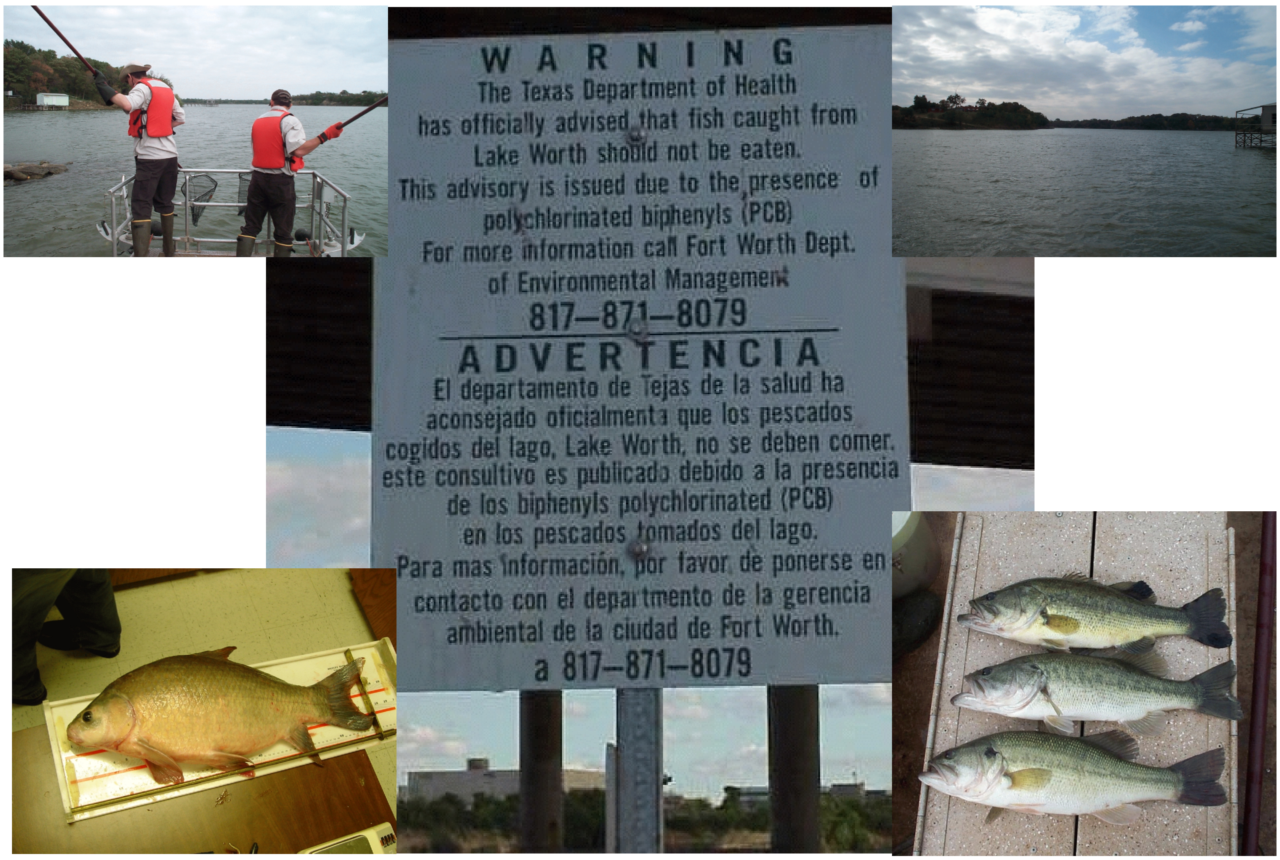
U. S. Fish and Wildlife Service
Region 2

ORGANOCHLORINE PESTICIDE AND POLYCHLORINATED BIPHENYL CONTAMINATION IN ROUGH AND GAME FISH COLLECTED FROM LAKE WORTH, TARRANT COUNTY, TEXAS 2003
Project ID No. 1926-2507



Prepared for the
U.S. Army Corps of Engineers
by

Craig M. Giggleman and Jacob M. Lewis
Arlington Ecological Services Field Office
711 Stadium Drive, Suite #252
Arlington, Texas 76011

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ABSTRACT

A contaminants investigation was initiated by the U.S. Fish and Wildlife Service (USFWS) and U.S. Army Corps of Engineers (USACOE) in November, 2003, at Lake Worth in Tarrant County, Texas. The purpose of this investigation was to determine residual organochlorine pesticide and polychlorinated biphenyl (PCB) levels in fish collected from the reservoir. Data resulting from this investigation were compared to screening criteria and a previous study conducted in the area by the U.S. Geological Survey in 1999 in an attempt to assess the temporal trend of organochlorine and PCB contamination in fish from the reservoir. A fish consumption advisory was issued by the Texas Department of Health for this reservoir in 2000 on the premise that persons should not consume any species of fish from the reservoir due to elevated PCBs.

A total of 48 fish [five smallmouth buffalo (*Ictiobus bubalus*), five common carp (*Cyprinus carpio*), five freshwater drum (*Aplodinotus grunniens*), 10 largemouth bass (*Micropterus salmoides*), five white bass (*Morone chrysops*), eight white crappie (*Pomoxis annularis*), and 10 channel catfish (*Ictalurus punctatus*)] were collected from the reservoir. Edible muscle tissues (skinless fillets) were collected from each fish and analyzed for residual organochlorine pesticides and PCBs.

The temporal trend of organochlorine contaminants in fish inhabiting the reservoir based on the 2003 results in comparison to the 1999 results was not readily evident. Some constituents were detected at lower levels in fish collected in 2003 than in fish from 1999, whereas other contaminants were detected at higher levels in 2003. Residual organochlorine contamination was detected in every fish sample collected from the reservoir in 2003. Several organochlorine pesticides (aldrin, hexachlorocyclohexane, dichloro-diphenyl-dichloroethane, dichloro-diphenyl-trichloroethane, dieldrin, endosulfan, and mirex) were measured in fish tissues collected from the reservoir in 2003 that were not detected in fish collected in 1999. Technical chlordane, hexachlorobenzene, and dichloro-diphenyl-dichloroethylene concentrations measured in fish collected in 2003 were slightly higher than those measured in 1999, but as with the 1999 data, the non-cancer health risk hazard quotients calculated for these contaminants were less than unity and the cancer risk levels were less than 1 in 10,000.

All of the fish collected from the reservoir in 2003 contained detectable amounts of total PCBs, but, overall, these fish appeared to contain lower total PCB levels than the fish sampled in 1999. Two game fish species (largemouth bass and channel catfish) and two rough fish species (common carp and freshwater drum) sampled in 2003 contained lower concentrations than those measured in the same species in 1999. However, one game fish species (white crappie) and one rough fish species

(smallmouth buffalo) sampled in 2003 contained higher concentrations than those detected in 1999. The smallmouth buffalo collected in 2003 contained elevated total PCB levels not only in comparison to data collected in 1999, but also to current human health screening criteria. As with the 1999 results, the non-cancer health risk hazard indices calculated for total PCBs from the 2003 data exceeded unity and still preclude adults and children from consuming one fish-meal per week to avoid exceeding the minimum risk level. The overall estimated cancer risk levels associated with consuming fish collected in 2003 were similar to those determined from the 1999 data, in that both resulted in excess cancer values of less than 1 in 10,000.

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INTRODUCTION

A contaminants investigation was initiated by the U.S. Fish and Wildlife Service (USFWS) and U.S. Army Corps of Engineers (USACOE) in November, 2003, at Lake Worth in Tarrant County, Texas. The purpose of this investigation was to determine residual organochlorine pesticide and polychlorinated biphenyl (PCB) levels in fish collected from the reservoir. Data resulting from this investigation were compared to screening criteria and a previous study conducted in the area in an attempt to assess the temporal trend of organochlorine and PCB contamination in fish from the reservoir.

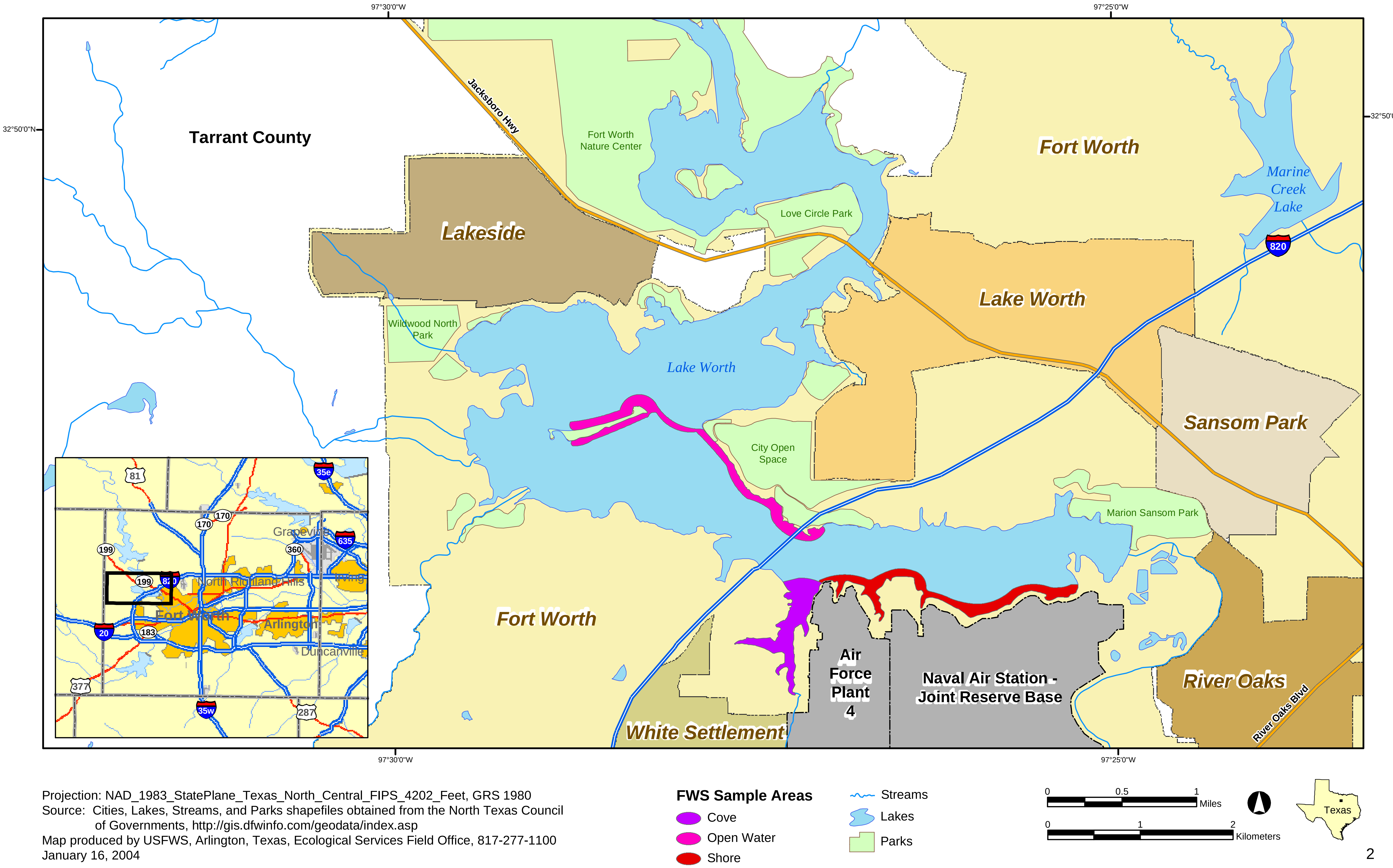
STUDY AREA AND BACKGROUND

Located in western Tarrant County, Texas, Lake Worth is an impoundment of the West Fork of the Trinity River. This reservoir was constructed in 1914 as a municipal water source for the City of Fort Worth and impounds approximately 3,560 acres (1,440 hectares). The reservoir is bounded to the north by the Fort Worth Nature Center and Refuge, to the east by the City of Lake Worth, to the west by the City of Lakeside, to the south by portions of the Cities of Fort Worth and White Settlement, and to the southeast by the Naval Air Station Joint Reserve Base (NASJRB) (formerly Carswell Air Force Base), including Air Force Plant Number 4 (Figure 1).

Air Force Plant Number 4 was placed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priority List (NPL) by the U.S. Environmental Protection Agency (USEPA) in August, 1990, due to groundwater and surface water contamination attributed to the facility's past operations (TDH, 2000). This facility began operations in 1942 and generated annually an estimated 5,500 to 6,000 tons of waste oils, fuels, solvents, paint residues, and spent process chemicals (RUST, 1993). Originally, these wastes were disposed of on site by burial in landfills, burning, and/or discharged into pits or the sanitary sewer (RUST, 1993). Remedial activities are on-going at the facility to address the surface and subsurface contamination.

In 1998, the Texas Department of Health (TDH) and the Agency for Toxic Substances and Disease Registry (ATSDR) released a public health assessment for Lake Worth which concluded that non-game fish [mosquito fish (*Gambusia affinis*)] collected during remedial investigations by the U.S. Air Force from the reservoir in the cove adjacent to Air Force Plant Number 4 posed an indeterminate (potential) human health risk due to detected concentrations of organochlorine pesticides and PCBs (TDH, 2000). As a result of this assessment, the TDH and ATSDR recommended that edible fish be collected and analyzed for contamination to determine the human

Figure 1: Lake Worth Contaminants Investigation



Projection: NAD_1983_StatePlane_Texas_North_Central_FIPS_4202_Feet, GRS 1980
Source: Cities, Lakes, Streams, and Parks shapefiles obtained from the North Texas Council of Governments, http://gis.dfwinfo.com/geodata/index.asp
Map produced by USFWS, Arlington, Texas, Ecological Services Field Office, 817-277-1100
January 16, 2004

health hazard associated with eating fish from the reservoir (TDH, 1999). In response to this recommendation, the U.S. Geological Survey (USGS), under contract to the U.S. Air Force, collected edible rough and game fish for contaminant analyses from the reservoir in March and April, 1999 (TDH, 2000). The fish species sampled by the USGS included smallmouth buffalo (*Ictiobus bubalus*), common carp (*Cyprinus carpio*), freshwater drum (*Aplodinotus grunniens*), largemouth bass (*Micropterus salmoides*), white crappie (*Pomoxis annularis*), and channel catfish (*Ictalurus punctatus*) (TDH, 2000). A total of 55 fish (five smallmouth buffalo, 10 common carp, 10 freshwater drum, 10 largemouth bass, 10 white crappie, and 10 channel catfish) were collected from Lake Worth by the USGS and analyzed for metals, semi-volatile organic compounds (SVOCs), organophosphate pesticides, organochlorine pesticides, and PCBs (TDH, 2000). The results of these analyses indicated that metals, SVOCs, organophosphate pesticides, and organochlorine pesticides were below levels where adverse affects through consumption of these fish would be expected to occur (TDH, 2000). However, PCBs were detected at levels that represented a potential human health concern (TDH, 2000). Based on these results, a fish consumption advisory was issued by the TDH for Lake Worth on April 19, 2000 (TDH, 2003). The premise of this advisory is that persons should not consume any species of fish from the reservoir due to elevated PCBs (TDH, 2003).

METHODS AND MATERIALS

Fish were collected at Lake Worth by USFWS and USACOE personnel on November 3, 4, 5, and 13, 2003, to assess the temporal trend of organochlorine pesticide and PCB contamination in fish tissue from the reservoir. The species targeted were three rough and four game fish species. The rough fish species collected consisted of smallmouth buffalo, common carp, and freshwater drum, while game fish included largemouth bass, white crappie, white bass (*Morone chrysops*), and channel catfish.

A member of the sucker family (family Catostomidae), smallmouth buffalo (Figure 2) are opportunistic, omnivorous, benthic feeders (Robison and Buchanan, 1988; Kolbe and Luedke, 1993; Linam *et al.*, 2002). Adults will eat zooplankton, insect larvae, and detritus, while juveniles feed primarily on microcrustaceans (Robison and Buchanan, 1988). Smallmouth buffalo will sexually mature at 2 to 3 years of age (Robison and Buchanan, 1988). The maximum life span for this species is estimated at 15 years (Robison and Buchanan, 1988).

Extremely tolerant to degraded water quality, the common carp (Figure 3) is a non-native member of the minnow family (family Cyprinidae) (Kolbe and Luedke, 1993; Linam *et al.*, 2002). This species was introduced into the United States from Europe circa 1876 (Robison and Buchanan, 1988; Stickney, 1989). An omnivorous, benthic fish, carp will feed on insect larvae, crustaceans, annelids, detritus, organic sewage, algae, and plant material (Robison and Buchanan, 1988; Linam *et al.*, 2002). This species sexually matures at 2 to 5 years of age and can live up to 20 years (McCrimmon, 1968; Robison and Buchanan, 1988).

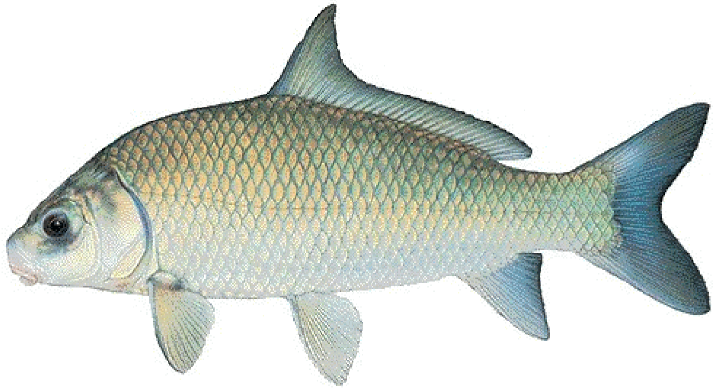


Figure 2. Smallmouth Buffalo (WUM, 2003).

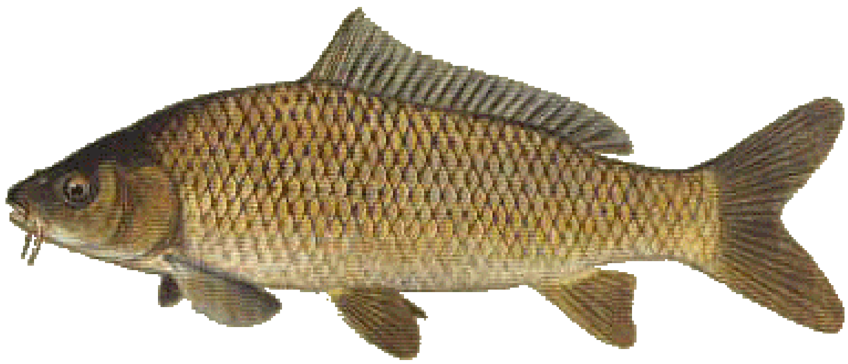


Figure 3. Common Carp (IDNR, 2003).

Also known as gaspergous and sheepshead, freshwater drum (Figure 4) are the only freshwater representative of the marine family Sciaenidae (Robison and Buchanan, 1988). Fairly tolerant to changes in water conditions, this benthic fish feeds primarily on molluscs and other aquatic invertebrates (Robison and Buchanan, 1988; Linam *et al.*, 2002). The normal life span for drum is usually 7 to 8 years, however some individuals have lived up to 17 years (IDNR, 2003).

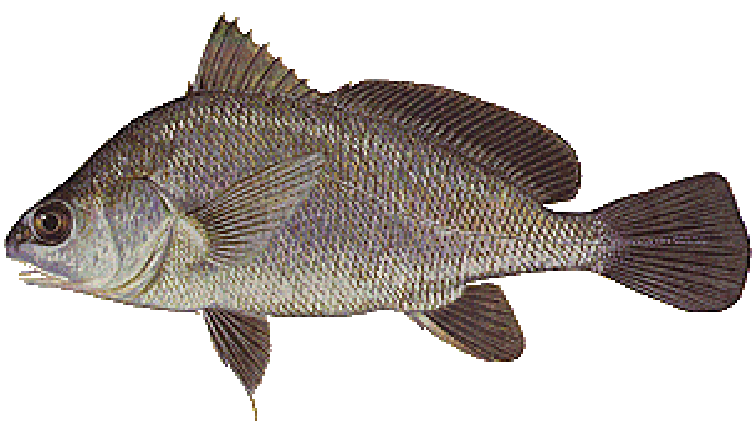


Figure 4. Freshwater Drum (IDNR, 2003).

A member of the sunfish family (family Centrarchidae), largemouth bass (Figure 5) are highly adaptive to both lentic and lotic systems. This species is moderately tolerant to changes in water conditions, but is intolerant to high turbidity and extreme siltation (Robison and Buchanan, 1988; Pflieger, 1991; Jester *et al*., 1992). Fingerling largemouth bass prey principally on microcrustaceans, whereas adults are primarily piscivorus, but will eat crayfish, insects, frogs, snakes, and even mice (Becker, 1983; Robison and Buchanan, 1988; Pflieger, 1991; Linam *et al*., 2002). In large reservoirs, this species depends heavily on gizzard shad (*Dorosoma cepedianum*) and bluegill (*Lepomis macrochirus*) as prey items (Becker, 1983; Pflieger, 1991). Food is converted to a fish flesh ratio of 4 to 1 (Becker, 1983). Largemouth bass sexually mature at 2 years and may live up to 10 years or more (Robison and Buchanan, 1988). As fingerlings, this species is preyed upon by a host of organisms, but as they become adults predation by other organisms is very low (Becker, 1983).

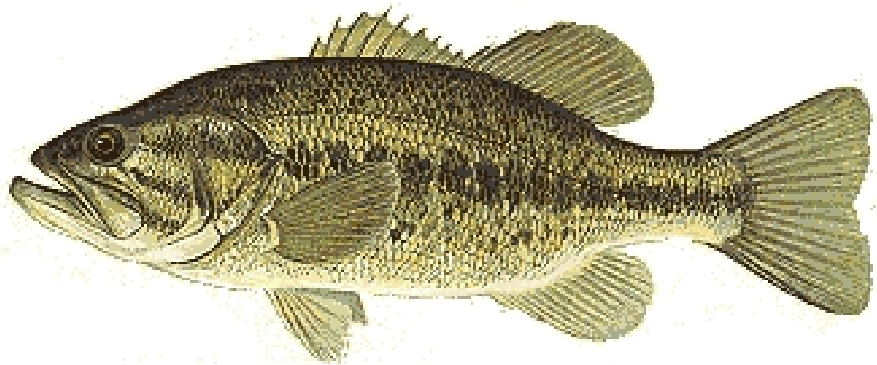


Figure 5. Largemouth Bass (IDNR, 2003).

Like largemouth bass, white crappie (Figure 6) are members of the family Centrarchidae that can be found in both lentic and lotic environments (Robison and Buchanan, 1988). This species demonstrates a preference for quiet waters and is more tolerant to turbidity than most other sunfish species (Robison and Buchanan, 1988). Juvenile crappie will feed on small crustaceans, but adults are primarily piscivorus (Robison and Buchanan, 1988; Linam *et al*., 2002). Crappie sexually mature at 2 to 3 years of age and can live up to 8 years (Robison and Buchanan, 1988).

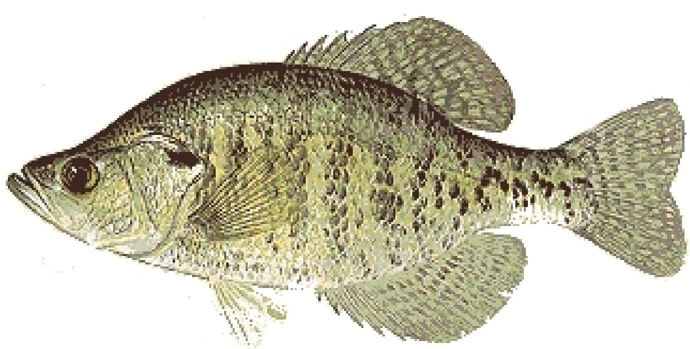


Figure 6. White Crappie (IDNR, 2003).

Also known as sand bass, white bass (Figure 7) are temperate bass that are members of the family Percichthyidae (formerly family Moronidae) (Robison and Buchanan, 1988; Kolbe and Luedke, 1993). This species is pelagic and is intolerant to continuous high turbidity (Robison and Buchanan, 1988). White bass will travel in large schools in search of food (Robison and Buchanan, 1988). Juvenile white bass will subsist on crustaceans and insects, while adults are primarily piscivorus, feeding on shad, centrarchids, and cyprinids (Robison and Buchanan, 1988; Linam *et al.*, 2002). Growth for this species is relatively rapid and the life span is short with individuals rarely living more than 4 years (Robison and Buchanan, 1988).

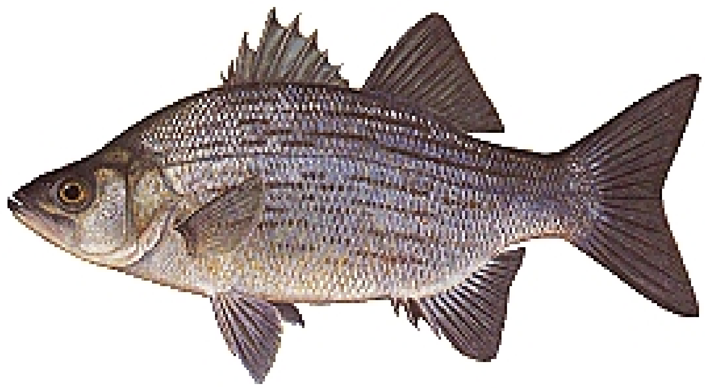


Figure 7. White Bass (IDNR, 2003).

