Pollutant	Gasoline	See Specific Cause
1101	7/6/97	19974A1003	Unnamed tributary to Turkey Creek	5	Inorganic compound	Brine	See Specific Cause
1113	12/12/97	19984B1047	Spencer Highway and Big Island Slough	19568	Organic compound	Gasoline	See Specific Cause
1206	9/28/97	19992A7329	Palo Pinto Creek - From Highway 4 down to Santo, Tx.	25	Pollutant	Pesticide	Volume Undetermined
1218	9/12/97	19972A1385	South Nolan Creek - both Backstrom Crossing Bridges	1991	Inorganic compound	Chlorine	See Specific Cause
1218	9/28/97	19972A1390	South Nolan Creek - from just above Levy Crossing to below Highway 190	2194	Inorganic compound	Chlorine	See Specific Cause
1223	9/18/97	19972A1388	Leon River at Gustine, Texas	174	Organic compound	Pesticide	Undetermined
1226	2/3/99	20002A7777	Little Duffau Creek- At County Road 222 Erath County TX	1050	Pollutant	Fertilizer	Dairy waste
1226	4/18/99	19992A7354	North Bosque River - near Highway 6 and Hico, Texas	200	Pollutant	Fertilizer	Dairy Waste
1232	7/6/97	19972A1348	Duck Creek - on old Caddo Rd. from Breckenridge to Melrose	300	Organic compound	Crude oil	See Specific Cause
1244	3/25/99	19991A2013	Mustang Cr at HWY 95 1 mi S of Taylor (loop 79)	2	Inorganic compound	Ammonia	See Specific Cause

Table 13-2. Toxic Substances Related Fish Kills (Continued)

Segment Number	Start Date	Event ID	Location	Fish Killed	General Cause	Specific Cause	Contaminant
1113248	10/12/98	20001A2891	Mankins Branch Creek at CR 102, E of Georgetown	37	Pollutant	Chlorine	Not Applicable
1402	9/18/98	19981A933	From LaGrange, E on FM 609 to rt on O'Quinn Branch Rd, go 1.5 mi, farm on left	28760	Pollutant	Other	poultry operation wastewater
1403	5/10/01	20010B8796	Bull Creek - upstream on the tributary that is 1mi north of FM2222 on Loop 360 in Austin	15615	Pollutant	Chlorine	See Specific Cause
1404	4/4/98	19981A918	Hurst Creek at Lakeway Blvd. in Lakeway (Next to "The Oaks" golf course)	1317	Organic compound	Herbicide/defoliant	daconil (chlorothalonil)
1404	8/8/97	19971A897	Lake Travis, Anderson Bend area	3485	Inorganic compound	Other	low dissolved oxygen
1410	6/4/00	20002A7897	Colorado River - near Big Valley, Texas	2000	Pollutant	Other	applied dairy waste
1427	5/10/01	19971A877	Williamson Cr 1 mi upstream of Onion Cr, McKinney Falls State Park.	944	Inorganic compound	Other	quick lime
1427	7/9/97	19971A889	Water main break at Stassney Ln 0.2 mi E of IH 35, Austin	6598	Inorganic compound	Chlorine	Not Applicable
1428	6/25/00	20001A2901	Wells Branch Creek in Walnut Creek Park, Austin (near Lamar St at Walnut Cr)	9232	Pollutant	Chlorine	See Specific Cause
1428	11/23/98	19991A1999	Walnut Creek near corner of MOPAC and Parmer Ln, Austin	1364	Inorganic compound	Chlorine	See Specific Cause
1428	4/7/97	19971A895	Tannehill Branch Cr at HWY 290, 0.5 mi W of IH35, Austin	1	Organic compound	Fuel oils	JP #4
1428	8/16/00	20001A3054	Little Walnut Creek upstream of the southern most 183 crossing	2542	Pollutant	Chlorine	See Specific Cause

Table 13-2. Toxic Substances Related Fish Kills (Continued)

Segment Number	Start Date	Event ID	Location	Fish Killed	General Cause	Specific Cause	Contaminant
1429	8/17/98	19981A930	Waller Cr at 2,000 blk of San Jacinto St.	4054	Inorganic compound	Chlorine	See Specific Cause
1429	10/23/96	19961A847	Shoal Creek	337	Inorganic compound	Chlorine	See Specific Cause
1429	7/12/97	19981A929	Waller Cr next to MLK and Red River St in Austin.	1598	Pollutant	Chlorine	See Specific Cause
1429	7/12/97	19971A893	Shoal Cr at Windsor Rd near Pease Park	1	Inorganic compound	Chlorine	Not Applicable
1602	12/29/96	19971A851	Lavaca River in Hallettsville and downstream for about two miles	50	Organic compound	Fuel oils	See Specific Cause
1604	4/25/97	19975A423	North side of hwy 59, approx 1 mile west of Ganado on Cherry rd	50	Inorganic compound	Brine	brine water
1804	10/28/97	19971A883	Nash Creek - 0.5 mi downstream of CR 1150 (Darst Oil Field)	309	Inorganic compound	Brine	See Specific Cause
1810	2/8/00	20001A2846	Spring Creek immediately upstream of HWY183 in Lockhart	41	Pollutant	Caustic/base	Not Applicable
1906	1/8/99	19991A2004	Kelly AFB at outfall #1 near Military Dr and Leon Creek	1	Pollutant	Other	Undetermined
2002	4/30/97	19975A415	3 miles N of Blackburn Ranch into Indian Creek, leading to Blanco Creek.	12	Organic compound	Crude oil	crude oil and brine
2108	6/23/97	19971A878	FK occurred at Burnt Boot Cr 0.5 mi upstream of IH-35, Devine.	25	Inorganic compound	Other	hydrogen peroxide
2301	1/25/00	20025A3126	FM 511 at State Rd. 48 extending 3 miles NE	33177	Pollutant	Other	Furfural

Table 13-2. Toxic Substances Related Fish Kills (Continued)

Segment Number	Start Date	Event ID	Location	Fish Killed	General Cause	Specific Cause	Contaminant
2302	8/4/99	19995A2964	Los indios pumping station #2 to highway 281	439	Pollutant	Fertilizer	See Specific Cause
2425	6/25/00	20004B4711	North end of Taylor Lake near Port rd and Bay Area Blvd.	1000	Pollutant	Other petroleum products	See Specific Cause
2453	12/4/98	19995A2913	Cox Creek at Formosa Plastics Pt. Comfort.	21	Pollutant	Other	AFFF (fire fighting foam)
2456	7/4/01	20015A3058	About 8 miles upstream in Caranchua Creek	10005	Pollutant	Other	Undetermined
2481	5/13/97	19975A889	Van Glidden Ditch, Bear Lane , Corpus Christi	39	Organic compound	Gasoline	super unleaded gasoline

Fish Abnormalities

Significant reports of fish abnormalities have focused the efforts of TCEQ on the Rio Grande downstream of Laredo/Nuevo Laredo. The observations of unusually high numbers of fish abnormalities is often an indicator of toxic substances in the aquatic environment that effect normal growth or cause disease. Testing of water, sediment, tissue, and wastewater effluent has been undertaken to discover the potential sources of toxic substances for this water body.