Channel catfish (Figure 8) are extremely adaptable fish that do equally well in lentic and lotic systems and are moderately tolerant to variations in water quality conditions (Robison and Buchanan, 1988; Jester *et al.*, 1992). This species feeds on a variety of prey ranging from fish, insects, molluscs, and crayfish to plant material and detritus (Robison and Buchanan, 1988). Fingerlings feed predominantly on benthic invertebrates while adults, which also usually feed on the benthos, prefer a more omnivorous to piscivorus diet (Becker, 1983; Robison and Buchanan, 1988; Pflieger, 1991; Etnier and Starnes, 1993). Channel catfish sexually mature at 3 to 5 years [305-380 millimeters (mm) (12 - 15 inches) in length] and can live from 10 to 24 years; however, their normal life span is usually 7 years or less (Robison and Buchanan, 1988; Pflieger, 1991; Etnier and Starnes, 1993). Adults suffer little from predation but juveniles are vulnerable to predacious insects and other fish including bluegill and bass (Becker, 1983).

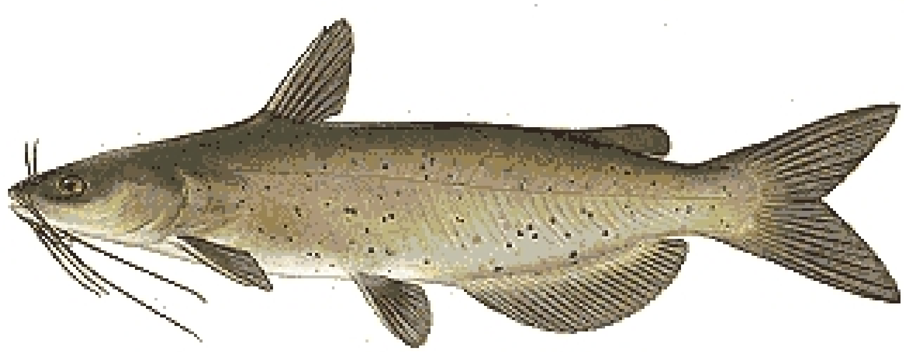


Figure 8. Channel Catfish (IDNR, 2003).

A total of 48 fish (five smallmouth buffalo, five common carp, five freshwater drum, 10 largemouth bass, five white bass, eight white crappie, and 10 channel catfish) were collected at Lake Worth from the cove adjacent to Air Force Plant Number 4, from the shoreline adjacent to the NASJRB, and from an area of the reservoir away from the NASJRB (Figure 1) using a direct-current-boom electro-fishing boat. The cove receives inflow from Meandering Road Creek. This portion of the reservoir and the shoreline next to the NASJRB were targeted by the USFWS/USACOE because the most contaminated fish collected by the USGS in 1999 appeared to be from these areas. Once collected, all fish were placed on ice in coolers and transported to the USFWS Arlington, Texas, Ecological Services Field Office where each fish was measured, weighed, individually vacuum sealed in plastic bags using a Food Saver VacLoc Deluxe II Vacuum Sealer (Model No. 99-21-F-01-5226), and frozen. These fish were subsequently submitted through the USFWS Patuxent Analytical Control Facility to a contract laboratory for tissue-chemical analyses. Edible muscle tissues (skinless fillets) were collected from each fish by the contract laboratory and analyzed for lipid and moisture content, residual organochlorine pesticides [1,2,3,4-terachlorobenzene, 1,2,4,5-tetrachlorobenzene, aldrin, hexachlorobenzene (HCB), heptachlor, alpha-hexachlorocyclohexane (αBHC), alpha (α) chlordane, beta-hexachlorocyclohexane (βBHC), *cis*-nonachlor, delta- hexachlorocyclohexane (δBHC), dieldrin, endosulfan II, endrin, gamma-hexachlorocyclohexane (γBHC), gamma (γ) chlordane, heptachlor epoxide, mirex, *o,p*'-dichloro-diphenyl-dichloroethane (o,p'-DDD), *o,p*'-dichloro-diphenyl-dichloroethylene (o,p'-DDE), *o,p*'-dichloro-diphenyl-trichloroethane (o,p'-DDT), *oxy*chlordane, *p,p*'-dichloro-diphenyl-dichloroethane (p,p'-DDD), *p,p*'-dichloro-diphenyl-dichloroethylene (p,p'-DDE), *p,p*'-dichloro-diphenyl-trichloroethane (p,p'-DDT), pentachloro-anisole, toxaphene, and *trans*-nonachlor], an organophosphate pesticide (chlorpyrifos), and PCBs (Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260, total PCBs, and 96 PCB congeners) (for analytical methods see Appendix A).

RESULTS AND DISCUSSION

Size and general sample location of the fish collected from Lake Worth by the USFWS/USACOE are presented in Table 1. Arithmetic mean length and weight of these fish are presented in Table 2, while lipid and moisture content for each fish collected from the reservoir in 2003 are presented as percentages in Table 3. Smallmouth buffalo, largemouth bass, channel catfish, and freshwater drum collected in 2003 were larger in comparison to the same species collected by the USGS in 1999 (Table2). In contrast, the white crappie and common carp collected in 2003 were smaller in body weight than the crappie and carp sampled from the reservoir in 1999 (Table 2). White bass were not collected from the reservoir by the USGS in 1999. Of the seven species sampled, smallmouth buffalo contained the highest lipid content, followed by common carp and white bass (Table 3). Freshwater drum contained the lowest lipid content (Table 3).

Following are the organochlorine pesticide and PCB analytical results. In interpreting the analytical data, the conservative approach of selecting the numeric value immediately below the detection limit (ie.,using 0.0004 mg/kg wet weight when the analytical detection limit was 0.0005 mg/kg wet weight) was employed when concentrations were less than the analytical detection limits to calculate arithmetic means and other descriptive statistics. This method was selected instead of the more

Table 1. Individual fish collected from Lake Worth, Tarrant County, Texas, November, 2003 [Note - mm is millimeters; in is inches; g is grams; lb is pounds; C is cove adjacent to Air Force Plant Number 4; S is shoreline adjacent to Naval Air Station Joint Reserve Base Ft. Worth (NASJRB); and OW is open water away from NASJRB].

Family	Species	Sample ID	Length		Weight		Location
			mm	in	g	lb	
Catostomidae	*Ictiobus bubalus* - Smallmouth Buffalo	LWB1	620	24.4	4700	10.4	C
	Ictiobus bubalus - Smallmouth Buffalo	LWB2	680	26.8	6400	14.1	C
	Ictiobus bubalus - Smallmouth Buffalo	LWB3	580	22.8	4700	10.4	C
	Ictiobus bubalus - Smallmouth Buffalo	LWB4	680	26.8	6000	13.2	C
	Ictiobus bubalus - Smallmouth Buffalo	LWB5	670	26.4	5365	11.8	C
Centrarchidae	*Micropterus salmoides* - Largemouth Bass	LWLMB1	410	16.1	1050	2.3	C
	Micropterus salmoides - Largemouth Bass	LWLMB2	455	17.9	1400	3.1	C
	Micropterus salmoides - Largemouth Bass	LWLMB3	400	15.7	875	1.9	C
	Micropterus salmoides - Largemouth Bass	LWLMB4	572	22.5	3700	8.2	S
	Micropterus salmoides - Largemouth Bass	LWLMB5	448	17.6	1100	2.4	C
	Micropterus salmoides - Largemouth Bass	LWLMB6	435	17.1	1300	2.9	C
	Micropterus salmoides - Largemouth Bass	LWLMB7	380	14.9	800	1.8	OW
	Micropterus salmoides - Largemouth Bass	LWLMB8	410	16.1	1000	2.2	OW
	Micropterus salmoides - Largemouth Bass	LWLMB9	400	15.7	950	2.1	OW
	Micropterus salmoides - Largemouth Bass	LWLMB10	480	18.9	1700	3.7	OW
	Pomoxis annularis - White Crappie	LWCR1	335	13.1	550	1.2	C
	Pomoxis annularis - White Crappie	LWCR2	230	9.1	200	0.4	C
	Pomoxis annularis - White Crappie	LWCR3	200	7.9	150	0.3	C
	Pomoxis annularis - White Crappie	LWCR4	260	10.2	200	0.4	C
	Pomoxis annularis - White Crappie	LWCR5	230	9.1	150	0.3	C
	Pomoxis annularis - White Crappie	LWCR6	235	9.3	100	0.2	OW
	Pomoxis annularis - White Crappie	LWCR7	210	8.3	80	0.2	OW
	Pomoxis annularis - White Crappie	LWCR8	258	10.2	271	0.6	S
Cyprinidae	*Cyprinus carpio* - Common Carp	LWC1	536	21.1	2174	4.8	C
	Cyprinus carpio - Common Carp	LWC2	680	26.8	4300	9.5	C
	Cyprinus carpio - Common Carp	LWC3	730	28.7	5500	12.1	C
	Cyprinus carpio - Common Carp	LWC4	640	25.2	3648	8.0	C
	Cyprinus carpio - Common Carp	LWC5	575	22.6	2800	6.2	C
Ictaluridae	*Ictalurus punctatus* - Channel Catfish	LWCC1	560	22.0	2000	4.4	C
	Ictalurus punctatus - Channel Catfish	LWCC2	528	20.8	1500	3.3	C
	Ictalurus punctatus - Channel Catfish	LWCC3	560	22.0	1600	3.5	C
	Ictalurus punctatus - Channel Catfish	LWCC4	485	19.1	850	1.9	OW
	Ictalurus punctatus - Channel Catfish	LWCC5	430	16.9	600	1.3	OW
	Ictalurus punctatus - Channel Catfish	LWCC6	525	20.7	1500	3.3	OW
	Ictalurus punctatus - Channel Catfish	LWCC7	585	23.0	1600	3.5	S
	Ictalurus punctatus - Channel Catfish	LWCC8	536	21.1	1700	3.7	S
	Ictalurus punctatus - Channel Catfish	LWCC9	529	20.8	1300	2.9	S
	Ictalurus punctatus - Channel Catfish	LWCC10	636	25.0	3200	7.1	S
Percichthyidae	*Morone chrysops* - White Bass	LWWB1	325	12.8	400	0.9	OW
	Morone chrysops - White Bass	LWWB2	341	13.4	500	1.1	OW
	Morone chrysops - White Bass	LWWB3	360	14.2	500	1.1	OW
	Morone chrysops - White Bass	LWWB4	365	14.4	600	1.3	OW
	Morone chrysops - White Bass	LWWB5	340	13.4	400	0.9	OW
Sciaenidae	*Aplodinotus grunniens* - Freshwater Drum	LWD1	511	20.1	1743	3.8	C
	Aplodinotus grunniens - Freshwater Drum	LWD2	555	21.9	2098	4.6	C
	Aplodinotus grunniens - Freshwater Drum	LWD3	543	21.4	2139	4.7	C
	Aplodinotus grunniens - Freshwater Drum	LWD4	535	21.1	1750	3.9	C
	Aplodinotus grunniens - Freshwater Drum	LWD5	515	20.3	1859	4.1	C

Table 2. Arithmetic mean length and weight of fish collected from Lake Worth by the USFWS/USACOE in 2003, compared to mean length and weight of fish collected from Lake Worth by the USGS in 1999 (Note - mm is millimeters; in is inches; g is grams; lb is pounds; nc is not collected; and na is not applicable).

Species Collected	Sample	Length		Weight		Species Collected	Sample	Length		Weight	
in 2003	Size	mm	in	g	lb	in 1999	Size	mm	in	g	lb
Smallmouth Buffalo	5	646	25.4	5433	12.0	Smallmouth Buffalo	5	447	17.6	4873	10.7
Largemouth Bass	10	439	17.3	1388	3.1	Largemouth Bass	10	384	15.1	1312	2.9
White Crappie	8	245	9.7	213	0.5	White Crappie	10	242	9.5	423	0.9
Common Carp	5	632	24.9	3684	8.1	Common Carp	10	533	21.0	4458	9.8
Channel Catfish	10	537	21.1	1585	3.5	Channel Catfish	10	389	15.3	986	2.2
White Bass	5	346	13.6	480	1.1	White Bass - nc	na	na	na	na	na
Freshwater Drum	5	532	21.0	1918	4.2	Freshwater Drum	10	369	14.5	1520	3.4

traditional approach of using one-half the analytical detection limit in evaluating concentrations less than the detection levels because of potential human health concerns associated with consuming contaminated fish from the reservoir.

Organochlorine Pesticides

Results of the organochlorine pesticide analyses in milligrams/kilogram (mg/kg) wet weight for the individual skinless fish fillet samples are presented in Table 4. Each sample was analyzed for 28 separate compounds. Of these compounds, heptachlor, alpha- and gamma-BHC, endrin, heptachlor epoxide, *o,p'*-DDE, toxaphene, and chlorpyrifos were not detected above the analytical detection limits in any of the samples collected and are not discussed further in this report. Where applicable, detected organochlorine pesticide concentrations were qualitatively compared to data collected from the previous study conducted at Lake Worth by the USGS in 1999 and to the subsequent TDH health advisory in an attempt to ascertain the temporal trend of organochlorine pesticides in fish inhabiting the reservoir. Resulting data were also qualitatively compared to human health screening criteria and/or action levels developed by the USEPA, U.S. Food and Drug Administration (USFDA), and Texas Commission on Environmental Quality (TCEQ) to evaluate possible health risks associated with consuming fish from the reservoir. The 2003 data were not statistically compared to the 1999 data because, on average, the analytical detection limits used in 1999 were 10 times higher than those employed in 2003 (0.0005 verses 0.005 mg/kg wet weight for organochlorine pesticides and 0.005 verses 0.05 mg/kg wet weight for PCBs).

[1,2,3,4-Tetrachlorobenzene] Used as an ingredient in dielectric fluids and pesticides, 1,2,3,4-tetrachlorobenzene is highly toxic to aquatic organisims and is considered a suspected teratogen (Sax and Lewis, 1987). Currently, screening criteria are not available for this compound nor were the fish tissue samples collected in 1999 analyzed for 1,2,3,4-tetrachlorobenzene. This compound was detected at or above the analytical detection limits in 29% (14/48) of the fish collected from Lake Worth by the USFWS/USACOE in 2003 (Table 4). The arithmetic mean ($\bar{x}$) 1,2,3,4-tetrachlorobenzene concentration was calculated to be 0.0005 mg/kg wet weight [sample size (n) = 48; standard deviation (s) = 0.0002]. Detected concentrations ranged from 0.0005 mg/kg wet weight in one largemouth bass (LWLMB7) and two channel catfish (LWCC1 and LWCC3) to 0.0013

Table 3. Lipid and moisture content of 48 fish collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note - B is smallmouth buffalo; LMB is largemouth bass, CR is white crappie; C is common carp; CC is channel catfish; and D is freshwater drum).

Sample ID	Percent Lipid	Percent Moisture
LWB1	5.6	73.5
LWB2	8.5	61.7
LWB3	9.0	68.6
LWB4	5.6	73.9
LWB5	2.7	77.3
LWLMB1	0.4	77.7
LWLMB2	0.4	78.0
LWLMB3	0.2	77.5
LWLMB4	0.8	78.2
LWLMB5	0.1	78.1
LWLMB6	0.3	78.4
LWLMB7	1.1	77.7
LWLMB8	0.3	78.5
LWLMB9	0.3	78.2
LWLMB10	0.6	77.2
LWCR1	0.1	78.8
LWCR2	0.2	79.0
LWCR3	0.4	79.5
LWCR4	0.2	78.8
LWCR5	0.4	79.3
LWCR6	0.4	79.4
LWCR7	0.6	80.1
LWCR8	0.3	77.5
LWC1	0.4	78.9
LWC2	1.0	78.4
LWC3	0.8	76.5
LWC4	1.6	76.9
LWC5	1.5	77.0
LWCC1	0.2	80.8
LWCC2	0.2	80.2
LWCC3	0.1	83.3
LWCC4	0.2	80.6
LWCC5	0.2	82.4
LWCC6	0.2	82.5
LWCC7	0.7	79.6
LWCC8	1.6	78.6
LWCC9	0.2	80.9
LWCC10	4.1	77.3
LWWB1	0.7	77.8
LWWB2	1.0	78.4
LWWB3	1.1	77.6
LWWB4	1.2	78.6
LWWB5	1.3	76.6
LWD1	0.1	82.1
LWD2	0.2	80.3
LWD3	0.2	79.7
LWD4	0.1	81.3
LWD5	0.3	79.9

Table 4. Results of organochlorine pesticide analyses in mg/kg wet weight for skinless fish muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note - B is smallmouth buffalo; LMB is largemouth bass; dl is the analytical detection limit; bdl is below the analytical detection limit; and ✭ is detected above the analytical detection limit).

Analyte	LWB1	LWB2	LWB3	LWB4	LWB5	LWLMB 1	LWLMB 2	LWLMB 3
1,2,3,4-tetrachlorobenzene ✭	bdl	0.0013✭	bdl	bdl	bdl	0.0007✭	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
1,2,4,5-tetrachlorobenzene ✭	0.0035✭	0.0021✭	0.0045✭	0.0044✭	0.0021✭	0.0049✭	0.0017✭	0.0021✭
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
aldrin	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
HCB ✭	bdl	0.0013✭	0.0005✭	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
heptachlor	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
αBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
αchlordane ✭	0.0017✭	0.0231✭	0.0029✭	0.0040✭	0.0021✭	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
βBHC ✭	bdl	0.0005✭	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
cis-nonachlor ✭	0.0012✭	0.0304✭	0.0022✭	0.0039✭	0.0035✭	0.0006✭	0.0009✭	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
δBHC ✭	bdl	bdl	0.0009✭	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
dieldrin✭	0.0010✭	0.0074✭	0.0020✭	0.0014✭	0.0008✭	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
endosulfan II ✭	bdl	bdl	0.0008✭	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
endrin	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
γBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
γchlordane ✭	0.0012✭	0.0111✭	0.0021✭	0.0021✭	0.0008✭	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
heptachlor epoxide	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
mirex ✭	bdl	0.0024✭	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
o,p'-DDD ✭	bdl	0.0071✭	bdl	0.0007✭	0.0007✭	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
o,p'-DDE	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
o,p'-DDT ✭	bdl	0.0099✭	0.0005✭	0.0009✭	0.0009✭	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
oxychlordane ✭	bdl	0.0035✭	bdl	0.0010✭	0.0005✭	bdl	0.0005✭	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
p,p'-DDD ✭	0.0006✭	0.0187✭	0.0015✭	0.0017✭	0.0014✭	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
p,p'-DDE ✭	0.0055✭	0.265✭	0.0128✭	0.0245✭	0.0808✭	0.0024✭	0.0060✭	0.0008✭
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
p,p'-DDT ✭	bdl	0.0072✭	bdl	0.0005✭	0.0007✭	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
pentachloro-anisole ✭	0.0013✭	0.0037✭	0.0020✭	0.0012✭	0.0010✭	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
toxaphene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0047	0.0044	0.0045	0.0048	0.0048	0.0049	0.0049	0.0050
trans-nonachlor ✭	0.0019✭	0.0435✭	0.0030✭	0.0057✭	0.0059✭	0.0009✭	0.0022✭	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
chlorpyrifos	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005

Table 4 (continued). Results of organochlorine pesticide analyses in mg/kg wet weight for skinless fish muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note - LMB is largemouth bass; CR is white crappie; dl is the analytical detection limit; bdl is below the analytical detection limit; and ★ is detected above the analytical detection limit).

Analyte	LWLMB 4	LWLMB 5	LWLMB 6	LWLMB 7	LWLMB 8	LWLMB 9	LWLMB10	LWCR1
1,2,3,4-tetrachlorobenzene ★	bdl	bdl	bdl	0.0005★	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
1,2,4,5-tetrachlorobenzene ★	0.0018★	0.0021★	0.0019★	0.0023★	0.0025★	0.0020★	0.0028★	0.0037★
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
aldrin	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
HCB	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
heptachlor	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
αBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
αchlordane	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
βBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
cis-nonachlor ★	0.0008★	0.0005★	0.0008★	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
δBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
dieldrin	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
endosulfan II	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
endrin	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
γBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
γchlordane	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
heptachlor epoxide	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
mirex	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
o,p'-DDD	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
o,p'-DDE	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
o,p'-DDT	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
oxychlordane	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
p,p'-DDD	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
p,p'-DDE ★	0.0045★	0.0028★	0.0027★	0.0033★	0.0011★	0.0009★	0.0017★	0.0009★
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
p,p'-DDT	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
pentachloro-anisole	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
toxaphene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0049	0.0051	0.0049	0.0050	0.0049	0.0049	0.0052	0.0047
trans-nonachlor ★	0.0009★	0.0008★	0.0016★	0.0008★	0.0005★	0.0008★	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
chlorpyrifos	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005

Table 4 (continued). Results of organochlorine pesticide analyses in mg/kg wet weight for skinless fish muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note- CR is white crappie; C is common carp; dl is the analytical detection limit; bdl is below the analytical detection limit; and ★ is detected above the analytical detection limit).

Analyte	LWCR2	LWCR3	LWCR4	LWCR5	LWCR6	LWCR7	LWCR8	LWC1
1,2,3,4-tetrachlorobenzene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
1,2,4,5-tetrachlorobenzene ★	0.0056★	0.0058★	0.0037★	0.0034★	0.0036★	0.0064★	0.0021★	0.0026★
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
aldrin	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
HCB	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
heptachlor	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
αBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
αchlordane	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
βBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
cis-nonachlor ★	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.0006★
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
δBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
dieldrin	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
endosulfan II	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
endrin	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
γBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
γchlordane	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
heptachlor epoxide	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
mirex	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
o,p'-DDD	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
o,p'-DDE	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
o,p'-DDT	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
oxychlordane	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
p,p'-DDD	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
p,p'-DDE ★	0.0006★	0.0010★	0.0006★	0.0012★	0.0006★	0.0015★	0.0007★	0.0026★
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
p,p'-DDT	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
pentachloro-anisole	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
toxaphene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0049	0.0077	0.0051	0.0045	0.0047	0.0072	0.0049	0.0050
trans-nonachlor ★	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.0007★
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005
chlorpyrifos	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0008	0.0005	0.0005	0.0005	0.0007	0.0005	0.0005

Table 4 (continued). Results of organochlorine pesticide analyses in mg/kg wet weight for fish skinless muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note - C is common carp; CC is channel catfish; dl is the analytical detection limit; bdl is below the analytical detection limit; and ✭ is detected above the analytical detection limit).

Analyte	LWC2	LWC3	LWC4	LWC5	LWCC1	LWCC2	LWCC3	LWCC4
1,2,3,4-tetrachlorobenzene ✭	bdl	bdl	0.0008✭	bdl	0.0005✭	0.0008✭	0.0005✭	0.0010✭
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
1,2,4,5-tetrachlorobenzene ✭	0.0041✭	0.0042✭	0.0029✭	0.0023✭	0.0023✭	0.0025✭	0.0034✭	0.0022✭
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
aldrin	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
HCB	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
heptachlor	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
αBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
αchlordane ✭	0.0009✭	0.0013✭	0.0009✭	0.0009✭	0.0005✭	0.0009✭	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
βBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
cis-nonachlor ✭	0.0012✭	0.0020✭	0.0010✭	0.0012✭	0.0010✭	0.0009✭	0.0008✭	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
δBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
dieldrin ✭	bdl	0.0006✭	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
endosulfan II ✭	bdl	0.0018✭	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
endrin	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
γBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
γchlordane ✭	0.0007✭	0.0010✭	0.0005✭	0.0006✭	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
heptachlor epoxide	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
mirex	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
o,p'-DDD ✭	bdl	0.0006✭	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
o,p'-DDE	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
o,p'-DDT ✭	0.0005✭	0.0007✭	0.0006✭	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
oxychlordane ✭	bdl	bdl	bdl	bdl	0.0008✭	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
p,p'-DDD ✭	0.0006✭	0.0008✭	0.0005✭	0.0006✭	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
p,p'-DDE ✭	0.0059✭	0.0082✭	0.0057✭	0.0053✭	0.0098✭	0.0070✭	0.0051✭	0.0016✭
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
p,p'-DDT	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
pentachloro-anisole ✭	bdl	bdl	0.0005✭	0.0005✭	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
toxaphene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0048	0.0046	0.0048	0.0050	0.0049	0.0049	0.0049	0.0049
trans-nonachlor ✭	0.0020✭	0.0031✭	0.0012✭	0.0015✭	0.0033✭	0.0031✭	0.0015✭	0.0008✭
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
chlorpyrifos	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005

Table 4 (continued). Results of organochlorine pesticide analyses in mg/kg wet weight for skinless fish muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note - CC is channel catfish; WB is white bass; dl is the analytical detection limit; bdl is below the analytical detection limit; and ✭ is detected above the analytical detection limit).

Analyte	LWCC5	LWCC6	LWCC7	LWCC8	LWCC9	LWCC10	LWWB1	LWWB2
1,2,3,4-tetrachlorobenzene ✭	bdl	0.0007✭	bdl	bdl	0.0007✭	0.0006✭	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
1,2,4,5-tetrachlorobenzene ✭	0.0026✭	0.0026✭	0.0023✭	0.0018✭	0.0033✭	0.0009✭	0.0040✭	0.0035✭
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
aldrin	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
HCB ✭	bdl	bdl	bdl	bdl	bdl	0.0007✭	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
heptachlor	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
αBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
αchlordane ✭	bdl	bdl	bdl	bdl	bdl	0.0016✭	0.0006✭	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
βBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
cis-nonachlor ✭	bdl	bdl	0.0009✭	bdl	bdl	0.0020✭	0.0007✭	0.0006✭
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
δBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
dieldrin ✭	bdl	bdl	bdl	bdl	bdl	0.0008✭	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
endosulfan II	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
endrin	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
γBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
γchlordane ✭	bdl	bdl	bdl	bdl	bdl	0.0006✭	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
heptachlor epoxide	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
mirex	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
o,p'-DDD	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
o,p'-DDE	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
o,p'-DDT	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
oxychlordane	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
p,p'-DDD ✭	bdl	bdl	bdl	bdl	bdl	0.0008✭	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
p,p'-DDE ✭	0.0009✭	0.0012✭	0.0078✭	0.0009✭	0.0013✭	0.0167✭	0.0038✭	0.0039✭
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
p,p'-DDT	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
pentachloro-anisole ✭	bdl	bdl	bdl	bdl	bdl	0.0014✭	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
toxaphene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0050	0.0049	0.0051	0.0050	0.0047	0.0050	0.0048	0.0048
trans-nonachlor ✭	bdl	0.0005✭	0.0022✭	0.0014✭	bdl	0.0034✭	0.0007✭	0.0006✭
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
chlorpyrifos	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005

Table 4 (concluded). Results of organochlorine pesticide analyses in mg/kg wet weight for skinless fish muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note - WB is white bass; D is freshwater drum; dl is the analytical detection limit; bdl is below the analytical detection limit; and ✯ is detected above the analytical detection limit).

Analyte	**LWWB3**	**LWWB4**	**LWWB5**	**LWD1**	**LWD2**	**LWD3**	**LWD4**	**LWD5**
1,2,3,4-tetrachlorobenzene ✯	bdl	bdl	bdl	bdl	0.0010✯	0.0006✯	bdl	0.0008✯
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
1,2,4,5-tetrachlorobenzene ✯	0.0029✯	0.0029✯	0.0019✯	0.0022✯	0.0032✯	0.0020✯	0.0021✯	0.0027✯
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
aldrin ✯	bdl	bdl	bdl	bdl	0.0006✯	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
HCB	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
heptachlor	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
αBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
αchlordane ✯	0.0007✯	0.0006✯	0.0007✯	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
βBHC ✯	bdl	bdl	bdl	bdl	bdl	0.0010✯	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
cis-nonachlor ✯	0.0016✯	0.0010✯	0.0010✯	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
δBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
dieldrin	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
endosulfan II	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
endrin	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
γBHC	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
γchlordane	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
heptachlor epoxide	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
mirex	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
o,p'-DDD	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
o,p'-DDE	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
o,p'-DDT	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
oxychlordane	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
p,p'-DDD	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
p,p'-DDE ✯	0.0131✯	0.0069✯	0.0051✯	0.0011✯	0.0031✯	0.0005✯	0.0007✯	0.0007✯
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
p,p'-DDT	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
pentachloro-anisole	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
toxaphene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0045	0.0048	0.0048	0.0049	0.0050	0.0048	0.0049	0.0050
trans-nonachlor ✯	0.0023✯	0.0010✯	0.0009✯	bdl	bdl	0.0006✯	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
chlorpyrifos	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005

mg/kg wet weight in a smallmouth buffalo (LWB2)(Table 4). None of the white crappie or white bass sampled from the reservoir contained detectable amounts of 1,2,3,4-tetrachlorobenzene (Table 4).

[1,2,4,5-Tetrachlorobenzene] Listed by the USEPA as a persistent, bio-accumulative, and toxic chemical (PBT), 1,2,4,5-tetrachlorobenzene is a common component of many herbicides, insecticides, defoliants, and electrical insulation fluids (Sax and Lewis, 1987; NDDH, 2002). Sub-chronic exposure to 1,2,4,5-tetrachlorobenzene has resulted in renal non-carcinogenic toxicological effects to exposed mammals (USEPA, 2004). In fish tissues, the TCEQ (2003) recommends a human-health screening level of 5.85 mg/kg wet weight for freshwater systems. The fish collected from the reservoir in 1999 were not analyzed for 1,2,4,5-tetrachlorobenzene.

In contrast to the 1,2,3,4-tetrachlorobenzene analytical results, 1,2,4,5-tetrachlorobenzene was detected above the analytical detection limits in all 48 of the fish collected from Lake Worth in 2003 (Table 4). Measured concentrations ranged from 0.0009 mg/kg wet weight in a channel catfish (LWCC10) to 0.0064 mg/kg wet weight in a white crappie (LWCR7) (Table 4). The overall arithmetic mean was calculated to be 0.003 mg/kg wet weight (n = 48; s = 0.0012). By species, white crappie contained the highest 1,2,4,5-tetrachlorobenzene concentrations ($\bar{x}$ = 0.0043 mg/kg wet weight; n = 8; s = 0.0015), while largemouth bass ($\bar{x}$ = 0.0024 mg/kg wet weight; n = 10; s = 0.0009), channel catfish ($\bar{x}$ = 0.0024 mg/kg wet weight; n = 10; s = 0.0007), and freshwater drum ($\bar{x}$ = 0.0024 mg/kg wet weight; n = 5; s = 0.0005) all contained the lowest concentrations. Common carp were determined to have a mean concentration of 0.0032 mg/kg wet weight (n = 5; s = 0.0009), while both smallmouth buffalo (n = 5; s = 0.0008) and white bass (n = 5; s = 0.0008) had mean concentrations equal to 0.003 mg/kg wet weight. None of the 48 fish collected contained 1,2,4,5-tetrachlorobenzene concentrations that equaled or exceeded the screening value recommended by the TCEQ (2003).

[Aldrin] Considered by the USEPA as a probable human carcinogen, aldrin was used as a pesticide in the United States from 1950 through 1970 (ATSDR, 1993). In 1974, the USEPA banned all uses of aldrin except for subterranean termite control (ATSDR, 1993). In 1987, the USEPA banned all commercial uses of this compound in the United States (ATSDR, 1993). When released into the environment, aldrin readily breaks down to the epoxide dieldrin through microbial and photic degradation (ATSDR, 1993; Cornell, 1998). Chronic exposure to aldrin has resulted in hepatic non-carcinogenic toxicological effects in mammals (USEPA, 2004).

In edible fish tissue, the USEPA reports an aldrin concentration of 0.0007 mg/kg wet weight as a conservative human health screening value, whereas the USFDA action level is 0.3 mg/kg wet weight and the screening value recommended by the TCEQ is 0.136 mg/kg wet weight (Nowell and Resek, 1994; USFDA, 2000; TCEQ, 2003). The USEPA value is based on a carcinogenicity risk level of 1 x 10^{-6} (1 in 1,000,000) and negligible non-cancer health risks (Nowell and Resek, 1994). The USFDA action level is applicable for interstate commerce and represents a regulatory limit that when equaled or exceeded could result in legal action being taken by the USFDA to prevent the consumption of a given contaminant (Nowell and Resek, 1994; USFDA, 2000). The screening value reported by the TCEQ (2003) is based on a carcinogenicity risk level of 1 x 10^{-5} (1 in 100,000).

None of the 55 fish collected from Lake Worth by the USGS in 1999 contained aldrin levels above the analytical detection limits (TDH, 2000). Of the 48 fish collected by the USFWS/USACOE in 2003, only one sample, a freshwater drum (LWD2), contained an aldrin concentration above the analytical detection limit (Table 4). The concentration measured in this fish (0.0006 mg/kg wet weight) was below all cited screening values (Nowell and Resek, 1994; USFDA, 2000; TCEQ, 2003).

[Chlordane, isomers, and metabolites)] Listed by the USEPA as a probable carcinogen, technical chlordane consists of the stereoisomers alpha (α) and gamma (γ) or *cis* and *trans*-chlordane, heptachlor, *cis*- and *trans*-nonachlor, and the metabolites oxychlordane and heptachlor epoxide (ATSDR, 1994; USEPA, 2004). First developed in 1946, chlordane was used as a general pesticide until 1983 (LMF, 2002). Between 1983 and 1988, use of chlordane in the United States was restricted by the USEPA to subterranean termite control (ATSDR, 1994). All commercial use of chlordane as a pesticide was banned by the USEPA in the United States in 1988 (ATSDR, 1994). Once in the environment, chlordane binds tightly with soil particles and can remain in the soil for more than 20 years (LMF, 2002). It can bio-accumulate in the tissues of fish, birds, and mammals and can adversely affect the nervous, digestive, and hepatic systems in both humans and animals (ATSDR, 1994; LMF, 2002). In edible fish tissue, the USEPA considers a technical chlordane concentration of 0.0083 mg/kg wet weight as a conservative human-health screening value (Nowell and Resek, 1994). This concentration is based on a carcinogenicity risk level of 1 x 10^{-6} and negligible non-cancer health risks (Nowell and Resek, 1994). In contrast, both the USFDA action level and the TCEQ screening value are reported at 0.3 mg/kg wet weight (USFDA, 2000; TCEQ, 2003). The TCEQ (2003) value is based on a carcinogenicity risk of 1 x 10^{-5}.

According to the TDH (2000), technical chlordane was detected in 51% (28/55) of the fish samples collected by the USGS from Lake Worth in 1999. Chlordane isomers and/or metabolites were detected above the analytical limits in three of the five smallmouth buffalo, five of the 10 freshwater drum, eight of the 10 common carp, four of the 10 largemouth bass, and eight of the 10 channel catfish collected by the USGS (TDH, 2000). White crappie collected in 1999 did not contain detectable amounts of chlordane (TDH, 2000). The reported concentrations ranged from below the analytical detection limits [less than (<)0.005 mg/kg wet weight] to 0.0389 mg/kg wet weight ($\bar{x}$ = 0.0034 mg/kg wet weight; n = 55) (TDH, 2000).

In comparison, chlordane metabolites and/or isomers were detected at or above the analytical detection limits in 67% (32/48) of the fish collected by the USFWS/USACOE from Lake Worth in 2003 (Table 4). All of the smallmouth buffalo, common carp, and white bass collected in 2003 contained detectable amounts of chlordane (Table 4). In addition, eight of the 10 largemouth bass, eight of the 10 channel catfish, and one of the five freshwater drum sampled by the USFWS/USACOE also contained chlordane levels above the analytical detection limits (Table 4).

As with the 1999 results, white crappie collected in 2003 did not contain detectable amounts of chlordane (Table 4).

Technical chlordane values were determined for the 2003 fish data following Munn and Gruber (1997), by calculating the sum of α- and γchlordane, *cis*- and *trans*-nonachlor, oxychlordane, heptachlor, and heptachlor epoxide for each sample where detected above the analytical detection limit (Table 5). The overall arithmetic mean was determined to be 0.005 mg/kg wet weight (n = 48; s = 0.0161). The calculated technical chlordane concentrations ranged from 0.0005 mg/kg wet weight to 0.1116 mg/kg wet weight (n = 32) (Table 5). By species, mean technical chlordane levels ranged from 0.0004 mg/kg wet weight in freshwater drum (n = 5; s = 8.94 x 10^{-5}) to 0.0315 mg/kg wet weight in smallmouth buffalo (n = 5; s = 0.0449). Common carp contained a mean chlordane concentration of 0.0043 mg/kg wet weight (n = 5; s = 0.0022), while white bass (n = 5; s = 0.0013), channel catfish (n = 10; s = 0.0026), and largemouth bass (n = 10; s = 0.001) contained mean concentrations of 0.0026, 0.0024, and 0.0013 mg/kg wet weight; respectively. None of these fish contained detectable technical chlordane concentrations that exceeded the cited USFDA action level or the TCEQ screening value; however four smallmouth buffalo (LWB2, LWB3, LWB4, and LWB5) contained levels that exceeded the cited USEPA criterion (Nowell and Resek, 1994; TCEQ, 2003). In addition, the overall mean (0.005 mg/kg wet weight) calculated from the 2003 data was slightly greater than the arithmetic mean (0.0034 mg/kg wet weight) reported by the TDH (2000) from the 1999, USGS data.

[Dichloro-diphenyl-trichloroethane (DDT), isomers, and metabolites] First developed in 1939, dichloro-diphenyl-trichloroethane (DDT) was used extensively throughout the world as an all purpose insecticide (ATSDR, 1995). Considered a probable human carcinogen by the USEPA, commercial production of DDT was banned in the United States in 1972 because of adverse affects to non-target wildlife species and the potential harm to human health (ATSDR, 1995; ATSDR, 2000a). The metabolites dichloro-diphenyl-dichloroethane (DDD) and dichloro-diphenyl-dichloroethylene (DDE) are microbial degradation products formed by the dehydrohalogenation of DDT (ATSDR, 2000a). In wildlife, DDT exposure has resulted in birds, alligators, and turtles producing eggs with shells too thin for offspring survival (Baskin, 2002). This compound exhibits very low solubility in aquatic environments and bio-accumulates in the fatty tissues of fish, birds, and other animals (Baskin, 2002). Chronic exposure has resulted in hepatic non-carcinogenic toxicological effects in mammals (USEPA, 2004). In edible fish tissue, the USEPA recommends DDD, DDE, and DDT concentrations of 0.0449, 0.0316, and 0.0316 mg/kg wet weight, respectively, as conservative screening values (Nowell and Resek, 1994). These concentrations are based on carcinogenicity risk levels of 1 x 10^{-6} and negligible non-cancer health risks (Nowell and Resek, 1994). The USFDA action levels for DDT and its metabolites are 5 mg/kg wet weight, while the screening values reported by the TCEQ for DDD, DDE, and DDT are 9.606, 5.45, and 5.277 mg/kg wet weight, respectively (USFDA, 2000; TCEQ, 2003). The values reported by the TCEQ (2003) are based on a carcinogenicity risk level of 1 x 10^{-5}.

The *p,p'*-DDE isomer of the metabolite DDE was the only DDT compound measured above the analytical detection limits in any of the 55 fish collected from Lake Worth by the USGS in 1999

Table 5. Technical chlordane values in mg/kg wet weight for skinless fish muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003, calculated using the sum of α- and γ chlordane, *cis*- and *trans*-nonachlor, oxychlordane, heptachlor, and heptachlor epoxide concentrations in mg/kg dry weight for each site (Note - B is smallmouth buffalo; LMB is largemouth bass; CR is white crappie; C is common carp; CC is channel catfish; WB is white bass; D is freshwater drum; and bdl is below the analytical detection limit).

Sample ID	α chlordane	γ chlordane	*cis*-nonachlor	*trans*-nonachlor	oxy-chlordane	heptachlor	heptachlor epoxide	Technical chlordane
LWB1	0.0017	0.0012	0.0012	0.0019	bdl	bdl	bdl	**0.0060**
LWB2	0.0231	0.0111	0.0304	0.0435	0.0035	bdl	bdl	**0.1116**
LWB3	0.0029	0.0021	0.0022	0.0030	bdl	bdl	bdl	**0.0102**
LWB4	0.0040	0.0021	0.0039	0.0057	0.0010	bdl	bdl	**0.0167**
LWB5	0.0021	0.0008	0.0035	0.0059	0.0005	bdl	bdl	**0.0128**
LWLMB1	bdl	bdl	0.0006	0.0009	bdl	bdl	bdl	**0.0015**
LWLMB2	bdl	bdl	0.0009	0.0022	0.0005	bdl	bdl	**0.0036**
LWLMB3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	**bdl**
LWLMB4	bdl	bdl	0.0008	0.0009	bdl	bdl	bdl	**0.0017**
LWLMB5	bdl	bdl	0.0005	0.0008	bdl	bdl	bdl	**0.0013**
LWLMB6	bdl	bdl	0.0008	0.0016	bdl	bdl	bdl	**0.0024**
LWLMB7	bdl	bdl	bdl	0.0008	bdl	bdl	bdl	**0.0008**
LWLMB8	bdl	bdl	bdl	0.0005	bdl	bdl	bdl	**0.0005**
LWLMB9	bdl	bdl	bdl	0.0008	bdl	bdl	bdl	**0.0008**
LWLMB10	bdl	bdl	bdl	bdl	bdl	bdl	bdl	**bdl**
LWCR1	bdl	bdl	bdl	bdl	bdl	bdl	bdl	**bdl**
LWCR2	bdl	bdl	bdl	bdl	bdl	bdl	bdl	**bdl**
LWCR3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	**bdl**
LWCR4	bdl	bdl	bdl	bdl	bdl	bdl	bdl	**bdl**
LWCR5	bdl	bdl	bdl	bdl	bdl	bdl	bdl	**bdl**
LWCR6	bdl	bdl	bdl	bdl	bdl	bdl	bdl	**bdl**
LWCR7	bdl	bdl	bdl	bdl	bdl	bdl	bdl	**bdl**
LWCR8	bdl	bdl	bdl	bdl	bdl	bdl	bdl	**bdl**
LWC1	bdl	bdl	0.0006	0.0007	bdl	bdl	bdl	**0.0013**
LWC2	0.0009	0.0007	0.0012	0.0020	bdl	bdl	bdl	**0.0048**
LWC3	0.0013	0.0010	0.0020	0.0031	bdl	bdl	bdl	**0.0074**
LWC4	0.0009	0.0005	0.0010	0.0012	bdl	bdl	bdl	**0.0036**
LWC5	0.0009	0.0006	0.0012	0.0015	bdl	bdl	bdl	**0.0042**
LWCC1	0.0005	bdl	0.0010	0.0033	0.0008	bdl	bdl	**0.0056**
LWCC2	0.0009	bdl	0.0009	0.0031	bdl	bdl	bdl	**0.0049**
LWCC3	bdl	bdl	0.0008	0.0015	bdl	bdl	bdl	**0.0023**
LWCC4	bdl	bdl	bdl	0.0008	bdl	bdl	bdl	**0.0008**
LWCC5	bdl	bdl	bdl	bdl	bdl	bdl	bdl	**bdl**
LWCC6	bdl	bdl	bdl	0.0005	bdl	bdl	bdl	**0.0005**
LWCC7	bdl	bdl	0.0009	0.0022	bdl	bdl	bdl	**0.0031**
LWCC8	bdl	bdl	bdl	0.0014	bdl	bdl	bdl	**0.0014**
LWCC9	bdl	bdl	bdl	bdl	bdl	bdl	bdl	**bdl**
LWCC10	0.0016	0.0006	0.0020	0.0034	bdl	bdl	bdl	**0.0076**
LWWB1	0.0006	bdl	0.0007	0.0007	bdl	bdl	bdl	**0.0020**
LWWB2	bdl	bdl	0.0006	0.0006	bdl	bdl	bdl	**0.0012**
LWWB3	0.0007	bdl	0.0016	0.0023	bdl	bdl	bdl	**0.0046**
LWWB4	0.0006	bdl	0.0010	0.0010	bdl	bdl	bdl	**0.0026**
LWWB5	0.0007	bdl	0.0010	0.0009	bdl	bdl	bdl	**0.0026**
LWD1	bdl	bdl	bdl	bdl	bdl	bdl	bdl	**bdl**
LWD2	bdl	bdl	bdl	bdl	bdl	bdl	bdl	**bdl**
LWD3	bdl	bdl	bdl	0.0006	bdl	bdl	bdl	**0.0006**
LWD4	bdl	bdl	bdl	bdl	bdl	bdl	bdl	**bdl**
LWD5	bdl	bdl	bdl	bdl	bdl	bdl	bdl	**bdl**

(TDH, 2000). Approximately 47% (26/55) of these fish contained detectable amounts of *p,p'*-DDE (TDH, 2000). Reported concentrations ranged from less than the analytical detection limit (<0.05 mg/kg wet weight) to 0.064 mg/kg wet weight ($\bar{x}$ = 0.0056 mg/kg wet weight; n = 55) (TDH, 2000). By species, one smallmouth buffalo, five largemouth bass, one white crappie, eight common carp, nine channel catfish, and two freshwater drum collected in 1999 contained *p,p'*-DDE concentrations greater than analytical detection limits (TDH, 2000).

In contrast, one or both isomers of the metabolite DDD (*o,p'*-DDD and *p,p'*-DDD) were detected above the analytical detection limits in 21% (10/48) of the fish collected from the reservoir by the USFWS/USACOE in 2003 (Table 4). In addition, one or both of the DDT isomers (*o,p'*-DDT and *p,p'*-DDT) were detected in 15% (7/48) of the fish sampled in 2003 (Table 4). As previously stated, the DDE isomer, *o,p'*-DDE, was not detected above the analytical detection limits in any of the fish collected in 2003; however, the DDE isomer, *p,p'*-DDE, was measured above the analytical limit in all 48 fish sampled (Table 4).

For screening purposes, the sum of the isomer concentrations of the metabolite DDD (*o,p'*-DDD + *p,p'*-DDD) and the sum of the DDT isomers (*o,p'*-DDT + *p,p'*-DDT) were calculated following Munn and Gruber (1997) for each sample where detected above the analytical detection limits (Table 6). Four common carp (LWC2 - LWC5), one channel catfish (LWCC10), and all five smallmouth buffalo (LWB1- LWB5) collected in 2003 contained DDD concentrations above the analytical detection limits (Tables 4 and 6). Calculated DDD concentrations ranged from 0.0005 mg/kg wet weight in a common carp (LWC4) to 0.0258 mg/kg wet weight in a smallmouth buffalo (LWB2) (n = 10) (Table 6). The overall mean DDD concentration was determined to be 0.0011 mg/kg wet weight (n = 48). All of the detected concentrations were less than the cited USEPA, USFDA, and TCEQ values for DDD (Nowell and Resek, 1994; USFDA, 2000; TCEQ, 2003).

As stated above, DDE was detected above the analytical detection limit in all of the fish collected in 2003 (Tables 4 and 6). Measured concentrations ranged from 0.0005 mg/kg wet weight in a freshwater drum (LWD3) to 0.265 mg/kg wet weight in a smallmouth buffalo (LWB2) (n = 48) (Tables 4 and 6). The overall arithmetic mean DDE concentration calculated from the 2003 data was 0.0113 mg/kg wet weight (n = 48; s = 0.0392), which was two times higher than the arithmetic mean (0.0056 mg/kg wet weight) reported by the TDH (2000) from fish collected in 1999. By species, the smallmouth buffalo sampled in 2003 contained the highest concentrations ($\bar{x}$ = 0.078 mg/kg wet weight; n =5; s = 0.109), while white crappie contained the lowest DDE levels ($\bar{x}$ = 0.0009; n = 8; s = 0.0003). The overall mean DDE level may have been elevated in comparison to the 1999 mean, but it was well less than the cited USEPA, USFDA, and TCEQ criteria (Nowell and Resek, 1994; TDH, 2000; USFDA, 2000; TCEQ, 2003). On a species basis, the arithmetic mean calculated from the smallmouth buffalo collected in 2003 exceeded the cited USEPA screening value, but was less than all other referenced criteria (Nowell and Resek, 1994; USFDA, 2000; TCEQ, 2003). This elevated mean concentration can be attributed primarily to samples LWB2 and LWB5 which contained DDE levels of 0.265 and 0.0808 mg/kg wet weight, respectively.

Table 6. Calculated DDD (DDD_{SUM}), DDE (DDE_{SUM}), and DDT (DDT_{SUM}) values in mg/kg wet weight for skinless fish muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note - B is smallmouth buffalo; LMB is largemouth bass; CR is white crappie; C is common carp; CC is channel catfish; WB is white bass; D is freshwater drum; bdl is below the analytical detection limit).

Site	DDD_{SUM}	DDE_{SUM}	DDT_{SUM}
LWB1	0.0006	0.0055	bdl
LWB2	0.0258	0.2650	0.0171
LWB3	0.0015	0.0128	0.0005
LWB4	0.0017	0.0245	0.0014
LWB5	0.0021	0.0808	0.0016
LWLMB1	bdl	0.0024	bdl
LWLMB2	bdl	0.0060	bdl
LWLMB3	bdl	0.0008	bdl
LWLMB4	bdl	0.0045	bdl
LWLMB5	bdl	0.0028	bdl
LWLMB6	bdl	0.0027	bdl
LWLMB7	bdl	0.0033	bdl
LWLMB8	bdl	0.0011	bdl
LWLMB9	bdl	0.0009	bdl
LWLMB10	bdl	0.0017	bdl
LWCR1	bdl	0.0009	bdl
LWCR2	bdl	0.0006	bdl
LWCR3	bdl	0.0010	bdl
LWCR4	bdl	0.0006	bdl
LWCR5	bdl	0.0012	bdl
LWCR6	bdl	0.0006	bdl
LWCR7	bdl	0.0015	bdl
LWCR8	bdl	0.0007	bdl
LWC1	bdl	0.0026	bdl
LWC2	0.0006	0.0059	0.0005
LWC3	0.0014	0.0082	0.0007
LWC4	0.0005	0.0057	0.0006
LWC5	0.0006	0.0053	bdl
LWCC1	bdl	0.0098	bdl
LWCC2	bdl	0.0070	bdl
LWCC3	bdl	0.0051	bdl
LWCC4	bdl	0.0016	bdl
LWCC5	bdl	0.0009	bdl
LWCC6	bdl	0.0012	bdl
LWCC7	bdl	0.0078	bdl
LWCC8	bdl	0.0009	bdl
LWCC9	bdl	0.0013	bdl
LWCC10	0.0008	0.0167	bdl
LWWB1	bdl	0.0038	bdl
LWWB2	bdl	0.0039	bdl
LWWB3	bdl	0.0131	bdl
LWWB4	bdl	0.0069	bdl
LWWB5	bdl	0.0051	bdl
LWD1	bdl	0.0011	bdl
LWD2	bdl	0.0031	bdl
LWD3	bdl	0.0005	bdl
LWD4	bdl	0.0007	bdl
LWD5	bdl	0.0007	bdl

Four smallmouth buffalo (LWB2 - LWB5) and three common carp (LWC2 - LWC4) collected by the USFWS/USACOE contained detectable amounts of DDT (Tables 4 and 6). Calculated DDT concentrations from these fish ranged from 0.0005 mg/kg wet weight in a common carp (LWC2) to 0.0171 mg/kg wet weight in a smallmouth buffalo (LWB2) (n = 7) (Table 6), all below cited screening values (Nowell and Resek, 1994; USFDA, 2000; TCEQ, 2003). The overall mean DDT concentration was determined to be 0.0008 mg/kg wet weight (n = 48; s = 0.0024), well less than the referenced screening values (Nowell and Resek, 1994; USFDA, 2000; TCEQ, 2003).

[Dieldrin] Listed by the USEPA as a probable carcinogen, dieldrin is a synthetic cyclic hydrocarbon that exhibits high toxicity and is persistent in soils (Cornell, 1998). It is formed as a degradation product of aldrin (Cornell, 1998; USEPA, 2004). From 1950 through 1970, this compound was used in the United States as a pesticide (ATSDR, 1993). In 1974, the USEPA banned all uses of dieldrin except for termite control (ATSDR, 1993). Once in the environment, dieldrin degrades very slowly and binds tightly to soil and sediment particles (ATSDR, 1993). Chronic exposure has resulted in hepatic non-carcinogenic toxicological effects in mammals (USEPA, 2004). In edible fish tissue, the USEPA reports a dieldrin concentration of 0.0007 mg/kg wet weight as a conservative human-health screening value, whereas the USFDA action level is 0.3 mg/kg wet weight (Nowell and Resek, 1994; USFDA, 2000). The USEPA concentration is based on a carcinogenicity risk level of 1×10^{-6} and negligible non-cancer health risks (Nowell and Resek, 1994). The dieldrin-fish tissue screening value recommended by the TCEQ (2003) for freshwater systems is 0.057 mg/kg wet weight. This value is based on a carcinogenicity risk level of 1×10^{-5} (TCEQ, 2003).

None of the 55 fish collected from Lake Worth by the USGS in 1999 contained dieldrin concentrations above the analytical detection limits (TDH, 2000). In contrast, seven of the 48 fish (15%) collected by the USFWS/USACOE in 2003 contained detectable amounts of dieldrin (Table 4). All five smallmouth buffalo (LWB1-LWB5), one common carp (LWC3), and one channel catfish (LWCC10) sampled in 2003 contained dieldrin levels greater than the analytical detection limits (Table 4). The measured concentrations in these fish ranged from 0.0006 mg/kg wet weight in LWC3 to 0.0074 mg/kg wet weight in LWB2 (Table 4). The overall mean concentration was calculated to be 0.0006 mg/kg wet weight (n = 48; s = 0.001). All five of the smallmouth buffalo plus the channel catfish, LWCC10, contained dieldrin levels that exceeded the cited USEPA criterion; however, none of these fish contained concentrations that were greater than or equal to the cited USFDA action level or the TCEQ screening value (Nowell and Resek, 1994; USFDA, 2000; TCEQ, 2003).

[Endosulfan II] The organochlorine pesticide endosulfan was first introduced in the United States in 1954, however it has not been commercially produced in the U.S. since 1982 (ATSDR, 2000b). This compound exists as two principal isomers, endosulfan I [alpha (α)-endosulfan] and endosulfan II [beta (β)-endosulfan] (ATSDR, 2000b). Endosulfan can degrade in the environment through photolysis, bio-transformation, or oxidation into the metabolite, endosulfan sulfate (ATSDR, 2000b). Chronic exposure to endosulfan has resulted in loss of body weight and hepatic non-cancer toxicological effects in exposed organisms (ATSDR, 2004; USEPA, 2004). In fish tissues, the

USEPA recommends an endosulfan II concentration of 20 mg/kg wet weight as being an interim screening value (Nowell and Resek, 1994).

None of the 55 fish collected from Lake Worth by the USGS in 1999 contained endosulfan II concentrations above the analytical detection limits (TDH, 2000). By comparison, two of the 48 (4%) fish collected by the USFWS/USACOE in 2003, one smallmouth buffalo (LWB3) and a common carp (LWC3), contained detectable amounts of endosulfan II (Table 4). The concentrations measured in these two fish (0.0008 and 0.0018 mg/kg wet weight, respectively) did not approach the cited USEPA screening criterion (Nowell and Resek, 1994).

[Hexachlorobenzene(HCB)] First introduced in 1945, hexachlorobenzene (HCB) was widely used in the United States as a fungicide (ATSDR, 1997; EMS 2002a). It was also used in the manufacturing of fireworks, ammunition, and synthetic rubber, and can be produced as a by-product in the waste streams of chloralkali and wood-preserving plants and the incineration of industrial and municipal solid wastes (ATSDR, 1997). This compound is a suspected carcinogen and is toxic to fish and avian species, while chronic exposure in humans may lead to liver disease and cancer (ATSDR, 1997; EMS, 2002a). Production of HCB as a fungicide ceased in 1965 and currently there are no commercial uses for this compound in the United States (ATSDR, 1997). Hexachlorobenzene is highly persistent in the environment, with reported half lives in soils ranging from 2.7 to 22.9 years (ETN, 1996; EMS, 2002a). In edible fish tissue, the USEPA recommends a HCB concentration of 0.0067 mg/kg wet weight as a conservative screening value, whereas the criterion reported by the TCEQ is 0.609 mg/kg wet weight (Nowell and Resek, 1994; TCEQ, 2003). The USEPA concentration is based on a carcinogenicity risk level of 1×10^{-6} and negligible noncancer health risks, while the TCEQ value is based on a carcinogenicity risk level of 1×10^{-5} (Nowell and Resek, 1994; TCEQ, 2003).

Hexachlorobenzene was detected in 24% (13/55) of the of the fish collected by the USGS from Lake Worth in 1999 (TDH, 2000). Six of the 10 channel catfish and seven of the 10 white crappie collected in 1999 contained HCB levels above the analytical detection limits (TDH, 2000). No other fish species sampled by the USGS in 1999 contained detectable amounts of HCB (TDH, 2000). The highest HCB concentration measured in the 1999 data was 0.0063 mg/kg wet weight in a white crappie sample (TDH, 2000). Overall, the fish collected in 1999 contained an average HCB concentration of 2.2×10^{-4} mg/kg wet weight (TDH, 2000). In comparison, 6% (3/48) of the fish collected from the reservoir by the USFWS/USACOE in 2003 contained detectable amounts of HCB (Table 4). The concentrations measured in these three fish [two smallmouth buffalo (LWB2 and LWB3) and one channel catfish (LWCC10)] ranged from 0.0005 to 0.0013 mg/kg wet weight (Table 4), all below the cited USEPA and TCEQ criteria (Nowell and Resek, 1994; TCEQ, 2003).

[Hexachlorocyclohexane (BHC)] Hexachlorocyclohexane (BHC) represents a group of manufactured chemicals used in pesticides that do not occur naturally in the environment (ATSDR, 1999). Eight isomers are formed from BHC of which the four most common are alpha (α)-, beta (β)-, delta (δ)-, and gamma (γ)-BHC (ATSDR, 1999). In the United States, the commercial production of γBHC, also known as lindane, began in 1945 (EHP, 2002). This compound was used extensively in the 1950s as an insecticide in the timber industry but is no longer produced commercially in the United States (ATSDR, 1999; EHP, 2002). The commercial production of all BHC pesticides ceased after 1983 in the United States (EHP, 2002).

In a terrestrial environment, BHC can degrade rapidly under anaerobic conditions (Damborsky *et al.*, 2002). Under aerobic conditions, bio-degradation mineralizes αBHC and γBHC, whereas βBHC persists (Middeldorp and McLeish, 2002). Anaerobically, βBHC can biodegrade to benzene and chlorobenzene (Middeldorp and McLeish, 2002). In aquatic systems, BHC can be absorbed and adsorbed to sediments and broken down biologically by microflora and fauna (ETN, 1993). It can accumulate in the fatty tissue of fish, birds, and mammals (ETN, 1993; ATSDR, 1999). The isomer γBHC is highly toxic to fish and aquatic invertebrates and may cause birth defects in amphibians (ETN, 1993). Sub-chronic exposure to γBHC has resulted in hepatic non-carcinogenic toxicological effects to exposed organisms (USEPA, 2004). Hexachlorocyclohexane and its isomers are also reasonably anticipated to be human carcinogens (EHP, 2002). In edible fish tissue, the USEPA recommends αBHC, βBHC, and γBHC concentrations of 0.0017, 0.006, and 0.0081 mg/kg wet weight, respectively, as conservative human health screening criteria (Nowell and Resek, 1994). These concentrations are based on carcinogenicity risk levels of 1×10^{-6} and negligible non-cancer health risks (Nowell and Resek, 1994). In contrast, the TCEQ (2003) recommends concentrations of 0.366, 1.281, and 5.852 mg/kg wet weight as screening values for αBHC, βBHC, and γBHC, respectively. These values are based on an acceptable carcinogenicity risk level of 1×10^{-5} (TCEQ, 2003).

Hexachlorocyclohexane isomers were not detected above the analytical detection limits in any of the 55 fish collected from Lake Worth by the USGS in 1999 (TDH, 2000). By comparison, three of the 48(6%) fish sampled by the USFWS/USACOE from the reservoir in 2003 contained detectable BHC isomers (Table 4). Beta hexachlorocyclohexane concentrations were detected above the analytical detection limits in one smallmouth buffalo (LWB2) and one freshwater drum (LWD3), while δBHC was measured above the analytical detection limit in one smallmouth buffalo (LWB3) (Table 4). No other BHC isomers were measured at or above the analytical detection limits in any of the remaining 45 fish collected in 2003 (Table 4). The βBHC concentrations measured in LWB2 (0.0005 mg/kg wet weight) and LWD3 (0.001 mg/kg wet weight) were less than the cited USEPA and TCEQ βBHC criteria (Nowell and Resek, 1994; TCEQ, 2003). Currently, there are no specific screening criteria for comparison with the δBHC concentration detected in LWB3 (0.0009 mg/kg wet weight); however, this concentration was below all of the screening values cited for other BHC isomers (Nowell and Resek, 1994; TCEQ, 2003).

[Mirex] First developed in 1946, the pesticide mirex is a highly stable chlorinated hydrocarbon compound that exhibits very low solubility in water and is highly resistant to chemical, thermal, and biochemical degradation (Eisler, 1985). From 1959 to 1972, mirex was used to control fire ants and as a flame retardant in plastics, rubber, paint, paper, and electrical goods (Eco-USA, 2002). It has not been produced for commercial use in the United States since 1978 (Eco-USA, 2002). Because of its resistance to degradation, mirex has a projected half-life of over 10 years in the environemnt (Eisler, 1985; EMS, 2002b). In lentic sediments, mirex can continue to remain bio-available from

200 to 600 years (Eisler, 1985). Listed by the USEPA as PBT, mirex is a known endocrine disruptor and suspected carcinogen (Eco-USA, 2002; EMS, 2002b). Chronic exposure has resulted in hepatic non-carcinogenic toxicological effects in mammals (USEPA, 2004). Based on a reference dose of 2 x 10^{-4}(mg/kg)/day, the USEPA recommends a mirex concentration of 2 mg/kg wet weight as a screening value in edible fish tissue, whereas the USFDA action level is 0.1 mg/kg wet weight and the TCEQ screening value is 0.0355 mg/kg wet weight (Nowell and Resek, 1994; USFDA, 2000; TCEQ, 2003).

None of the 55 fish collected from Lake Worth by the USGS in 1999 contained mirex concentrations above the analytical detection limits (TDH, 2000). In comparison, one of the 48 fish collected by the USFWS/USACOE from the reservoir in 2003, a smallmouth buffalo (LWB2), contained detectable amounts of mirex (Table 4). The concentration measured in this fish (0.0024 mg/kg wet weight) was below all cited screening values (Nowell and Resek, 1994; USFDA, 2000; TCEQ, 2003).

[Pentachloroanisole] A suspected carcinogen, pentachloroanisole is a chlorinated aromatic compound that is widely distributed in the environment (NTP, 2002). It is formed as a degradation product of pentachloronitrobenzene and pentachlorophenol (NTP, 2002). Currently, screening criteria are not available for pentachloroanisole nor were the fish samples collected in 1999 analyzed for this compound. Pentachloroanisole was detected in approximately 17% (8/48) of the fish collected from Lake Worth by the USFWS/USACOE in 2003 (Table 4). All five of the smallmouth buffalo (LWB1-LWB2), two common carp (LWC4 and LWC5), and one channel catfish (LWCC10) contained detectable amounts of pentachloroanisole (Table 4). Measured concentrations ranged from 0.0005 mg/kg wet weight in LWC4 and LWC5 to 0.0037 mg/kg wet weight in LWB2 (n = 8) (Table 4). The overall arithmetic mean pentachloroanisole concentration was determined to be 0.0006 mg/kg wet weight (n = 48; s = 0.0006).

Polychlorinated Biphenyls

Results of the PCB analyses for the individual skinless fish fillet samples are presented in Table 7. Each sample was analyzed for total-PCBs and four separate aroclors (Aroclor 1242, 1248, 1254, and 1260). In addition, each sample was also analyzed for 96 PCB congeners. The results of this analysis are presented in Table 8. All results in both tables are presented in mg/kg wet weight. As with the organochlorine pesticide analytical results, the PCB analytical data were qualitatively compared to pertinent human health screening criteria, data collected from the previous study conducted by the USGS in 1999, and to the TDH health advisory in an attempt to ascertain the temporal trend of PCBs in fish inhabiting Lake Worth, as well as evaluate possible health risks associated with consuming fish from this reservoir

First developed in 1929, PCBs were used extensively in the United States in electrical transformers, capacitors, heat transfer fluids, and electrical utilities as lubricants, insulators, and coolants until production ceased in 1977 due to potential adverse environmental and human health affects (USEPA, 1994; Moring, 1997; ATSDR, 2000c). Total PCBs represent a quantification of

Table 7. Results of PCB analyses in mg/kg wet weight for skinless fish muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note - B is smallmouth buffalo; C is common carp; D is freshwater drum; WB is white bass; CR is white crappie; CC is channel catfish; LMB is largemouth bass; dl is the analytical detection limit; and bdl is below the analytical detection limit).

Analyte	LWB1	LWB2	LWB3	LWB4	LWB5	LWC1	LWC2	LWC3	LWC4	LWC5
Aroclor 1242	bdl	bdl	0.0053	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0047	0.0044	0.0045	0.0048	0.0048	0.0050	0.0048	0.0046	0.0048	0.0050
Aroclor 1248	0.0151	0.1263	0.0423	0.0370	0.0072	0.0045*	bdl	bdl	0.0143	bdl
dl	0.0047	0.0044	0.0045	0.0048	0.0048	0.0050	0.0048	0.0046	0.0048	0.0050
Aroclor 1254	0.0453	1.3889	0.0317	0.0925	0.0506	0.0312	0.0850	0.1044	0.0646	0.0457
dl	0.0047	0.0044	0.0045	0.0048	0.0048	0.0050	0.0048	0.0046	0.0048	0.0050
Aroclor 1260	0.0151	1.0101	0.0265	0.0555	0.0867	0.0534	0.1039	0.1276	0.0646	0.0559
dl	0.0047	0.0044	0.0045	0.0048	0.0048	0.0050	0.0048	0.0046	0.0048	0.0050
Total-PCBs	0.0755	2.5253	0.1058	0.1850	0.1445	0.0891	0.1889	0.2320	0.1435	0.1016
dl	0.0047	0.0044	0.0045	0.0048	0.0048	0.0050	0.0048	0.0046	0.0048	0.0050
Analyte	**LWD1**	**LWD2**	**LWD3**	**LWD4**	**LWD5**	**LWWB1**	**LWWB2**	**LWWB3**	**LWWB4**	**LWWB5**
Aroclor 1242	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0049	0.0050	0.0048	0.0049	0.0050	0.0048	0.0048	0.0045	0.0048	0.0048
Aroclor 1248	bdl	bdl	bdl	bdl	bdl	0.0030*	0.0026*	bdl	bdl	0.0019*
dl	0.0049	0.0050	0.0048	0.0049	0.0050	0.0048	0.0048	0.0045	0.0048	0.0048
Aroclor 1254	bdl	bdl	bdl	bdl	bdl	0.0091	0.0064	0.0152	0.0137	0.0078
dl	0.0049	0.0050	0.0048	0.0049	0.0050	0.0048	0.0048	0.0045	0.0048	0.0048
Aroclor 1260	bdl	bdl	bdl	bdl	bdl	0.0183	0.0166	0.0609	0.0550	0.0292
dl	0.0049	0.0050	0.0048	0.0049	0.0050	0.0048	0.0048	0.0045	0.0048	0.0048
Total-PCBs	0.0119	0.0236	0.0108	0.0115	0.0083	0.0304	0.0256	0.0761	0.0687	0.0389
dl	0.0049	0.0050	0.0048	0.0049	0.0050	0.0048	0.0048	0.0045	0.0048	0.0048
Analyte	**LWCR1**	**LWCR2**	**LWCR3**	**LWCR4**	**LWCR5**	**LWCR6**	**LWCR7**	**LWCR8**		
Aroclor 1242	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl		
dl	0.0047	0.0049	0.0077	0.0051	0.0045	0.0047	0.0072	0.0049		
Aroclor 1248	bdl	bdl	0.0020*	bdl	bdl	bdl	bdl	bdl		
dl	0.0047	0.0049	0.0077	0.0051	0.0045	0.0047	0.0072	0.0049		
Aroclor 1254	bdl	bdl	0.0061*	bdl	bdl	bdl	bdl	bdl		
dl	0.0047	0.0049	0.0077	0.0051	0.0045	0.0047	0.0072	0.0049		
Aroclor 1260	bdl	bdl	0.0122	bdl	bdl	bdl	bdl	bdl		
dl	0.0047	0.0049	0.0077	0.0051	0.0045	0.0047	0.0072	0.0049		
Total-PCBs	0.0101	0.0103	0.0204	0.0124	0.0134	0.0062	0.0146	0.0076		
dl	0.0047	0.0049	0.0077	0.0051	0.0045	0.0047	0.0072	0.0049		
Analyte	**LWCC1**	**LWCC2**	**LWCC3**	**LWCC4**	**LWCC5**	**LWCC6**	**LWCC7**	**LWCC8**	**LWCC9**	**LWCC10**
Aroclor 1242	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0049	0.0049	0.0049	0.0049	0.0050	0.0049	0.0051	0.0050	0.0047	0.0050
Aroclor 1248	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0049	0.0049	0.0049	0.0049	0.0050	0.0049	0.0051	0.0050	0.0047	0.0050
Aroclor 1254	0.0247	0.0295	0.0216	bdl	bdl	bdl	0.0127	bdl	bdl	0.0543
dl	0.0049	0.0049	0.0049	0.0049	0.0050	0.0049	0.0051	0.0050	0.0047	0.0050
Aroclor 1260	0.0272	0.0295	0.0505	bdl	bdl	bdl	0.0236	bdl	bdl	0.0444
dl	0.0049	0.0049	0.0049	0.0049	0.0050	0.0049	0.0051	0.0050	0.0047	0.0050
Total-PCBs	0.0544	0.0590	0.0721	0.0160	0.0184	0.0203	0.0363	0.0105	0.0099	0.0986
dl	0.0049	0.0049	0.0049	0.0049	0.0050	0.0049	0.0051	0.0050	0.0047	0.0050
Analyte	**LWLMB 1**	**LWLMB 2**	**LWLMB 3**	**LWLMB 4**	**LWLMB 5**	**LWLMB 6**	**LWLMB 7**	**LWLMB 8**	**LWLMB 9**	**LWLMB10**
Aroclor 1242	0.0022*	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.0049	0.0049	0.0050	0.0049	0.0051	0.0049	0.0050	0.0049	0.0049	0.0052
Aroclor 1248	0.0023*	0.0019*	0.0017*	0.0041*	0.0024*	0.0016*	0.0031*	bdl	bdl	bdl
dl	0.0049	0.0049	0.0050	0.0049	0.0051	0.0049	0.0050	0.0049	0.0049	0.0052
Aroclor 1254	0.0136	0.0136	0.0070	0.0696	0.0265	0.0128	0.0125	bdl	bdl	bdl
dl	0.0049	0.0049	0.0050	0.0049	0.0051	0.0049	0.0050	0.0049	0.0049	0.0052
Aroclor 1260	0.0272	0.0210	0.0087	0.0082	0.0193	0.0176	0.0156	bdl	bdl	bdl
dl	0.0049	0.0049	0.0050	0.0049	0.0051	0.0049	0.0050	0.0049	0.0049	0.0052
Total-PCBs	0.0454	0.0382	0.0174	0.0819	0.0482	0.0320	0.0312	0.0108	0.0163	0.0240
dl	0.0049	0.0049	0.0050	0.0049	0.0051	0.0049	0.0050	0.0049	0.0049	0.0052

* Represents laboratory estimated value less than analytical detection limit.

Table 8. Results of PCB congener analyses in mg/kg wet weight for skinless fish muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note - B is smallmouth buffalo; C is common carp; dl is the analytical detection limit; and bdl is below the analytical detection limit).

Analyte	LWB1	LWB2	LWB3	LWB4	LWB5	LWC1	LWC2	LWC3	LWC4	LWC5
PCB 1	0.000276	bdl	bdl	0.000125	bdl	bdl	bdl	bdl	bdl	bdl
PCB 7/9	0.00143	0.00148	0.000972	0.0018	0.000635	0.000177	bdl	0.000224	0.0014	0.000469
PCB 8/5	0.000184	0.000445	bdl	0.000128	0.000258	bdl	bdl	bdl	0.000698	bdl
PCB 15	0.000306	0.00295	0.000947	0.000175	0.000605	bdl	bdl	bdl	bdl	bdl
PCB 16/32	0.000777	0.00244	0.00205	0.000742	0.000258	0.000144	bdl	0.000077	0.000512	bdl
PCB 18/17	0.000128	0.000714	0.000094	0.000035	bdl	0.000198	0.000139	0.000248	0.000619	0.000318
PCB 22/51	0.000199	0.00274	bdl	0.000386	0.000127	0.000069	bdl	bdl	0.000173	0.000167
PCB 24/27	0.000119	0.0018	bdl	0.000221	0.000041	bdl	bdl	bdl	0.000229	bdl
PCB 25	0.000426	0.00403	0.000966	0.000378	0.000206	bdl	bdl	0.000155	bdl	bdl
PCB 26	bdl	0.00137	0.000567	bdl	0.000058	bdl	0.000058	0.000095	0.000033	0.000076
PCB 28	0.00125	0.0163	0.00248	0.00178	0.000941	0.000487	0.00153	0.00173	0.000816	0.000896
PCB 29	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 30	bdl	0.000054	0.000066	bdl	bdl	bdl	0.000042	bdl	0.000137	bdl
PCB 31	0.000386	bdl	0.000964	0.000497	0.00015	0.000147	0.000306	0.000339	0.000175	0.000118
PCB 33/20	0.000163	0.00423	bdl	0.000252	0.000146	0.000076	0.000091	bdl	0.00062	bdl
PCB 39	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 40	0.000069	bdl	bdl	bdl	0.000266	bdl	bdl	bdl	0.000313	bdl
PCB 41/64	0.001	bdl	bdl	0.00173	bdl	bdl	bdl	bdl	bdl	bdl
PCB 42/59/37	0.000434	0.00612	0.000885	0.00074	0.000553	0.000132	0.000468	0.000897	0.00022	0.000511
PCB 44	0.00118	0.0126	0.00167	0.00178	0.00172	0.000949	0.00171	0.00196	0.00115	0.00115
PCB 45	bdl	0.00127	0.00144	bdl	bdl	bdl	bdl	0.000778	bdl	bdl
PCB 46	0.000083	0.000732	0.00118	0.000059	bdl	bdl	bdl	bdl	bdl	bdl
PCB 47/75	0.000785	0.0245	0.00208	0.00199	0.00108	0.000469	0.000309	0.000917	0.000926	0.000804
PCB 48	0.000336	bdl	bdl	0.000312	bdl	bdl	bdl	bdl	bdl	bdl
PCB 49	0.000694	0.0218	0.0017	0.00169	0.00037	0.000859	0.00189	0.00209	0.00161	0.00108
PCB 52	0.00203	0.0293	0.00276	0.00343	0.00173	0.00108	0.00274	0.00351	0.00238	0.00134
PCB 53	bdl	bdl	0.00386	bdl	bdl	bdl	bdl	0.000232	bdl	bdl
PCB 60/56	0.00126	0.0236	0.00193	0.00264	0.00136	0.00114	0.00165	0.00192	0.00158	0.00121
PCB 63	bdl	bdl	0.000972	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 66	0.000871	0.03	0.00128	0.00249	0.0012	0.000847	0.00144	0.00174	0.00188	0.000951
PCB 67	0.000135	0.00165	0.00189	0.000217	0.000482	0.000199	bdl	0.000107	0.000336	bdl
PCB 69	bdl	bdl	bdl	bdl	0.000128	bdl	bdl	bdl	0.000146	bdl
PCB 70	0.00128	0.0321	0.00157	0.00309	0.00136	0.00103	0.00239	0.00246	0.00185	0.00125
PCB 72	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 74/61	0.000666	0.0248	0.0012	0.00195	0.00903	0.00619	0.00135	0.00147	0.0014	0.000848
PCB 77	0.000043	0.000096	0.000036	0.000022	0.000049	0.000066	0.00004	0.000024	0.000084	0.000035
PCB 81	0.000042	0.000034	0.000045	bdl	0.000087	0.000074	0.000045	0.000027	0.000101	0.00004
PCB 82	0.000476	0.021	0.000579	0.00128	0.00149	0.000915	0.000909	0.00123	0.000823	0.000555
PCB 83	0.00026	0.00664	0.000159	0.000734	0.000354	0.000282	0.000608	0.000697	0.000442	0.000362
PCB 84	0.000637	0.0145	0.000661	0.000968	0.000487	0.000481	0.00118	0.00142	0.000886	0.000533
PCB 85	0.000425	0.00484	0.00045	0.000925	0.000159	0.000678	0.000725	0.00242	0.000981	0.000838
PCB 87/115	0.00111	0.0506	0.00106	0.00245	0.00146	0.00124	0.0031	0.00368	0.00186	0.00155
PCB 92	0.00216	0.0423	0.00274	0.00517	0.00258	0.0012	0.00264	0.00345	0.00173	0.00172
PCB 95/80	0.00248	0.0587	0.00238	0.00429	0.00277	0.00172	0.004	0.00537	0.00288	0.00189
PCB 97	0.00124	0.0451	0.00143	0.00282	0.00137	0.00131	0.00292	0.00338	0.00189	0.00158
PCB 99	0.00257	0.0874	0.00361	0.00618	0.00425	0.00279	0.00545	0.0073	0.00385	0.00329
PCB 101/90	0.00396	0.162	0.00363	0.00908	0.00609	0.00451	0.0102	0.0123	0.00607	0.00512
PCB 105	0.000718	0.0274	0.00101	0.00232	0.00182	0.000891	0.00248	0.00146	0.00193	0.00119
dl	0.000019	0.000018	0.000018	0.000019	0.000019	0.000020	0.000019	0.000018	0.000019	0.000020

Table 8 (continued). Results of PCB congener analyses in mg/kg wet weight for skinless fish muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note - B is smallmouth buffalo; C is common carp; dl is the analytical detection limit; and bdl is below the analytical detection limit).

Analyte	LWB1	LWB2	LWB3	LWB4	LWB5	LWC1	LWC2	LWC3	LWC4	LWC5
PCB 107	0.000196	0.0268	0.000076	0.000527	0.000731	0.000168	0.00112	0.00141	0.000742	0.000635
PCB 110	0.00386	0.135	0.00376	0.00824	0.00415	0.00308	0.00737	0.0108	0.00599	0.00352
PCB 114	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 118	0.00274	0.146	0.00289	0.00739	0.0057	0.00356	0.00776	0.00986	0.00646	0.00444
PCB 119	0.000344	0.00782	0.000591	0.00105	0.000455	0.0002	0.000141	0.000597	0.00035	0.000307
PCB 126	0.000074	0.000262	0.000242	0.00005	0.000076	0.000092	0.00009	bdl	0.000098	0.000026
PCB 128	0.000905	0.0419	0.00114	0.00243	0.0016	0.00122	0.00327	0.00409	0.00171	0.0016
PCB 129	0.00022	0.0138	0.000274	0.000516	0.000391	0.000393	0.000886	0.00102	0.000468	0.000443
PCB 130	bdl	0.0207	0.000303	0.000718	0.000475	0.000528	0.000965	0.0014	0.000558	0.000369
PCB 135	0.00065	0.0279	bdl	0.0014	0.00144	0.000778	0.00198	bdl	0.00110	0.00122
PCB 136	0.000252	0.00534	0.000324	0.000461	0.000607	0.000293	0.000381	0.000839	0.000401	0.000405
PCB 138/160	0.00528	0.241	0.00632	0.0147	0.0128	0.00893	0.0198	0.0234	0.011	0.0098
PCB 141/179	0.000998	0.0633	0.00119	0.00333	0.00276	0.00182	0.00366	0.00471	0.00246	0.00216
PCB 146	0.00112	0.0439	0.00208	0.00333	0.00325	0.00177	0.00383	0.00438	0.00233	0.00205
PCB 149/123	0.00275	0.105	0.00319	0.00614	0.00488	0.00294	0.00646	0.00901	0.0048	0.00348
PCB 151	0.000969	0.0319	0.00128	0.00249	0.00164	0.00126	0.00258	0.00304	0.00157	0.00144
PCB 153/132	0.00675	0.287	0.00816	0.0189	0.0174	0.0112	0.0239	0.0322	0.0125	0.0121
PCB 156	0.000368	bdl	0.000711	0.00128	0.00155	0.000835	0.002	0.00238	0.00113	0.00107
PCB 158	0.0062	0.034	0.000777	0.00171	0.00163	0.00132	0.00282	0.00323	0.00163	0.00143
PCB 166	0.000019	0.00115	bdl	bdl	bdl	bdl	bdl	bdl	0.000047	bdl
PCB 167	0.000203	0.0166	0.000341	0.000836	0.000912	0.000573	0.00118	0.00163	0.000679	0.000581
PCB 169	0.000055	0.000138	0.00015	0.000041	0.000059	0.000154	0.000064	bdl	0.000123	bdl
PCB 170/190	0.000828	0.0404	0.00273	0.00254	0.0029	0.00177	0.00359	0.00354	0.00265	0.00182
PCB 171/202	0.000612	0.0204	0.00103	0.00181	0.00164	0.000847	0.00141	0.0017	0.00175	0.00101
PCB 172	0.000162	0.00885	0.000613	0.000559	0.000801	0.000385	0.000792	0.000812	0.000672	0.000365
PCB 174	0.000343	0.0183	0.00055	0.00108	0.00106	0.000587	0.000981	0.00153	0.00112	0.000468
PCB 175	0.000146	0.00422	0.000297	0.000684	0.000585	0.00025	0.000534	0.000507	0.000366	0.000181
PCB 176/137	0.00049	0.0265	0.00066	0.00131	0.00107	0.00086	0.0019	0.00225	0.00116	0.00108
PCB 177	0.000443	0.0157	0.000622	0.00122	0.00128	0.00101	0.00172	0.00183	0.00143	0.000957
PCB 178	0.000189	0.00675	0.000288	0.00065	0.0007	0.00035	0.000557	0.000673	0.000582	0.000324
PCB 180	0.00451	0.129	0.00613	0.0139	0.0132	0.00606	0.0151	0.0203	0.0183	0.00834
PCB 183	0.000466	0.0253	0.000944	0.0017	0.0023	0.0011	0.00218	0.00218	0.00142	0.000988
PCB 185	0.000114	0.00566	0.000256	0.000369	0.000494	0.000294	0.000559	0.0007	0.000613	0.000276
PCB 187	0.00144	0.0668	0.00192	0.00477	0.00566	0.00326	0.00587	0.00592	0.00433	0.0023
PCB 189	0.000027	0.00167	bdl	0.000086	0.000157	0.000073	0.000119	0.000063	bdl	bdl
PCB 191	0.000066	0.00174	0.000188	0.000275	bdl	bdl	0.000282	0.000035	0.000227	0.000162
PCB 193	0.000146	0.00558	0.000233	0.000613	0.000668	0.000315	0.000569	0.000568	0.000566	0.000237
PCB 194	0.00032	0.0219	0.000522	0.00117	0.00185	0.00106	0.00215	0.00197	0.00162	0.000976
PCB 195/208	0.000172	0.00977	0.000266	0.000661	0.000943	0.000553	0.000949	0.000914	0.000785	0.000498
PCB 196	0.000437	0.0287	0.000621	0.00155	0.00261	0.00147	0.00248	0.00235	0.00218	0.00119
PCB 197	bdl	0.000993	bdl	bdl	0.000088	bdl	bdl	0.000066	0.000054	bdl
PCB 199	0.000597	0.0245	0.000775	0.00174	0.00261	0.00147	0.00243	0.00233	0.00212	0.00129
PCB 200	0.000057	0.00213	0.000086	0.000202	0.00042	0.000099	0.000125	0.000181	0.000142	0.000123
PCB 201	0.000193	0.00351	0.000101	0.000562	0.000322	0.000219	0.000252	0.000211	0.000176	0.000105
PCB 205	0.000051	0.00204	0.000147	0.000335	0.000853	0.000097	0.000213	0.000195	0.000156	0.000127
PCB 206	0.000117	0.00946	0.000253	0.000498	0.000835	0.000502	0.000918	0.000754	0.000832	0.000429
PCB 207	bdl	0.00147	bdl	0.00006	0.000143	0.000053	0.000103	0.000097	0.000074	0.000051
PCB 209	0.000086	0.00325	0.000453	0.000596	0.000304	0.00029	0.000604	0.000513	0.000289	0.000351
dl	0.000019	0.000018	0.000018	0.000019	0.000019	0.000020	0.000019	0.000018	0.000019	0.000020

Table 8 (continued). Results of PCB congener analyses in mg/kg wet weight for skinless fish muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note - D is freshwater drum; WB is white bass; dl is the analytical detection limit; and bdl is below the analytical detection limit).

Analyte	LWD1	LWD2	LWD3	LWD4	LWD5	LWWB1	LWWB2	LWWB3	LWWB4	LWWB5
PCB 1	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.000587	bdl	0.00064
PCB 7/9	0.000242	0.000697	0.00086	0.0005	0.000098 7	0.000181	bdl	bdl	bdl	bdl
PCB 8/5	0.00104	0.00103	0.000323	0.00157	bdl	bdl	0.000571	0.000221	0.000392	0.000504
PCB 15	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 16/32	bdl	bdl	0.000459	bdl	bdl	bdl	bdl	0.000035	bdl	bdl
PCB 18/17	bdl	bdl	bdl	bdl	bdl	bdl	0.000076	bdl	0.000079	0.00002
PCB 22/51	bdl	bdl	0.000182	bdl	0.000061	0.000192	0.0004	0.000282	0.000507	bdl
PCB 24/27	bdl	bdl	bdl	bdl	bdl	bdl	0.000032	0.000047	0.000048	0.000023
PCB 25	bdl	bdl	bdl	bdl	bdl	0.000066	bdl	bdl	bdl	bdl
PCB 26	bdl	bdl	0.000109	bdl	bdl	bdl	0.000042	0.000048	0.00006	0.000075
PCB 28	0.000032	0.00016	0.000564	0.000038	0.000075	0.000131	0.00014	0.00014	0.000331	0.000123
PCB 29	bdl	bdl	0.000463	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 30	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.000038	bdl
PCB 31	bdl	bdl	0.000091	bdl	bdl	0.000206	bdl	bdl	bdl	bdl
PCB 33/20	bdl	bdl	0.000377	bdl	0.00015	bdl	bdl	bdl	bdl	bdl
PCB 39	bdl	0.000042	bdl	0.000053	bdl	bdl	bdl	bdl	bdl	bdl
PCB 40	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 41/64	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 42/59/37	bdl	bdl	bdl	bdl	bdl	0.000035	0.000072	0.000087	0.000135	0.000084
PCB 44	bdl	0.000321	bdl	bdl	0.000615	0.000343	0.000635	0.000599	0.000733	0.000597
PCB 45	bdl	bdl	bdl	bdl	bdl	0.000102	0.000137	bdl	0.000122	bdl
PCB 46	0.000194	bdl	bdl	bdl	0.000129	bdl	bdl	bdl	bdl	bdl
PCB 47/75	bdl	bdl	bdl	bdl	bdl	0.000142	0.000121	0.000194	0.000257	0.000188
PCB 48	bdl	bdl	bdl	bdl	bdl	0.000396	bdl	0.000378	0.00036	0.000341
PCB 49	bdl	0.000245	bdl	bdl	bdl	0.000287	0.000222	0.000283	0.000388	0.000276
PCB 52	bdl	bdl	bdl	bdl	0.000111	0.000354	0.000254	0.000327	0.000485	0.000362
PCB 53	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 60/56	0.000571	0.000889	bdl	0.000743	0.000126	0.000647	0.000637	0.000669	0.000788	0.000645
PCB 63	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 66	0.000089	0.000192	0.00008	0.00005	0.000055	0.000257	0.000238	0.000393	0.000364	0.000314
PCB 67	bdl	bdl	bdl	bdl	0.00017	bdl	bdl	bdl	bdl	bdl
PCB 69	0.000165	bdl	0.00007	bdl	0.000058	bdl	bdl	bdl	bdl	bdl
PCB 70	0.000068	0.000161	0.000054	0.00003	0.000047	0.000297	0.000272	0.000449	0.000463	0.000374
PCB 72	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 74/61	0.000056	0.000116	0.00002	bdl	bdl	0.00014	0.00015	0.000307	0.00025	0.000217
PCB 77	bdl	bdl	bdl	0.00005	0.000029	0.000037	bdl	bdl	bdl	0.00003
PCB 81	bdl	0.000174	bdl	0.000072	0.00011	0.000057	0.000024	bdl	bdl	0.000026
PCB 82	bdl	bdl	bdl	bdl	bdl	0.000175	0.000192	0.000413	0.000311	0.000137
PCB 83	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.000107	0.000095	bdl
PCB 84	bdl	bdl	bdl	bdl	bdl	0.000057	bdl	0.00009	0.000196	0.000103
PCB 85	bdl	0.00013	bdl	0.000053	bdl	0.000085	0.000092	0.000315	0.000337	0.000196
PCB 87/115	0.000125	0.00021	0.000065	0.000107	0.000048	0.000354	0.000311	0.000658	0.000559	0.000393
PCB 92	0.00014	0.000281	0.000097	0.000094	0.000118	0.000712	0.000625	0.00124	0.00102	0.000857
PCB 95/80	0.00156	0.000278	0.000135	0.000172	0.000174	0.000395	0.000257	0.00058	0.000735	0.000472
PCB 97	0.000097	0.000306	0.000047	0.000076	0.000045	0.000309	0.000242	0.000634	0.000546	0.000338
PCB 99	0.000256	0.000772	0.000132	0.000589	0.000198	0.00132	0.000758	0.00217	0.0019	0.00125
PCB 101/90	0.000646	0.00135	0.00042	0.000467	0.000362	0.00116	0.000881	0.00271	0.00214	0.00132
PCB 105	0.000215	0.000349	0.000231	0.00026	0.000182	0.000222	0.000294	0.000511	0.00047	0.000277
dl	0.000020	0.000020	0.000019	0.000020	0.000020	0.000019	0.000019	0.000018	0.000019	0.000019

Table 8 (continued). Results of PCB congener analyses in mg/kg wet weight for skinless fish muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note - D is freshwater drum; WB is white bass; dl is the analytical detection limit; and bdl is below the analytical detection limit).

Analyte	LWD1	LWD2	LWD3	LWD4	LWD5	LWWB1	LWWB2	LWWB3	LWWB4	LWWB5
PCB 107	bdl	0.000053	bdl	bdl	bdl	0.000051	0.000047	0.000578	0.000106	0.00006
PCB 110	0.000395	0.000824	0.000213	0.000321	0.000243	0.00101	0.000775	0.00191	0.00186	0.00127
PCB 114	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 118	0.000399	0.0011	0.000214	0.000314	0.000245	0.000887	0.000741	0.00239	0.00212	0.00117
PCB 119	bdl	0.000031	bdl	bdl	bdl	0.000134	0.000106	0.000246	0.000231	0.000167
PCB 126	bdl	bdl	bdl	bdl	bdl	0.000046	0.000037	0.000043	0.000092	0.000096
PCB 128	0.000168	0.000306	bdl	0.000125	0.000121	0.000348	0.000299	0.00111	0.00103	0.000497
PCB 129	bdl	bdl	bdl	bdl	bdl	bdl	0.000036	0.000181	0.000173	0.000067
PCB 130	0.000181	0.000208	bdl	0.000027	bdl	0.000076	0.000081	0.000403	0.000416	0.000173
PCB 135	0.000125	0.000166	0.000061	bdl	bdl	0.000538	0.000565	0.00106	0.000924	0.000593
PCB 136	0.000057	0.000112	0.00008	bdl	bdl	0.000116	0.000113	0.00019	0.000209	0.000164
PCB 138/160	0.00112	0.00249	0.0022	0.00114	0.000828	0.0026	0.00212	0.00743	0.00652	0.00342
PCB 141/179	0.000171	0.000174	0.000088	0.000103	0.000059	0.000612	0.000435	0.00177	0.0016	0.000728
PCB 146	0.000261	0.000576	0.000079	0.000236	0.000151	0.000725	0.000625	0.00227	0.0019	0.00102
PCB 149/123	0.000516	0.00118	0.000269	0.000459	0.000305	0.00122	0.000884	0.00296	0.00259	0.0015
PCB 151	0.00014	0.000251	0.000088	0.000115	0.000072	0.00052	0.000414	0.0013	0.00121	0.000631
PCB 153/132	0.00169	0.00407	0.000842	0.00134	0.00106	0.00407	0.00316	0.0118	0.0105	0.00542
PCB 156	bdl	0.000081	0.000022	bdl	bdl	0.000252	0.000214	0.000746	0.000709	0.000308
PCB 158	0.00025	0.000412	0.000395	0.000442	0.000195	0.000321	0.000257	0.000899	0.000912	0.000441
PCB 166	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.000645	0.000548	bdl
PCB 167	0.000062	0.000146	bdl	bdl	0.000026	0.000113	0.000092	0.000399	0.000388	0.000164
PCB 169	bdl	0.000021	bdl	0.000068	0.00004	0.000047	0.000029	0.000072	0.000089	0.000101
PCB 170/190	0.000125	0.000141	0.000059	0.000115	0.000077	0.000853	0.000566	0.00212	0.00177	0.00086
PCB 171/202	0.00014	0.000153	0.000049	0.000123	0.000058	0.000395	0.000339	0.001	0.000837	0.000479
PCB 172	bdl	0.000033	bdl	bdl	bdl	0.00013	0.000109	0.000387	0.000396	0.000163
PCB 174	0.000068	0.000079	0.000052	0.000047	0.000033	0.000294	0.00022	0.000771	0.000677	0.000388
PCB 175	0.000151	0.000173	0.000126	0.000123	0.000136	0.000179	0.000177	bdl	bdl	0.000234
PCB 176/137	bdl	0.000049	bdl	bdl	bdl	0.000161	0.000127	0.000574	0.000434	0.000213
PCB 177	0.000112	0.000126	0.000027	0.000082	0.000041	0.000211	0.000154	0.000452	0.000326	0.000199
PCB 178	bdl	0.000046	0.000037	0.000039	bdl	bdl	0.000103	0.000402	0.000337	0.000178
PCB 180	0.000651	0.00126	0.000351	0.000543	0.00039	0.00219	0.00185	0.00687	0.00596	0.00297
PCB 183	0.000119	0.000232	0.000047	0.000089	0.000057	0.000364	0.000276	0.00105	0.000981	0.000471
PCB 185	bdl	bdl	bdl	bdl	bdl	0.000042	0.00005	0.000164	0.000151	0.000072
PCB 187	0.000414	0.000795	0.000199	0.000327	0.00024	0.00112	0.000908	0.00332	0.00295	0.00155
PCB 189	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 191	bdl	bdl	bdl	bdl	bdl	bdl	0.000049	0.000246	0.00018	0.000083
PCB 193	bdl	0.000073	bdl	bdl	0.000063	0.000103	0.000086	0.000349	0.000266	0.000132
PCB 194	0.000057	0.000064	0.000029	0.000061	0.000027	0.000354	0.00029	0.000977	0.000947	0.00046
PCB 195/208	0.000083	0.000093	0.000041	0.000062	0.000021	0.000161	0.000135	0.000457	0.000419	0.000211
PCB 196	0.000168	0.000246	0.00005	0.000117	0.000081	0.000418	0.000339	0.00116	0.00114	0.00056
PCB 197	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 199	0.000145	0.000167	0.00011	0.000129	bdl	0.000501	0.00044	0.00122	0.00108	0.00063
PCB 200	bdl	bdl	bdl	bdl	bdl	bdl	0.000031	0.000105	0.000071	0.000041
PCB 201	bdl	0.000026	0.000034	bdl	bdl	bdl	0.00008	0.000161	0.000133	0.000088
PCB 205	bdl	bdl	bdl	bdl	bdl	0.000086	0.000095	0.000345	0.000259	0.000143
PCB 206	bdl	0.000031	0.000045	0.000033	bdl	0.000145	0.000124	0.000361	0.000344	0.00019
PCB 207	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.000069	0.000062	bdl
PCB 209	bdl	bdl	0.000049	0.000054	bdl	bdl	0.000139	0.000378	0.00031	0.000202
dl	0.000020	0.000020	0.000019	0.000020	0.000020	0.000019	0.000019	0.000018	0.000019	0.000019

Table 8 (continued). Results of PCB congener analyses in mg/kg wet weight for skinless fish muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note - CR is white crappie; dl is the analytical detection limit; and bdl is below the analytical detection limit).

Analyte	LWCR1	LWCR2	LWCR3	LWCR4	LWCR5	LWCR6	LWCR7	LWCR8
PCB 1	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 7/9	bdl	bdl	0.000419	bdl	0.000079	0.000121	bdl	0.000206
PCB 8/5	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 15	0.000629	0.000052	bdl	bdl	bdl	bdl	bdl	0.000085
PCB 16/32	bdl	bdl	bdl	bdl	bdl	0.000048	0.00008	bdl
PCB 18/17	bdl	bdl	bdl	bdl	0.000093	0.000186	bdl	bdl
PCB 22/51	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 24/27	0.00004	0.000042	bdl	0.000037	bdl	0.000062	0.000032	bdl
PCB 25	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 26	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 28	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.000226
PCB 29	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 30	bdl	bdl	0.000147	bdl	0.00012	bdl	0.000087	bdl
PCB 31	0.000454	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 33/20	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 39	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 40	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 41/64	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 42/59/37	bdl	bdl	bdl	0.000023	bdl	bdl	bdl	bdl
PCB 44	0.000432	0.000464	0.00079	0.000523	0.000441	0.000373	0.000672	0.000417
PCB 45	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 46	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 47/75	bdl	bdl	0.000167	0.000108	bdl	bdl	bdl	bdl
PCB 48	0.000332	0.000397	bdl	bdl	0.000171	0.000337	0.000487	0.000393
PCB 49	0.000087	0.000109	0.000243	0.000169	0.000127	bdl	0.00013	0.000075
PCB 52	0.000097	0.000159	0.000237	0.000233	0.000125	bdl	0.000127	0.000068
PCB 53	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 60/56	0.000516	0.00043	0.000871	0.00048	0.000504	0.000441	0.000717	0.000433
PCB 63	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 66	0.00008	0.000102	0.000196	0.000124	0.000141	bdl	0.000116	bdl
PCB 67	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 69	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 70	0.00009	0.000083	0.000219	0.000139	0.000189	bdl	0.000085	bdl
PCB 72	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 74/61	0.000031	0.000028	0.00008	bdl	0.000071	bdl	bdl	bdl
PCB 77	bdl	0.000066	0.000046	0.000049	0.00005	bdl	bdl	bdl
PCB 81	0.000031	0.000066	0.000043	0.000055	bdl	0.000031	bdl	bdl
PCB 82	bdl	bdl	bdl	bdl	0.000072	bdl	bdl	bdl
PCB 83	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 84	bdl	bdl	0.000075	0.000067	bdl	bdl	bdl	bdl
PCB 85	0.000039	0.000042	0.000086	0.000053	0.000045	bdl	0.000047	0.000027
PCB 87/115	0.000239	0.000289	0.000561	0.000292	0.000226	0.000125	0.00026	0.000116
PCB 92	0.00007	0.000066	0.000248	0.000162	0.000227	bdl	0.000123	0.000064
PCB 95/80	0.000121	0.000157	0.000437	0.000309	0.000189	bdl	0.000198	0.00005
PCB 97	0.000077	0.0001	0.000209	0.000139	0.000131	bdl	0.000124	0.00007
PCB 99	0.000215	0.000228	0.000577	0.000254	0.000283	0.000088	0.000293	0.000158
PCB 101/90	0.000359	0.00044	0.000867	0.000543	0.000635	0.000225	0.000585	0.000329
PCB 105	0.00019	0.000216	0.000291	0.000229	0.00019	0.000117	0.000314	0.000183
dl	0.000019	0.000020	0.000031	0.000020	0.000018	0.000019	0.000029	0.000020

Table 8 (continued). Results of PCB congener analyses in mg/kg wet weight for skinless fish muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note - CR is white crappie; dl is the analytical detection limit; and bdl is below the analytical detection limit).

Analyte	LWCR1	LWCR2	LWCR3	LWCR4	LWCR5	LWCR6	LWCR7	LWCR8
PCB 107	bdl	0.00002	bdl	bdl	0.000024	bdl	bdl	bdl
PCB 110	0.000302	0.0004	0.000849	0.000587	0.000468	0.000143	0.000513	0.000281
PCB 114	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 118	0.000232	0.000292	0.000659	0.00038	0.00043	0.000125	0.000407	0.000231
PCB 119	bdl	bdl	bdl	0.000034	0.000041	bdl	bdl	bdl
PCB 126	bdl	0.00002	0.00004	0.000021	bdl	bdl	0.000057	0.000027
PCB 128	0.000099	0.000122	0.000265	0.000168	0.000163	0.000071	0.00018	0.000112
PCB 129	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 130	0.000033	0.000035	0.000078	bdl	bdl	bdl	bdl	bdl
PCB 135	0.000451	0.000576	0.000635	0.000615	0.000381	0.000474	0.000744	0.000345
PCB 136	0.000047	0.000049	0.000084	0.000062	0.000073	0.000024	0.000106	0.000038
PCB 138/160	0.000821	0.000971	0.002	0.00106	0.00144	0.000644	0.00149	0.000708
PCB 141/179	0.000147	0.000151	0.000369	0.000235	0.000216	0.000071	0.000204	0.00009
PCB 146	0.000214	0.00018	0.000396	0.000214	0.000316	0.000128	0.000336	0.00015
PCB 149/123	0.000428	0.00051	0.000895	0.000594	0.000528	0.000226	0.000617	0.00036
PCB 151	0.000139	0.000156	0.000317	0.000206	0.000202	0.000043	0.000202	0.000084
PCB 153/132	0.00103	0.00112	0.00247	0.00144	0.00173	0.00077	0.00184	0.000879
PCB 156	0.00005	0.000038	0.000153	0.000098	0.000096	bdl	bdl	0.000029
PCB 158	0.000081	0.000091	0.000202	0.000129	0.000184	bdl	0.000155	bdl
PCB 166	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 167	0.000031	0.000028	0.000194	bdl	bdl	bdl	bdl	bdl
PCB 169	bdl	0.000024	bdl	0.000021	0.000021	bdl	bdl	bdl
PCB 170/190	0.000202	0.000402	0.000509	0.000423	0.000437	0.000322	0.000538	0.000224
PCB 171/202	0.00008	0.000092	0.00015	0.000102	0.000107	0.000059	0.000164	0.000062
PCB 172	0.00003	0.000036	0.000064	bdl	0.000055	bdl	bdl	bdl
PCB 174	0.000076	0.00008	0.000184	0.000122	0.000128	0.000047	0.000135	0.000058
PCB 175	0.000126	0.000121	0.000221	0.000131	0.000129	0.000116	0.000192	0.000119
PCB 176/137	0.000046	0.000062	bdl	bdl	0.000078	bdl	bdl	bdl
PCB 177	0.000049	0.000068	0.000087	0.000078	0.000115	0.000046	0.00008	0.00005
PCB 178	0.000024	0.000033	0.00006	0.000031	0.000055	bdl	0.000049	bdl
PCB 180	0.000556	0.000614	0.00109	0.000653	0.000783	0.000377	0.000996	0.000464
PCB 183	0.000076	0.000077	0.000181	0.000108	0.000124	0.000055	0.000138	0.000061
PCB 185	0.000024	0.000048	bdl	bdl	bdl	bdl	bdl	bdl
PCB 187	0.000254	0.00026	0.000557	0.000319	0.000428	0.000192	0.000462	0.000199
PCB 189	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 191	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 193	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 194	0.000068	0.000056	0.000181	0.000109	0.000103	0.000042	0.000118	0.000035
PCB 195/208	bdl	bdl	0.000076	0.000045	0.000045	bdl	0.000046	bdl
PCB 196	0.000079	0.000064	0.000206	0.000127	0.000105	bdl	0.000136	bdl
PCB 197	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 199	0.000162	0.000164	0.000321	0.000213	0.000238	0.00014	0.000276	0.000162
PCB 200	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 201	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 205	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 206	bdl	bdl	0.000068	0.000049	bdl	bdl	bdl	bdl
PCB 207	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 209	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.000019	0.000020	0.000031	0.000020	0.000018	0.000019	0.000029	0.000020

Table 8 (continued). Results of PCB congener analyses in mg/kg wet weight for skinless fish muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note - CC is channel catfish; dl is the analytical detection limit; and bdl is below the analytical detection limit).

Analyte	LWCC1	LWCC2	LWCC3	LWCC4	LWCC5	LWCC6	LWCC7	LWCC8	LWCC9	LWCC10
PCB 1	0.00119	bdl	bdl	bdl	0.000577	bdl	bdl	bdl	0.00015	bdl
PCB 7/9	0.000862	0.00115	0.0012	0.0013	0.00102	0.0015	0.000465	0.000309	bdl	0.000607
PCB 8/5	0.000429	bdl	0.000473	0.000201	0.000466	0.000577	0.000173	0.000178	0.000191	0.000082
PCB 15	0.00027	0.000177	bdl	bdl	bdl	0.000217	bdl	bdl	bdl	bdl
PCB 16/32	0.000172	0.00028	0.000183	0.000165	bdl	0.000335	bdl	bdl	bdl	0.0008
PCB 18/17	bdl	0.000108	0.000255	0.000143	0.000054	0.000052	bdl	bdl	0.000022	bdl
PCB 22/51	0.000081	0.000082	0.000092	0.000057	0.000074	0.000236	0.000156	0.000156	bdl	0.000618
PCB 24/27	0.00025	0.000146	0.000251	0.000142	0.000159	0.000239	bdl	bdl	0.000028	bdl
PCB 25	0.000023	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.000112
PCB 26	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 28	0.000407	0.000399	0.000231	0.000464	0.000268	0.000039	0.000213	0.000532	0.00007	0.00164
PCB 29	bdl	0.000393	bdl	0.000394	bdl	bdl	bdl	bdl	bdl	0.000165
PCB 30	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 31	bdl	bdl	bdl	bdl	0.000041	bdl	bdl	bdl	bdl	0.000196
PCB 33/20	0.000119	0.000184	0.000174	0.000341	bdl	0.000588	bdl	bdl	bdl	0.000619
PCB 39	bdl	bdl	bdl	bdl	bdl	0.000115	bdl	bdl	bdl	bdl
PCB 40	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 41/64	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 42/59/37	0.000079	bdl	bdl	bdl	0.000097	bdl	bdl	bdl	bdl	bdl
PCB 44	0.000661	bdl	0.000477	bdl	0.000569	0.000431	bdl	bdl	0.000426	bdl
PCB 45	bdl	0.000022	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.000053
PCB 46	0.000024	bdl	bdl	bdl	bdl	0.000021	bdl	bdl	bdl	bdl
PCB 47/75	0.000218	0.00034	0.000254	bdl	bdl	bdl	bdl	bdl	0.000022	0.000297
PCB 48	bdl	0.000068	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 49	0.000486	0.000538	0.000347	0.00151	0.000249	0.000788	bdl	bdl	0.000083	0.000479
PCB 52	0.000348	0.000271	0.000326	bdl	0.000223	0.000352	bdl	bdl	0.000075	0.00067
PCB 53	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 60/56	0.000552	0.000615	0.000548	0.000491	0.000562	0.000472	bdl	bdl	0.000435	0.000771
PCB 63	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 66	0.000377	0.000685	0.000307	0.00006	bdl	0.000022	0.00024	0.00004	0.000059	0.000613
PCB 67	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 69	0.000033	bdl	0.000273	bdl	bdl	0.000294	bdl	bdl	bdl	bdl
PCB 70	0.000044	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.000309
PCB 72	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 74/61	0.000281	0.000431	0.000248	0.00003	bdl	bdl	0.00026	bdl	0.000035	0.000673
PCB 77	bdl	bdl	0.000027	bdl	bdl	0.000025	bdl	bdl	bdl	bdl
PCB 81	bdl	bdl	0.000028	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 82	0.000191	0.000257	0.000073	bdl	bdl	bdl	0.000117	bdl	bdl	0.000558
PCB 83	0.000104	0.000109	0.000121	bdl	bdl	bdl	0.000036	bdl	bdl	0.000308
PCB 84	0.000179	0.00017	0.000036	bdl	bdl	bdl	0.000045	bdl	bdl	0.000183
PCB 85	0.00017	0.00022	0.000159	0.000022	bdl	0.000033	0.000072	0.000022	0.000028	0.000406
PCB 87/115	0.000844	0.00076	0.000404	0.00008	0.000046	0.00015	0.000597	0.000623	0.000206	0.00584
PCB 92	0.00107	0.00103	0.000629	0.000132	0.000069	0.000104	0.000681	0.000193	0.000132	0.00227
PCB 95/80	0.000582	0.000575	0.000112	bdl	0.000093	bdl	0.000181	0.000091	0.000042	0.00101
PCB 97	0.000435	0.000445	0.000312	0.00002	bdl	bdl	0.000217	0.000078	0.000034	0.000894
PCB 99	0.0017	0.00227	0.00174	0.000307	0.000182	0.00028	0.00121	0.000295	0.000262	0.00322
PCB 101/90	0.00158	0.002	0.000775	0.000074	0.000086	0.000117	0.000581	0.000281	0.000135	0.00278
PCB 105	0.000521	0.000721	0.00061	0.000196	0.000163	0.000197	0.000274	0.000142	0.000129	0.00141
dl	0.000020	0.000020	0.000020	0.000020	0.000020	0.000019	0.000020	0.000020	0.000019	0.000020

Table 8 (continued). Results of PCB congener analyses in mg/kg wet weight for skinless fish muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note - C is channel catfish; dl is the analytical detection limit; and bdl is below the analytical detection limit).

Analyte	LWCC1	LWCC2	LWCC3	LWCC4	LWCC5	LWCC6	LWCC7	LWCC8	LWCC9	LWCC10
PCB 107	0.000237	0.000237	0.000246	0.000037	0.000028	bdl	0.000124	bdl	bdl	0.000291
PCB 110	0.00204	0.00222	0.00171	0.000214	0.000093	0.000175	0.00102	0.000335	0.000265	0.00319
PCB 114	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 118	0.00194	0.00247	0.00241	0.00037	0.000342	0.000394	0.00117	0.000238	0.00029	0.00364
PCB 119	0.00015	0.000158	0.000131	bdl	bdl	bdl	0.000129	bdl	bdl	0.00045
PCB 126	bdl	bdl	0.000038	bdl	bdl	0.000021	bdl	bdl	bdl	0.000025
PCB 128	0.000814	0.00086	0.00114	0.000148	0.000153	0.000128	0.000535	0.000097	0.000131	0.00113
PCB 129	0.000157	0.000202	0.000227	0.000021	bdl	bdl	0.000081	bdl	bdl	0.000237
PCB 130	0.000261	0.000333	0.000427	0.000043	0.000054	0.000079	0.000046	bdl	bdl	0.00024
PCB 135	0.000499	0.000491	0.000363	0.000097	0.000084	0.000102	0.000286	0.000103	0.000157	0.000542
PCB 136	0.000162	0.000158	0.000107	0.000044	0.000023	0.000039	0.000112	0.000032	bdl	0.000354
PCB 138/160	0.00557	0.00608	0.00783	0.00124	0.00203	0.00144	0.00372	0.00187	0.000906	0.0108
PCB 141/179	0.000957	0.00111	0.00137	0.000178	0.000165	0.000258	0.000685	0.000118	0.000111	0.00165
PCB 146	0.00116	0.00137	0.00196	0.000338	0.000381	0.000382	0.00107	0.000186	0.00025	0.00236
PCB 149/123	0.00175	0.00183	0.00156	0.000206	0.00153	0.000212	0.000991	0.000381	0.000262	0.003
PCB 151	0.000663	0.000876	0.000782	0.000108	0.000064	0.000113	0.000556	0.000145	0.000117	0.00136
PCB 153/132	0.00726	0.00814	0.0108	0.00174	0.00222	0.00214	0.00558	0.00117	0.00132	0.0122
PCB 156	0.000561	0.000349	0.000631	0.000078	0.000147	0.000119	0.000362	0.000048	0.000073	0.000916
PCB 158	0.000831	0.00097	0.00119	0.000297	0.00022	0.000285	0.000695	0.00041	0.000087	0.00138
PCB 166	0.00002	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.000026
PCB 167	0.000246	0.000285	0.000428	0.000054	0.000088	0.000066	0.000168	0.000033	0.000032	0.000503
PCB 169	bdl	bdl	0.000039	0.000022	bdl	bdl	bdl	bdl	bdl	0.000035
PCB 170/190	0.00118	0.00131	0.00231	0.000361	0.000648	0.000563	0.00114	0.00011	0.000347	0.00191
PCB 171/202	0.000457	0.000625	0.000822	0.000127	0.000199	0.000163	0.00043	0.000079	0.000085	0.00095
PCB 172	0.000254	0.000275	0.000525	0.000089	0.000125	0.000124	0.00022	0.000032	0.000054	0.000439
PCB 174	0.000568	0.000646	0.00089	0.00014	0.000155	0.000205	0.000476	0.000101	0.000106	0.000929
PCB 175	0.000225	0.000275	0.000463	0.000161	0.000159	0.000154	0.000228	0.000115	0.000119	0.000588
PCB 176/137	0.000451	0.000486	0.000535	0.000064	0.000063	0.000062	0.00029	0.000032	0.000034	0.000762
PCB 177	0.000484	0.000495	0.000715	0.000094	0.000154	0.000127	0.000347	0.000074	0.000081	0.000761
PCB 178	0.000259	0.000289	0.000399	0.000074	0.000081	0.000094	0.000244	0.000127	bdl	0.000503
PCB 180	0.00405	0.00443	0.00805	0.00116	0.00185	0.00190	0.00365	0.000624	0.000772	0.00732
PCB 183	0.000657	0.000733	0.00123	0.000177	0.000324	0.000258	0.000605	0.000104	0.000123	0.00128
PCB 185	0.000124	0.000129	0.000195	0.000024	0.000031	0.000032	0.000095	bdl	bdl	0.000262
PCB 187	0.00182	0.00209	0.00365	0.000548	0.000789	0.000831	0.00176	0.00034	0.000429	0.00365
PCB 189	0.000042	0.00003	0.000083	bdl	bdl	bdl	bdl	bdl	bdl	0.000066
PCB 191	0.000076	0.000022	0.000059	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 193	0.000207	0.000189	0.000386	0.000035	0.000082	0.000075	0.000157	0.000029	0.000032	0.000345
PCB 194	0.000601	0.000642	0.00133	0.000212	0.000412	0.000452	0.000611	0.000073	0.000124	0.00098
PCB 195/208	0.000274	0.000326	0.000647	0.000115	0.000225	0.000204	0.000302	0.000038	0.000066	0.000504
PCB 196	0.000798	0.000877	0.00177	0.000289	0.00057	0.000612	0.000811	0.000104	0.000171	0.00132
PCB 197	0.000025	0.000029	0.00005	bdl	bdl	bdl	bdl	bdl	bdl	0.000046
PCB 199	0.0009	0.000936	0.00174	0.000398	0.000628	0.000646	0.000869	0.000196	0.000303	0.0014
PCB 200	0.000049	0.000072	0.000099	bdl	bdl	0.000038	0.000059	bdl	bdl	0.000143
PCB 201	0.000242	0.000229	0.000334	0.000055	0.000057	0.000059	0.000134	bdl	0.000036	0.000368
PCB 205	0.000089	0.000119	0.000438	0.000063	0.000114	0.00012	0.000161	bdl	0.000044	0.000284
PCB 206	0.000256	0.000275	0.00052	0.000108	0.000223	0.000231	0.000269	0.000027	0.000075	0.000416
PCB 207	0.00004	0.000046	0.000087	0.000022	0.000024	bdl	0.000049	bdl	bdl	0.000071
PCB 209	0.000228	0.000206	0.000535	0.000138	0.00021	0.000172	0.000272	0.000028	0.000071	0.000333
dl	0.000020	0.000020	0.000020	0.000020	0.000020	0.000019	0.000020	0.000020	0.000019	0.000020

Table 8 (continued). Results of PCB congener analyses in mg/kg wet weight for skinless fish muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note - LMB is largemouth bass; dl is the analytical detection limit; and bdl is below the analytical detection limit).

Analyte	LWLMB 1	LWLMB 2	LWLMB 3	LWLMB 4	LWLMB 5	LWLMB 6	LWLMB 7	LWLMB 8	LWLMB 9	LWLMB10
PCB 1	bdl	bdl	0.000856	0.00042	0.000775	0.000472	bdl	bdl	bdl	0.0035
PCB 7/9	0.00019	0.000073	0.000055	0.000126	0.000159	0.000092	0.00124	0.000892	0.000395	0.0011
PCB 8/5	bdl	0.000118	0.000351	0.000255	0.00041	0.000312	0.000295	0.000344	0.000287	0.000358
PCB 15	bdl	bdl	bdl	bdl	bdl	0.000028	0.000143	bdl	bdl	0.000279
PCB 16/32	0.00125	0.000068	bdl	0.000111	bdl	bdl	0.000241	0.000178	bdl	0.000246
PCB 18/17	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.000123	0.000194	0.000103
PCB 22/51	bdl	bdl	bdl	bdl	bdl	bdl	0.000136	0.000053	bdl	0.000138
PCB 24/27	bdl	0.000147	0.000126	0.000136	0.00015	0.000122	0.000138	0.000166	0.000099	0.000238
PCB 25	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 26	0.00133	0.000176	0.000108	0.000704	0.00231	bdl	0.000323	bdl	0.004	0.000381
PCB 28	0.000435	0.000217	0.000124	0.000256	0.000456	0.000245	bdl	bdl	0.000026	0.000066
PCB 29	bdl	bdl	bdl	bdl	bdl	bdl	0.000532	bdl	0.000497	bdl
PCB 30	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 31	bdl	0.000042	bdl	bdl	bdl	bdl	0.000042	bdl	bdl	bdl
PCB 33/20	bdl	bdl	bdl	bdl	bdl	bdl	0.00047	0.000095	bdl	0.000223
PCB 39	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.000024	0.00002	bdl
PCB 40	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 41/64	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 42/59/37	0.000096	0.000087	0.000039	0.000116	0.000079	0.000068	bdl	bdl	bdl	bdl
PCB 44	0.000565	0.0006	0.000518	0.00103	0.000565	0.000621	0.000545	0.000482	bdl	0.000526
PCB 45	0.000062	bdl	0.000072	0.00003	0.000091	0.000051	0.000036	bdl	bdl	bdl
PCB 46	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 47/75	0.00103	0.000497	0.000071	0.000495	0.000523	0.00023	0.000036	bdl	0.000204	0.000152
PCB 48	bdl	bdl	bdl	bdl	bdl	bdl	0.000055	bdl	0.000076	0.000021
PCB 49	0.000352	0.000384	0.000146	0.000929	0.000368	0.000281	0.000226	0.000078	bdl	0.000318
PCB 52	0.00036	0.000449	0.000156	0.00209	0.000428	0.000318	0.000386	0.000124	0.000029	0.000277
PCB 53	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.000037	bdl
PCB 60/56	0.000675	0.000737	0.000575	0.000796	0.000715	0.000711	0.000619	0.000514	0.000558	0.000649
PCB 63	bdl	bdl	bdl	bdl	0.000032	bdl	bdl	bdl	bdl	bdl
PCB 66	0.000376	0.000459	0.000143	0.000589	0.000381	0.000384	0.000251	0.000081	0.000043	0.000207
PCB 67	bdl	bdl	bdl	0.000054	0.000032	0.000034	bdl	bdl	bdl	bdl
PCB 69	bdl	bdl	bdl	bdl	bdl	bdl	0.000191	0.000062	bdl	0.000024
PCB 70	0.000306	0.000395	0.000107	0.00193	0.000315	0.000282	0.000235	0.000049	0.000049	0.000278
PCB 72	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 74/61	0.000205	0.000247	0.00008	0.000587	0.000266	0.000281	0.000153	0.000046	0.000041	0.000129
PCB 77	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 81	bdl	0.000044	bdl	0.000022	bdl	bdl	bdl	bdl	bdl	bdl
PCB 82	0.000477	0.000137	0.000063	0.000646	0.000188	0.000084	0.000099	0.000025	0.000024	0.000069
PCB 83	0.000446	0.000058	0.000033	0.00037	0.000335	0.000036	0.000065	0.000022	0.000388	0.000038
PCB 84	0.000051	0.000084	0.000037	0.000879	0.000093	0.000053	0.000055	bdl	bdl	0.000036
PCB 85	0.000241	0.000094	0.00009	0.00068	0.000233	0.000132	0.0001	0.00006	0.000042	0.000078
PCB 87/115	0.000746	0.000366	0.000159	0.00195	0.000441	0.000242	0.000246	0.000073	0.000081	0.000164
PCB 92	0.000554	0.000782	0.000184	0.00154	0.000655	0.000502	0.000554	0.000167	0.000159	0.000369
PCB 95/80	0.000559	0.000541	0.000187	0.00296	0.000815	0.000318	0.000357	0.000081	0.00052	0.00025
PCB 97	0.000425	0.000389	0.000162	0.00177	0.00053	0.000272	0.000278	0.000068	0.000092	0.000182
PCB 99	0.00137	0.00131	0.00047	0.00309	0.00145	0.000881	0.000908	0.000251	0.000272	0.000557
PCB 101/90	0.00204	0.00201	0.000651	0.0058	0.0022	0.00137	0.00128	0.000385	0.000428	0.0008
PCB 105	0.000517	0.000494	0.000291	0.00168	0.000587	0.000317	0.000337	0.000169	0.000191	0.000269
dl	0.000019	0.000020	0.000020	0.000020	0.000020	0.000020	0.000020	0.000020	0.000020	0.000021

Table 8 (concluded). Results of PCB congener analyses in mg/kg wet weight for skinless fish muscle tissue samples collected from Lake Worth (LW), Tarrant County, Texas, November, 2003 (Note - LMB is largemouth bass; dl is the analytical detection limit; and bdl is below the analytical detection limit).

Analyte	LWLMB 1	LWLMB 2	LWLMB 3	LWLMB 4	LWLMB 5	LWLMB 6	LWLMB 7	LWLMB 8	LWLMB 9	LWLMB10
PCB 107	0.000097	0.000145	0.00006	0.000494	0.000264	0.000163	0.000106	0.000033	0.000044	0.000063
PCB 110	0.00116	0.00103	0.000447	0.00548	0.00137	0.000689	0.000813	0.00023	0.000281	0.000491
PCB 114	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 118	0.00167	0.00148	0.000646	0.00551	0.00195	0.00109	0.00106	0.000303	0.000408	0.00067
PCB 119	0.000137	0.00015	0.000044	0.000212	0.000127	0.000095	0.000101	0.000021	0.000037	0.000068
PCB 126	0.000038	0.000031	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.000027
PCB 128	0.000769	0.00051	0.00025	0.00126	0.000772	0.000397	0.000415	0.000102	0.000135	0.000187
PCB 129	0.000136	0.000099	0.000038	0.000387	0.000149	0.00007	0.000054	bdl	0.00002	0.000038
PCB 130	0.000264	0.000175	0.000079	0.000528	0.000289	0.000133	0.00012	0.000035	0.000041	0.000065
PCB 135	0.000708	0.000281	0.000121	0.000671	0.000264	0.000248	0.000206	0.00009	0.00009	0.000121
PCB 136	0.000106	0.000106	0.000043	0.000276	0.000057	0.000101	0.000103	0.000039	0.000037	0.000057
PCB 138/160	0.00439	0.00358	0.0016	0.00658	0.00461	0.00319	0.00276	0.000887	0.00109	0.00172
PCB 141/179	0.000933	0.000727	0.000285	0.00135	0.000829	0.000653	0.000487	0.000141	0.000166	0.000264
PCB 146	0.000994	0.000855	0.000354	0.00129	0.00106	0.000736	0.000734	0.000196	0.000247	0.000403
PCB 149/123	0.00125	0.00135	0.000588	0.00304	0.00155	0.00117	0.000979	0.000285	0.000325	0.000539
PCB 151	0.000489	0.000529	0.000202	0.000911	0.000575	0.000528	0.000382	0.0001	0.000118	0.000214
PCB 153/132	0.0054	0.00464	0.00187	0.00807	0.00564	0.00424	0.00378	0.00114	0.00129	0.00214
PCB 156	0.000438	0.000223	0.000139	0.00102	0.000395	0.000215	0.000185	0.00005	0.000071	0.000124
PCB 158	0.00062	0.000467	0.000212	0.00106	0.000661	0.000418	0.000512	0.000191	0.000314	0.000283
PCB 166	0.000374	bdl	bdl	0.000094	0.000383	bdl	bdl	bdl	bdl	0.000025
PCB 167	0.000551	0.000272	0.000071	0.000323	0.000219	0.000125	0.000109	0.00003	0.000041	0.000088
PCB 169	0.000023	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 170/190	0.0011	0.000735	0.00033	0.000836	0.000849	0.000718	0.000596	0.000141	0.000177	0.000369
PCB 171/202	0.000419	0.00055	0.000212	0.000348	0.000453	0.000377	0.000329	0.000094	0.000108	0.000163
PCB 172	0.000163	0.00016	0.000079	0.000178	0.000193	0.000147	0.000129	0.000046	0.000052	0.000083
PCB 174	0.000239	0.000283	0.000111	0.000403	0.000247	0.000244	0.000226	0.000062	0.000067	0.00012
PCB 175	0.000267	0.000561	0.000145	0.000253	0.000305	0.00021	0.000219	0.000144	0.000151	0.000176
PCB 176/137	0.000296	0.000249	0.000094	0.000537	0.000278	0.000178	0.000197	0.000039	0.00006	0.000103
PCB 177	0.000233	0.000288	0.000096	0.000296	0.000216	0.000235	0.000215	0.000047	0.000053	0.000121
PCB 178	0.000137	0.000156	0.000062	0.000166	0.000157	0.000148	0.000118	0.000042	0.000072	0.000085
PCB 180	0.00298	0.00278	0.00137	0.00281	0.00318	0.00276	0.00221	0.000629	0.000746	0.00116
PCB 183	0.000563	0.000433	0.00019	0.000486	0.000553	0.000431	0.000345	0.000094	0.000106	0.000204
PCB 185	0.000043	0.000046	0.000028	0.000058	0.000066	0.000062	0.000037	bdl	bdl	0.000024
PCB 187	0.00139	0.00145	0.000615	0.00139	0.00173	0.00134	0.00110	0.000298	0.000344	0.000636
PCB 189	bdl	bdl	bdl	0.00004	0.000033	0.000025	bdl	bdl	bdl	bdl
PCB 191	0.000102	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.000033
PCB 193	0.000124	0.000121	0.000032	0.000128	0.000149	0.000122	0.000102	0.000027	0.000028	0.000036
PCB 194	0.000403	0.00036	0.00015	0.000374	0.000455	0.000286	0.000279	0.000057	0.00009	0.000158
PCB 195/208	0.000181	0.000195	0.000083	0.000186	0.000218	0.000156	0.00013	0.000035	0.000046	0.000076
PCB 196	0.00048	0.000467	0.000225	0.000486	0.00064	0.000392	0.00035	0.000087	0.000119	0.000205
PCB 197	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 199	0.000573	0.000602	0.000313	0.000597	0.0007	0.000486	0.000451	0.000168	0.000207	0.000302
PCB 200	bdl	0.000063	bdl	0.000038	bdl	0.000025	0.000027	bdl	bdl	bdl
PCB 201	0.000045	0.000187	0.000056	0.000223	0.000163	0.000091	0.000094	0.000025	0.000035	0.000052
PCB 205	0.000104	0.000194	0.000035	0.000105	0.000106	0.000106	0.000055	0.000026	bdl	0.000027
PCB 206	0.000147	0.000142	0.000067	0.000164	0.000202	0.000098	0.000102	0.000025	0.000041	0.000067
PCB 207	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
PCB 209	bdl	0.000213	0.00005	0.000167	0.000177	0.000136	0.000052	0.000038	0.000044	0.000032
dl	0.000019	0.000020	0.000020	0.000020	0.000020	0.000020	0.000020	0.000020	0.000020	0.000021

approximately 209 individual congeners (Moring, 1997). These congeners are relatively stable compounds that exhibit low water solubilities, high heat capacities, low flammabilities, low electric conductivities, and low vapor pressures (USEPA, 1994; Moring, 1997). Aroclors, in turn, are industrial mixtures of various PCB congeners. These aroclors are identified by the number of carbon atoms present plus the percentage by weight of chlorine (ATSDR, 2000c). For example, Aroclor 1254 contains 12 carbon atoms and approximately 54% chlorine, while Aroclor 1260 would contain 12 carbons and 60% chlorine (TDH, 2000). The more highly chlorinated aroclors have demonstrated the greater potential for adverse affects to human health and the environment (TDH, 2000).

Polychlorinated biphenyls are not naturally occurring and when released into the environment, degrade very slowly (ATSDR, 2000c). Reported half-lives for PCBs in lentic systems can range from 4 to 60 years (Spectrum, 2003). In wildlife, PCBs can be teratogenic and tumorigenic and demonstrate a trend to bio-accumulate and bio-concentrate. In fish, PCBs are stored in fat, liver, and brain tissue, but can be found in trace amounts in all tissues. According to Eisler (1986), total PCB concentrations greater than 0.4 mg/kg wet weight in whole body fish and greater than 3 mg/kg in the diet of avian species would result in lethal and/or sublethal toxicological affects. Studies cited by Niimi (1996), suggest that PCB concentrations greater than 25 mg/kg wet weight in macroinvertebrates and greater than 50 mg/kg wet weight in fish tissues may adversely affect reproduction and growth. Humans can absorb PCBs through the skin, lungs or gastrointestinal tract, but exposure is primarily through the consumption of PCB contaminated food. The USFDA reports a tolerance level of 2 mg/kg for PCBs in edible fish tissues, whereas the USEPA considers a PCB concentration of 0.01 mg/kg as a conservative human-health screening level (ODHS, 2004). The concentration recommended by the USEPA is based on a carcinogenicity risk level of 1×10^{-5} and a consumption rate of one fish-meal per month (ODHS, 2004).

Total PCBs were detected in 62% (34/55) of the fish sampled by the USGS at Lake Worth in 1999 (TDH, 2000). Aroclor 1254 was detected in 62 % (35/55) of the fish while Aroclor 1260 was detected in 51% (28/55) of these samples (TDH, 2000). All of the common carp and channel catfish collected by the USGS contained detectable amounts of PCBs (TDH, 2000). Eight of the 10 freshwater drum, one of the five smallmouth buffalo, and six of the 10 largemouth bass sampled in 1999 contained PCB levels above the analytical detection limits (TDH, 2000). None of the white crappie collected by the USGS contained PCB levels greater than the analytical detection limits (TDH, 2000). Reported concentrations ranged from less than the analytical detection limits (<0.05 mg/kg wet weight) to 2.13 mg/kg wet weight (TDH, 2000). The overall arithmetic mean was reported to be 0.218 mg/kg wet weight by the TDH (2000). By species, common carp contained the highest total PCB levels ($\bar{x}$ = 0.69 mg/kg wet weight; n = 10), followed by channel catfish ($\bar{x}$ = 0.18 mg/kg wet weight; n = 10) and freshwater drum ($\bar{x}$ = 0.11 mg/kg wet weight; n = 10; assumed detection limit of 0.05 mg/kg wet weight) (TDH, 2000).

In comparison to the USGS data, all 48 fish collected by the USFWS/USACOE from the reservoir in 2003 contained detectable amounts of PCBs (Table 7). Measured total PCB concentrations in these 48 fish ranged from 0.006 mg/kg wet weight in a white crappie (LWCR6) to 2.53 mg/kg wet weight in a smallmouth buffalo (LWB2) (Table 7). The overall arithmetic mean was calculated to be 0.103 mg/kg wet weight (n = 48; s = 0.361), which was two times lower than the mean (0.218 mg/kg wet weight) reported from the 1999 data. By species, the 2003 smallmouth buffalo contained the highest total PCB concentrations ($\bar{x}$ = 0.61 mg/kg wet weight; n = 5; s = 1.07), followed by common carp ($\bar{x}$ = 0.15 mg/kg wet weight; n = 5; s = 0.06) and white bass ($\bar{x}$ = 0.048 mg/kg wet weight; n = 5; s = 0.02). White crappie ($\bar{x}$ = 0.012 mg/kg wet weight; n = 8; s = 0.004) and freshwater drum ($\bar{x}$ = 0.013 mg/kg wet weight; n = 5; s = 0.006) contained the lowest detected concentrations. Channel catfish ($\bar{x}$ = 0.04 mg/kg wet weight; n = 10; s = 0.03), freshwater drum, and carp collected in 2003 contained lower total PCB concentrations than levels measured in the same species in 1999 (TDH, 2000). Largemouth bass ($\bar{x}$ = 0.035 mg/kg wet weight; n = 10; s = 0.02) sampled in 2003 also appeared to have lower PCB concentrations than those detected in the 1999 bass ($\bar{x}$ = 0.096 mg/kg wet weight; n = 10; detection limit assumed at 0.05 mg/kg wet weight). White crappie from 2003 appeared to contain higher levels than the white crappie from 1999 (TDH, 2000), but this may be attributed to more sensitive analytical detection limits being used in 2003 (0.005 verses 0.05 mg/kg wet weight). Smallmouth buffalo collected in 2003 contained higher PCB levels than the buffalo sampled in 1999 ($\bar{x}$ = 0.17 mg/kg wet weight; n = 5; detection limit assumed at 0.05 mg/kg wet weight). This may be because, on average, the smallmouth buffalo collected in 2003 were larger than the buffalo collected in 1999 (Table 2).

The only fish collected by the USFWS/USACOE that exceeded the USFDA PCB tolerance level was the smallmouth buffalo, LWB2, but 92% (44/48) of the fish sampled in 2003 contained total PCB concentrations that equaled or exceeded the cited USEPA criterion (ODHS, 2004). Only one freshwater drum (LWD5), one channel catfish (LWCC9), and two white crappie (LWCR6 and LWCR8) contained detectable PCB concentrations that were below this value.

Aroclor 1242 was measured in two fish samples collected in 2003, one smallmouth buffalo (LWB3) and one largemouth bass (LWLMB1), while Aroclor 1248 was detected in approximately 38% (18/48) of the samples (Table 7). Aroclors 1254 and 1260 were identified in approximately 28 (58%) of the 48 samples (Table 7). Aroclor 1260 was the dominant aroclor identified in 71% (20/28) of these 28 samples (Table 7). No aroclors were reported above the analytical detection limits in 20 of the fish collected in 2003 (LWCR1, LWCR2, LWCR4 - LWCR8, LWLMB8 - LWLMB10, LWD1 - LWD5, LWCC4 - LWCC6, LWCC8, and LWCC9) (Table 7). This is because no definitive Aroclor 1254 or Aroclor 1260 patterns could be ascertained in the laboratory (Denoux, personal communication, 2004).

Of the 96 congeners included in the analyses, PCB 72 and PCB 114 were the only congeners not detected above the analytical detection limits in any of the samples analyzed (Table 8). Conversely, 19 congeners (PCB 87/115, PCB 99, PCB 101/90, PCB 105, PCB 118, PCB 138/160, PCB 141/179, PCB 146, PCB 149/123, PCB 151, PCB 153/132, PCB 170/190, PCB 171/202, PCB 174, PCB 177, PCB 180, PCB 183, PCB 187, and PCB 194) were measured above the analytical detection limits in every fish collected from the reservoir (Table 8). Smallmouth buffalo contained the greatest number of detectable congeners (92), while white crappie (67 detected congeners), followed by freshwater drum (68 congeners), contained the lowest number of measured congeners (Table 8). One smallmouth buffalo (LWB2) contained seven congeners that were individually greater than 0.1

mg/kg wet weight (Table 8). No other fish sampled in 2003 contained detectable individual PCB congener concentrations that equaled or exceeded 0.1 mg/kg wet weight (Table 8). In LWB2, the congener measured with the highest concentration was PCB 153/132 (0.287 mg/kg wet weight).

Human Health Risk

As a further point of evaluation, organochlorine pesticide and PCB analytical results from the 2003 Lake Worth sampling were used to calculate possible non-cancer and cancer human health risks associated with consuming fish from the reservoir. This was performed for comparative purposes with the TDH (2000) advisory to determine if temporal trends in contamination were evident. The same assumptions that were applied by the TDH (2000) were used for the USFWS calculations.

[Non-Cancer Health Risk] Individual exposure to each organochlorine contaminant detected above their respective analytical detection limits were determined for two sub-populations (adults and children) (Table 9) by the following equation (from USEPA, 2000):

$$E_m = \frac{C_m \text{ x } CR}{BW}$$

where: E_m = estimated individual exposure dose to chemical *m* from ingesting fish in mg/kg/day;
C_m = concentration of chemical contaminant *m* in edible portion of fish in mg/kg wet weight;
CR = mean daily consumption rate of fish; assumed at 0.03 kg/day (30 grams/day) for adults and 0.015 kg/day (15 grams/day) for children (from TDH, 2000);
BW = body weight of individual consumer; assumed at 70 kg for adults and 15-35 kg for children (from TDH, 2000).

Non-cancer health risk quotients for the two sub-populations (adults and children) for the same organochlorine contaminants were determined by the following equation (from USEPA, 2000):

$$HQ = \frac{E_m}{RfD}$$

where: HQ = unitless non-cancer hazard quotient;
E_m = estimated individual exposure dose to chemical *m* from ingesting fish in mg/kg/day;
RfD = reference dose in mg/kg/day obtained from USEPA (2000), ATSDR (2004), and/or USEPA (2004).

The resulting non-cancer health risk hazard quotients for each organochlorine contaminant were used to determine hazard indices for the two sub-populations (adults and children) by calculating the total sum of the quotients for each sub-population, following the assumption that all of these contaminants, with the exception of endosulfan and tetrachlorobenzne, would have similar hepatic non-cancer health affects (Table 9). Endosulfan and tetrachlorobenzene were excluded from this calculation because chronic toxicity evaluations have not demonstrated direct hepatic non-cancer affects (USEPA, 2004).

Table 9. Non-cancer health risk associated with consumption of fish from Lake Worth for organochlorine contaminants detected above the analytical detection limits in fish collected by the USFWS/USACOE, 2003, compared with non-cancer health risk values reported by the TDH for fish collected in 1999 (Note - wwt is wet weight; RfD is reference dose; HQ is hazard quotient; HI is hazard index; rdna is reference dose not available; nc is not calculated; na is not analyzed; bdl is below the analytical detection limit).

Contaminant (m)	Detection Frequency	Mean Concentration (C) (mg/kg wwt)	Individual Exposure (E_m) Adult (70 kg)	Individual Exposure (E_m) Child (15 kg)	RfD (mg/kg/day)	HQ (Adult)	HQ (Child)	Reported TDH HQ[f]
1,2,3,4 TCB*	14/48	0.0005	2.143×10^{-7}	5×10^{-7}	3×10^{-4} (e)	7.14×10^{-4}	0.0017	na
1,2,4,5 TCB*	48/48	0.003	1.286×10^{-6}	3×10^{-6}	3×10^{-4} (d)	0.0043	0.0100	na
Aldrin	1/48	0.0004	1.714×10^{-7}	4×10^{-7}	0.00003 (b)	0.0057	0.0133	all bdl
HCB	3/48	0.0004	1.714×10^{-7}	4×10^{-7}	0.00005 (b)	0.0034	0.0080	0.0001
BHC	3/48	0.0004	1.714×10^{-7}	4×10^{-7}	0.0006 (c)	2.86×10^{-4}	6.67×10^{-4}	all bdl
Chlordane	32/48	0.0049	2.143×10^{-6}	5×10^{-6}	0.0006 (b)	0.0036	0.0083	0.003
DDD	10/48	0.0011	4.286×10^{-7}	1×10^{-6}	5×10^{-4} (a)	8.57×10^{-4}	0.0020	all bdl
DDE	48/48	0.0113	4.843×10^{-6}	1.13×10^{-5}	5×10^{-4} (a)	0.0097	0.0226	0.005
DDT	7/48	0.0008	3.429×10^{-7}	8×10^{-7}	5×10^{-4} (a)	6.86×10^{-4}	0.0016	all bdl
Dieldrin	7/48	0.0006	2.571×10^{-7}	6×10^{-7}	0.00005 (b)	0.0051	0.0120	all bdl
Endosulfan	2/48	0.0004	2.143×10^{-7}	5×10^{-7}	0.002 (b)	1.07×10^{-4}	2.5×10^{-4}	all bdl
Mirex	1/48	0.0005	2.143×10^{-7}	5×10^{-7}	0.0008 (b)	2.68×10^{-4}	6.25×10^{-4}	all bdl
Pentachloroanisole	8/48	0.0006	2.571×10^{-7}	6×10^{-7}	rdna	nc	nc	na
Total PCBs	48/48	0.103	4.414×10^{-5}	1.03×10^{-4}	0.00002 (b)	2.207	5.150	4.7
					HI	**2.24**	**5.22**	**4.71**

*HQ values for 1,2,3,4 TCB and 1,2,4,5 TCB were not used in HI calculations because of dissimilar non-cancer health affects.
[a]Reference dose from USEPA, 2000.
[b]Chronic Minimum Risk Level (MRL) from ATSDR, 2004; the reported MRL for PCBs is from Aroclor 1254.
[c]Intermediate βBHC MRL from ATSDR, 2004.
[d]Reference dose from USEPA, 2004.
[e]1,2,4,5 TCB reference dose from USEPA, 2004.
[f] from TDH, 2000.

According to the TDH (2000), calculated hazard quotients and/or hazard indices for multiple contaminants of less than one demonstrate that the estimated exposure levels are lower than the reference doses, consequently, adverse non-cancer health effects would not expected. Hazard quotients and/or indices greater than one do not necessarily mean that the contaminants represent a public health threat, but they do indicate that further evaluation may be warranted (TDH, 2000). Using the USGS, 1999 data, the TDH (2000) reported adult (70 kg) hazard quotients of 0.0001, 0.003, 0.0005, and 4.7 for HCB, technical chlordane, DDE, and total PCBs, respectively (Table 9).

No other hazard quotients were reported for any other contaminants (TDH, 2000). Of the reported values, only the quotient determined for total PCBs exceeded unity (Table 9).

In comparison, the adult hazard quotients calculated from the USFWS/USACOE, 2003 data for HCB, technical chlordane, and DDE were greater than the TDH values determined for the same constituents (Table 9). However, as with the TDH (2000) values, all of the hazard quotients for these contaminants were less than one, both collectively (Table 9) and individually by species (Tables 10A-10G). The PCB hazard quotient calculated for adults from the 2003 data was less than the value reported by the TDH from the 1999 data (Table 9), but still exceeded unity and thus warranted further evaluation. By species, total PCB hazard quotients calculated for smallmouth buffalo, common carp, and white bass collected in 2003 exceeded unity for non-cancer risks in both adults and children (Tables 10A, 10B, and 10D), while calculated PCB hazard quotients were greater than one in children only in channel catfish and largemouth bass sampled by the USFWS/USACOE (Tables 10F and 10G). Total PCB non-cancer hazard quotients were less than one for both adults and children in freshwater drum and white crappie sampled in 2003 (Tables 10C and 10E).

Table 10A. Non-cancer health risk associated with consumption of smallmouth buffalo collected by the USFWS/USACOE, 2003, from Lake Worth for organochlorine contaminants detected above the analytical detection limits (Note - wwt is wet weight; RfD is reference dose; HQ is hazard quotient; HI is hazard index; na is not available; and nc is not calculated).

Contaminant (m)	Detection Frequency	Mean Concentration (C) (mg/kg wwt)	Individual Exposure (E_m) Adult (70 kg)	Individual Exposure (E_m) Child (15 kg)	RfD (mg/kg/day)	HQ (Adult)	HQ (Child)
1,2,3,4 TCB*	1/5	0.00058	2.49×10^{-7}	5.8×10^{-7}	3×10^{-4}(e)	8.3×10^{-4}	0.0019
1,2,4,5 TCB*	5/5	0.00332	1.42×10^{-6}	3.32×10^{-6}	3×10^{-4}(d)	0.0047	0.0111
HCB	2/5	0.00060	2.57×10^{-7}	6×10^{-7}	0.00005(b)	0.0051	0.0120
BHC	2/5	0.00050	2.14×10^{-7}	5×10^{-7}	0.0006(c)	3.57×10^{-4}	8.33×10^{-4}
Chlordane	5/5	0.03146	1.35×10^{-5}	3.15×10^{-5}	0.0006(b)	0.0225	0.0524
DDD	5/5	0.00634	2.72×10^{-6}	6.34×10^{-6}	5×10^{-4}(a)	0.0054	0.0127
DDE	5/5	0.07772	3.33×10^{-5}	7.77×10^{-5}	5×10^{-4}(a)	0.0670	0.1554
DDT	4/5	0.00420	1.80×10^{-6}	4.2×10^{-6}	5×10^{-4}(a)	0.0036	0.0084
Dieldrin	5/5	0.00252	1.08×10^{-6}	2.52×10^{-6}	0.00005(b)	0.0216	0.0504
Endosulfan	1/5	0.00048	2.06×10^{-7}	4.8×10^{-7}	0.002(b)	1.03×10^{-4}	2.4×10^{-4}
Mirex	1/5	0.00080	3.43×10^{-7}	8×10^{-7}	0.0008(b)	4.29×10^{-4}	0.0010
Pentachloroanisole	5/5	0.00184	7.89×10^{-7}	1.84×10^{-6}	na	nc	nc
Total PCBs	5/5	0.610	2.61×10^{-4}	6.1×10^{-4}	0.00002(b)	13.07	30.5
					HI	**13.2**	**30.8**

*HQ values for 1,2,3,4 TCB and 1,2,4,5 TCB were not used in HI calculations because of dissimilar non-cancer health affects.
[a]Reference dose from USEPA, 2000.
[b]Chronic Minimum Risk Level (MRL) from ATSDR, 2004; the reported MRL for PCBs is from Aroclor 1254.
[c]Intermediate βBHC MRL from ATSDR, 2004.
[d]Reference dose from USEPA, 2004.
[e]1,2,4,5 TCB reference dose from USEPA, 2004.

Table 10B. Non-cancer health risk associated with consumption of common carp collected by the USFWS/USACOE, 2003, from Lake Worth for organochlorine contaminants detected above the analytical detection limits (Note - wwt is wet weight; RfD is reference dose; HQ is hazard quotient; HI is hazard index; na is not available; and nc is not calculated).

Contaminant (m)	Detection Frequency	Mean Concentration (C) (mg/kg wwt)	Individual Exposure (E_m) Adult (70 kg)	Individual Exposure (E_m) Child (15 kg)	RfD (mg/kg/day)	HQ (Adult)	HQ (Child)
1,2,3,4 TCB*	1/5	0.00048	2.06×10^{-7}	4.8×10^{-7}	3×10^{-4}[e]	6.87×10^{-4}	0.0016
1,2,4,5 TCB*	5/5	0.00322	1.38×10^{-6}	3.22×10^{-6}	3×10^{-4}[d]	0.0046	0.01073
Chlordane	5/5	0.00426	1.83×10^{-6}	4.26×10^{-6}	0.0006[b]	0.0030	0.0071
DDD	4/5	0.00070	3×10^{-7}	7×10^{-7}	5×10^{-4}[a]	6×10^{-4}	0.0014
DDE	5/5	0.00554	2.37×10^{-6}	5.54×10^{-6}	5×10^{-4}[a]	0.0047	0.01108
DDT	3/5	0.00052	2.23×10^{-7}	5.2×10^{-7}	5×10^{-4}[a]	4.4×10^{-4}	0.00104
Dieldrin	1/5	0.00044	1.89×10^{-7}	4.4×10^{-7}	0.00005[b]	0.0038	0.0088
Endosulfan	1/5	0.00068	2.91×10^{-7}	6.8×10^{-7}	0.002[b]	1.46×10^{-4}	3.4×10^{-4}
Pentachloroanisole	2/5	0.00044	1.89×10^{-7}	4.4×10^{-7}	na	nc	nc
Total PCBs	5/5	0.1510	6.47×10^{-5}	1.51×10^{-4}	0.00002[b]	3.24	7.55
					HI	**3.26**	**7.58**

Table 10C. Non-cancer health risk associated with consumption of freshwater drum collected by the USFWS/USACOE, 2003, from Lake Worth for organochlorine contaminants detected above the analytical detection limits (Note - wwt is wet weight; RfD is reference dose; HQ is hazard quotient; HI is hazard index; na is not available; and nc is not calculated).

Contaminant (m)	Detection Frequency	Mean Concentration (C) (mg/kg wwt)	Individual Exposure (E_m) Adult (70 kg)	Individual Exposure (E_m) Child (15 kg)	RfD (mg/kg/day)	HQ (Adult)	HQ (Child)
1,2,3,4 TCB*	3/5	0.00064	2.74×10^{-7}	6.4×10^{-7}	3×10^{-4}[e]	9.13×10^{-4}	0.0021
1,2,4,5 TCB*	5/5	0.00244	1.05×10^{-6}	2.44×10^{-6}	3×10^{-4}[d]	0.0035	0.0081
Aldrin	1/5	0.00044	1.89×10^{-7}	4.4×10^{-7}	0.00003[b]	0.0063	0.0147
BHC	1/5	0.00052	2.23×10^{-7}	5.2×10^{-7}	0.0006[c]	3.71×10^{-4}	8.67×10^{-4}
Chlordane	1/5	0.00044	1.89×10^{-7}	4.4×10^{-7}	0.0006[b]	3.14×10^{-4}	7.33×10^{-4}
DDE	5/5	0.00122	5.23×10^{-7}	1.22×10^{-6}	5×10^{-4}[a]	0.00105	0.00244
Total PCBs	5/5	0.01322	5.67×10^{-6}	1.32×10^{-5}	0.00002[b]	0.283	0.661
					HI	**0.30**	**0.68**

Table 10D. Non-cancer health risk associated with consumption of white bass collected by the USFWS/USACOE, 2003, from Lake Worth for organochlorine contaminants detected above the analytical detection limits (Note - wwt is wet weight; RfD is reference dose; HQ is hazard quotient; HI is hazard index; na is not available; and nc is not calculated).

Contaminant (m)	Detection Frequency	Mean Concentration (C) (mg/kg wwt)	Individual Exposure (E_m) Adult (70 kg)	Individual Exposure (E_m) Child (15 kg)	RfD (mg/kg/day)	HQ (Adult)	HQ (Child)
1,2,4,5 TCB*	5/5	0.00304	1.30×10^{-6}	3.04×10^{-6}	3×10^{-4}[d]	0.0043	0.0101
Chlordane	5/5	0.00260	1.11×10^{-6}	2.6×10^{-6}	0.0006[b]	0.0019	0.0043
DDE	5/5	0.00656	2.81×10^{-6}	6.56×10^{-6}	5×10^{-4}[a]	0.0056	0.01312
Total PCBs	5/5	0.04794	2.06×10^{-5}	4.79×10^{-5}	0.00002[b]	1.03	2.397
					HI	**1.04**	**2.42**

*HQ values for 1,2,3,4 TCB, and 1,2,4,5 TCB were not used in HI calculations because of dissimilar non-cancer health affects.

[a] Reference dose from USEPA, 2000.

[b] Chronic Minimum Risk Level (MRL) from ATSDR, 2004; the reported MRL for PCBs is from Aroclor 1254.

[c] Intermediate βBHC MRL from ATSDR, 2004.

[d] Reference dose from USEPA, 2004.

[e] 1,2,4,5 TCB reference dose from USEPA, 2004.

Table 10E. Non-cancer health risk associated with consumption of white crappie collected by the USFWS/USACOE, 2003, from Lake Worth for organochlorine contaminants detected above the analytical detection limits (Note - wwt is wet weight; RfD is reference dose; HQ is hazard quotient; HI is hazard index; na is not available; and nc is not calculated).

Contaminant (m)	Detection Frequency	Mean Concentration (C) (mg/kg wwt)	Individual Exposure (E_m) Adult (70 kg)	Individual Exposure (E_m) Child (15 kg)	RfD (mg/kg/day)	HQ (Adult)	HQ (Child)
1,2,4,5 TCB*	8/8	0.00429	1.84×10^{-6}	4.29×10^{-6}	3×10^{-4} (c)	0.0061	0.0143
DDE	8/8	0.00089	3.81×10^{-7}	8.88×10^{-7}	5×10^{-4} (a)	7.61×10^{-4}	0.0018
Total PCBs	8/8	0.01190	5.09×10^{-6}	1.19×10^{-5}	0.00002 (b)	0.2540	0.5938
					HI	**0.25**	**0.60**

Table 10F. Non-cancer health risk associated with consumption of channel catfish collected by the USFWS/USACOE, 2003, from Lake Worth for organochlorine contaminants detected above the analytical detection limits (Note - wwt is wet weight; RfD is reference dose; HQ is hazard quotient; HI is hazard index; na is not available; and nc is not calculated).

Contaminant (m)	Detection Frequency	Mean Concentration (C) (mg/kg wwt)	Individual Exposure (E_m) Adult (70 kg)	Individual Exposure (E_m) Child (15 kg)	RfD (mg/kg/day)	HQ (Adult)	HQ (Child)
1,2,3,4 TCB*	7/10	0.00060	2.57×10^{-7}	6×10^{-7}	3×10^{-4} (d)	8.57×10^{-4}	0.0020
1,2,4,5 TCB*	10/10	0.00239	1.02×10^{-6}	2.39×10^{-6}	3×10^{-4} (c)	0.0034	0.0080
HCB	1/10	0.00043	1.84×10^{-7}	4.3×10^{-7}	0.00005 (b)	0.0037	0.0086
Chlordane	8/10	0.00265	1.13×10^{-6}	2.65×10^{-6}	0.0006 (b)	0.0019	0.0044
DDD	1/10	0.00044	1.89×10^{-7}	4.4×10^{-7}	5×10^{-4} (a)	3.77×10^{-4}	8.8×10^{-4}
DDE	10/10	0.00523	2.24×10^{-6}	5.23×10^{-6}	5×10^{-4} (a)	0.0045	0.0105
Dieldrin	1/10	0.00044	1.89×10^{-7}	4.4×10^{-7}	0.00005 (b)	0.0038	0.0088
Pentachloroanisole	1/10	0.00050	2.14×10^{-7}	5×10^{-7}	na	nc	nc
Total PCBs	10/10	0.040	1.71×10^{-5}	4×10^{-5}	0.00002 (b)	0.857	2
					HI	**0.86**	**2.03**

Table 10G. Non-cancer health risk associated with consumption of largemouth bass collected by the USFWS/USACOE, 2003, from Lake Worth for organochlorine contaminants detected above the analytical detection limits (Note - wwt is wet weight; RfD is reference dose; HQ is hazard quotient; HI is hazard index; na is not available; and nc is not calculated).

Contaminant (m)	Detection Frequency	Mean Concentration (C) (mg/kg wwt)	Individual Exposure (E_m) Adult (70 kg)	Individual Exposure (E_m) Child (15 kg)	RfD (mg/kg/day)	HQ (Adult)	HQ (Child)
1,2,3,4 TCB*	2/10	0.00044	1.89×10^{-7}	4.4×10^{-7}	3×10^{-4} (d)	6.3×10^{-4}	0.0015
1,2,4,5 TCB*	10/10	0.00241	1.03×10^{-6}	2.41×10^{-6}	3×10^{-4} (c)	0.00344	0.0080
Chlordane	8/10	0.00134	5.74×10^{-7}	1.34×10^{-6}	0.0006 (b)	9.57×10^{-4}	0.00223
DDE	10/10	0.00262	1.12×10^{-6}	5.62×10^{-6}	5×10^{-4} (a)	0.00225	0.00524
Total PCBs	10/10	0.03454	1.48×10^{-5}	3.45×10^{-5}	0.00002 (b)	0.74	1.73
					HI	**0.75**	**1.73**

*HQ values for 1,2,3,4 TCB and 1,2,4,5 TCB were not used in HI calculations because of dissimilar non-cancer health affects.
[a]Reference dose from USEPA, 2000.
[b]Chronic Minimum Risk Level (MRL) from ATSDR, 2004; the reported MRL for PCBs is from Aroclor 1254.
[c]Reference dose from USEPA, 2004.
[d]1,2,4,5 TCB reference dose from USEPA, 2004.

Non-cancer risk levels associated with consumption of fish collected in 2003 were further evaluated by calculating the estimated number of meals per week that would not exceed the minimum risk level attributed to non-cancer effects from total PCBs (Table 11) using the following equation (from USEPA, 2000):

$$M = \frac{BW \times MRL}{C_{PCB}} \div MS \times DW$$

where: M = number of meals per week that may be consumed without exceeding the minimum risk level;
BW = body weight in kg; 15 to 35 kg for children; greater than 35 kg for adults (from TDH,2000);
MRL = total PCBs minimum risk level of 0.00002 mg/kg/day (from ATSDR, 2004);
C_{PCB} = mean concentration of total PCBs in edible portion of fish in mg/kg wet weight;
MS = average meal size in kg; assume 0.114 kg (4 ounces) for children and 0.227 kg (8 ounces) for adults (from TDH, 2000);
DW = 7 days/week.

In addition, the 95th percentile of the arithmetic mean for total PCBs (0.208 mg/kg wet weight) was calculated from the 2003 data and included in Table 11. The 95th percentile of the arithmetic mean represents a value that equals or exceeds the true mean 95 percent (%) of the time and constitutes the 95% upper confidence limit on the arithmetic average (TDH, 2000). It also provides a conservative estimate of the average concentration to which a person may be exposed (TDH, 2000). This value was calculated using the following equation (from Zar, 1984):

$$CL = \bar{X} + [(t_{\alpha\,(2),\,v}) \times (s_{\bar{X}})]$$

where: CL = 95% upper confidence limit;
$\bar{X}$ = arithmetic mean of total PCBs = 0.103 mg/kg wet weight;
α = 0.05;
v = n (sample size) - 1 = 48 - 1 = 47
$t_{\alpha\,(2),\,v} = t_{0.05\,(2),\,47}$ = table value from Zar (1984) = 2.012;
$s_{\bar{X}}$ = standard error of the mean $= \frac{s^*}{\sqrt{n}} = \frac{0.36103}{6.92820} = 0.05211$

*s = standard deviation calculated using Microsoft Excel software.

The arithmetic mean and 95th percentile values determined for total PCBs from the USFWS/USACOE Lake Worth fish data were less than the values calculated by the TDH (Table 11). Consequently, the acceptable number of meals consumed per week calculated from this data were greater than the estimated number of meals determined by the TDH (Table 11). However, the total PCB levels detected in fish collected from the reservoir in 2003 were still at levels that both adults and children would have to limit their consumption to less than one meal per week to avoid exceeding the non-cancer minimum risk level for PCBs.

Table 11. Number of meals per week that would not exceed the total PCBs minimum risk level (MRL) of 0.00002 mg/kg/day for non-cancer health effects in fish collected from Lake Worth by the USFWS/USACOE in 2003 compared to values reported by the TDH (2000) from USGS, 1999 data [Note - wwt is wet weight; Co. is concentration; weight of children ranges from 15 to 35 kg; meal size for children is assumed to be 4 ounces; weight of adults greater than 35 kg; meal size for adults is assumed to be 8 ounces; and Age Range is from TDH (2000)].

Risk-Based Consumption Limits (meals/week)					
Body Weight (kg)	**Age Range (years)**	**Number of meals per week that may be consumed without exceeding the MRL for non-cancer effects.**			
		USFWS Arithmetic Mean Concentration (0.103 mg/kg wwt)	**USFWS 95th Percentile of Mean Co. (0.208 mg/kg wwt)**	**TDH Arithmetic Mean Concentration (0.218 mg/kg wwt)**	**TDH 95th Percentile of Mean Co. (0.316 mg/kg wwt)**
15 kg	3 to 6	0.18	0.09	0.08	0.06
35 kg	10 to 11	0.42	0.21	0.20	0.14
50 kg	adult	0.30	0.15	0.14	0.10
60 kg	adult	0.36	0.18	0.17	0.12
70 kg	adult	0.42	0.21	0.20	0.14
80 kg	adult	0.48	0.24	0.23	0.16
90 kg	adult	0.54	0.27	0.25	0.18
100 kg	adult	0.60	0.30	0.28	0.20

[Cancer Health Risks] Lifetime exposure to each organochlorine contaminant detected above their respective analytical detection limits were determined for adults (Table 12) by the following equation (from Rauscher, personal communication, 2004):

$$LE_m = \frac{C_m \text{ x } CR \text{ x } DY \text{ x } EP}{BW \text{ x } DL}$$

where: LE_m = estimated individual lifetime exposure to chemical *m* from ingesting fish in mg/kg/day;
C_m = concentration of chemical contaminant *m* in edible portion of fish in mg/kg wet weight;
CR = mean daily consumption rate of fish; assumed at 0.03 kg/day for adults (from TDH, 2000);
DY = number of days in a year = 365 days/year;
EP = exposure period in years; assumed to be 30 years (from TDH, 2000);
BW = body weight of individual consumer; assumed at 70 kg for adults (from TDH, 2000);
DL = days in a lifetime = 365 days/year x 70 years.

Cancer health risks (Table 12) were subsequently calculated for adults for the same organochlorine contaminants using the following equation (from USEPA, 2000):

$$R = LE_m \text{ x } CSF$$

where: R = lifetime cancer risk;
LE_m = estimated individual lifetime exposure to chemical *m* from ingesting fish in mg/kg/day;
CSF = cancer slope factor in mg/kg/day; obtained from USEPA (2000) and/or USEPA (2004).

Table 12. Estimated lifetime cancer risk associated with consumption of fish from Lake Worth for organochlorine contaminants detected above the analytical detection limits in fish collected by the USFWS/USACOE, 2003, compared with estimated lifetime cancer risk values reported by the TDH for fish collected in 1999 (Note - wwt is wet weight; CSF is cancer slope factor; csfna is cancer slope factor not available; nc is not calculated; na is not analyzed; bdl is below the analytical detection limit).

Contaminant (m)	Detection Frequency	Mean Concentration (C) (mg/kg wwt)	Individual Exposure (LE_m) Adult (70 kg)	CSF (mg/kg/day)	Cancer Risk	Reported TDH Cancer Risk[d]
1,2,3,4 TCB	14/48	0.0005	9.18×10^{-8}	csfna	nc	na
1,2,4,5 TCB	48/48	0.0030	5.51×10^{-7}	csfna	nc	na
Aldrin	1/48	0.0004	7.35×10^{-8}	17.00[b]	1.25×10^{-6}	all bdl
HCB	3/48	0.0004	7.35×10^{-8}	1.60[a]	1.18×10^{-7}	6.47×10^{-8}
BHC	3/48	0.0004	7.35×10^{-8}	1.80[c]	1.32×10^{-7}	all bdl
Chlordane	32/48	0.0049	9×10^{-7}	0.35[a]	3.15×10^{-7}	2.20×10^{-7}
DDD	10/48	0.0011	2.02×10^{-7}	0.24[a]	4.85×10^{-8}	all bdl
DDE	48/48	0.0113	2.08×10^{-6}	0.34[a]	7.06×10^{-7}	3.50×10^{-7}
DDT	7/48	0.0008	1.47×10^{-7}	0.34[a]	5.00×10^{-8}	all bdl
Dieldrin	7/48	0.0006	1.10×10^{-7}	16.00[a]	1.76×10^{-6}	all bdl
Endosulfan	2/48	0.0004	7.35×10^{-8}	csfna	nc	all bdl
Mirex	1/48	0.0005	9.18×10^{-8}	csfna	nc	all bdl
Pentachloroanisole	8/48	0.0006	1.10×10^{-7}	csfna	nc	na
Total PCBs	48/48	0.1030	1.89×10^{-5}	2.00[a]	3.78×10^{-5}	8.00×10^{-5}
				Cumulative Risk	**4.22×10^{-5}**	**8.10×10^{-5}**

[a]Cancer slope factor from USEPA, 2000.
[b]Cancer slope factor from USEPA, 2004.
[c]Cancer slope factor for βBHC from USEPA, 2004.
[d]from TDH, 2000.

Individual cancer risk values calculated from the 2003 data for HCB, technical chlordane, and DDE were slightly greater than the cancer risks reported by the TDH for the same constituents from the 1999 data (Table 12). In contrast, the cancer risk attributed to total PCBs reported by the TDH from fish collected in 1999 was slightly more than two times greater than the total PCBs cancer risk calculated from the 2003 data (Table 12). The cumulative cancer risk associated with consumption of fish collected in 2003 was equal to the sum of the calculated individual risk values (Table 12). This value was half as much as the cumulative risk value reported by the TDH from the 1999 data (Table 12), consequently the estimated probability of developing cancer from consuming the 2003 fish was approximately two times lower than the excess cancer value determined by the TDH from the 1999 data (Table 14). However, as with the fish collected in 1999, total PCBs represented the majority of the cancer risk in the fish sampled in 2003 (90% in the 2003 data verses 99% in the 1999 data).

By species, smallmouth buffalo from 2003 contained contaminants at levels that represented the greatest cumulative risk (Table 13A), followed by common carp (Table 13B), white bass (Table 13D), channel catfish (Table 13F), and largemouth bass (Table 13G). The lowest cumulative risk values calculated from the 2003 data were associated with white crappie (Table 13E) and freshwater drum (Table 13C).

Table 13A. Estimated lifetime cancer risk associated with consumption of smallmouth buffalo collected by the USFWS/USACOE, 2003, from Lake Worth for organochlorine contaminants detected above the analytical detection limits (Note - wwt is wet weight; CSF is cancer slope factor; csfna is cancer slope factor not available; and nc is not calculated).

Contaminant (m)	Detection Frequency	Mean Concentration (C) (mg/kg wwt)	Individual Exposure (LE_m) Adult (70 kg)	CSF (mg/kg/day)	Cancer Risk
1,2,3,4 TCB	1/5	0.00058	1.07×10^{-7}	csfna	nc
1,2,4,5 TCB	5/5	0.00332	6.10×10^{-7}	csfna	nc
HCB	2/5	0.00060	1.10×10^{-7}	1.60[a]	1.76×10^{-7}
BHC	2/5	0.00050	9.18×10^{-8}	1.80[b]	1.65×10^{-7}
Chlordane	5/5	0.03146	5.78×10^{-6}	0.35[a]	2.02×10^{-6}
DDD	5/5	0.00634	1.16×10^{-6}	0.24[a]	2.79×10^{-7}
DDE	5/5	0.07772	1.43×10^{-5}	0.34[a]	4.85×10^{-6}
DDT	4/5	0.00420	7.71×10^{-7}	0.34[a]	2.62×10^{-7}
Dieldrin	5/5	0.00252	4.63×10^{-7}	16.00[a]	7.41×10^{-6}
Endosulfan	1/5	0.00048	8.82×10^{-8}	csfna	nc
Mirex	1/5	0.00080	1.47×10^{-7}	csfna	nc
Pentachloroanisole	5/5	0.00184	3.38×10^{-7}	csfna	nc
Total PCBs	5/5	0.610	1.12×10^{-4}	2.00[a]	2.24×10^{-4}
				Cumulative Risk	**2.39×10^{-4}**

Table 13B. Estimated lifetime cancer risk associated with consumption of common carp collected by the USFWS/USACOE, 2003, from Lake Worth for organochlorine contaminants detected above the analytical detection limits (Note - wwt is wet weight; CSF is cancer slope factor; csfna is cancer slope factor not available; and nc is not calculated).

Contaminant (m)	Detection Frequency	Mean Concentration (C) (mg/kg wwt)	Individual Exposure (LE_m) Adult (70 kg)	CSF (mg/kg/day)	Cancer Risk
1,2,3,4 TCB	1/5	0.00048	8.82×10^{-8}	csfna	nc
1,2,4,5 TCB	5/5	0.00322	5.91×10^{-7}	csfna	nc
Chlordane	5/5	0.00426	7.82×10^{-7}	0.35[a]	2.74×10^{-7}
DDD	4/5	0.00070	1.29×10^{-7}	0.24[a]	3.09×10^{-8}
DDE	5/5	0.00554	1.02×10^{-6}	0.34[a]	3.46×10^{-7}
DDT	3/5	0.00052	9.55×10^{-8}	0.34[a]	3.25×10^{-8}
Dieldrin	5/5	0.00044	8.08×10^{-8}	16.00[a]	1.29×10^{-6}
Endosulfan	1/5	0.00068	1.25×10^{-7}	csfna	nc
Pentachloroanisole	1/5	0.00044	8.08×10^{-8}	csfna	nc
Total PCBs	5/5	0.1510	2.77×10^{-5}	2.00[a]	5.55×10^{-5}
				Cumulative Risk	**5.74×10^{-5}**

[a]Cancer slope factor from USEPA, 2000.
[b]Cancer slope factor for βBHC from USEPA, 2004.

Table 13C. Estimated lifetime cancer risk associated with consumption of freshwater drum collected by the USFWS/USACOE, 2003, from Lake Worth for organochlorine contaminants detected above the analytical detection limits (Note - wwt is wet weight; CSF is cancer slope factor; csfna is cancer slope factor not available; and nc is not calculated).

Contaminant (m)	Detection Frequency	Mean Concentration (C) (mg/kg wwt)	Individual Exposure (LE_m) Adult (70 kg)	CSF (mg/kg/day)	Cancer Risk
1,2,3,4 TCB	3/5	0.00064	1.18×10^{-7}	csfna	nc
1,2,4,5 TCB	5/5	0.00244	4.48×10^{-7}	csfna	nc
Aldrin	1/5	0.00044	8.08×10^{-8}	17.00[b]	1.37×10^{-6}
BHC	1/5	0.00052	9.55×10^{-8}	1.80[c]	1.72×10^{-7}
Chlordane	1/5	0.00044	8.08×10^{-8}	0.35[a]	2.83×10^{-8}
DDE	5/5	0.00122	2.24×10^{-7}	0.34[a]	7.62×10^{-8}
Total PCBs	5/5	0.01322	2.43×10^{-6}	2.00[a]	4.85×10^{-6}
				Cumulative Risk	**6.50×10^{-6}**

Table 13D. Estimated lifetime cancer risk associated with consumption of white bass collected by the USFWS/USACOE, 2003, from Lake Worth for organochlorine contaminants detected above the analytical detection limits (Note - wwt is wet weight; CSF is cancer slope factor; csfna is cancer slope factor not available; and nc is not calculated).

Contaminant (m)	Detection Frequency	Mean Concentration (C) (mg/kg wwt)	Individual Exposure (LE_m) Adult (70 kg)	CSF (mg/kg/day)	Cancer Risk
1,2,4,5 TCB	5/5	0.00304	5.58×10^{-7}	csfna	nc
Chlordane	5/5	0.00260	4.78×10^{-7}	0.35[a]	1.67×10^{-7}
DDE	5/5	0.00656	1.20×10^{-6}	0.34[a]	4.10×10^{-7}
Total PCBs	5/5	0.04794	8.81×10^{-6}	2.00[a]	1.76×10^{-5}
				Cumulative Risk	**1.82×10^{-5}**

Table 13E. Estimated lifetime cancer risk associated with consumption of white crappie collected by the USFWS/USACOE, 2003, from Lake Worth for organochlorine contaminants detected above the analytical detection limits (Note - wwt is wet weight; CSF is cancer slope factor; csfna is cancer slope factor not available; and nc is not calculated).

Contaminant (m)	Detection Frequency	Mean Concentration (C) (mg/kg wwt)	Individual Exposure (LE_m) Adult (70 kg)	CSF (mg/kg/day)	Cancer Risk
1,2,4,5 TCB	8/8	0.00429	7.88×10^{-7}	csfna	nc
DDE	8/8	0.00089	1.63×10^{-7}	0.34[a]	5.56×10^{-8}
Total PCBs	8/8	0.01190	2.19×10^{-6}	2.00[a]	4.37×10^{-6}
				Cumulative Risk	**4.43×10^{-6}**

[a]Cancer slope factor from USEPA, 2000.
[b]Cancer slope factor from USEPA, 2004.
[c]Cancer slope factor for βBHC from USEPA, 2004.

Table 13F. Estimated lifetime cancer risk associated with consumption of channel catfish collected by the USFWS/USACOE, 2003, from Lake Worth for organochlorine contaminants detected above the analytical detection limits (Note - wwt is wet weight; CSF is cancer slope factor; csfna is cancer slope factor not available; and nc is not calculated).

Contaminant (m)	Detection Frequency	Mean Concentration (C) (mg/kg wwt)	Individual Exposure (LE_m) Adult (70 kg)	CSF (mg/kg/day)	Cancer Risk
1,2,3,4 TCB	7/10	0.00060	1.10×10^{-7}	csfna	nc
1,2,4,5 TCB	10/10	0.00239	4.39×10^{-7}	csfna	nc
HCB	1/10	0.00043	7.90×10^{-8}	1.60[a]	1.26×10^{-7}
Chlordane	8/10	0.00265	4.87×10^{-7}	0.35[a]	1.70×10^{-7}
DDD	1/10	0.00044	8.08×10^{-8}	0.24[a]	1.94×10^{-8}
DDE	10/10	0.00523	9.61×10^{-7}	0.34[a]	3.27×10^{-7}
Dieldrin	1/10	0.00044	8.08×10^{-8}	16.00[a]	1.29×10^{-6}
Pentachloroanisole	1/10	0.00050	9.18×10^{-8}	csfna	nc
Total PCBs	10/10	0.040	7.35×10^{-6}	2.00[a]	1.47×10^{-5}
				Cumulative Risk	**1.66×10^{-5}**

Table 13G. Estimated lifetime cancer risk associated with consumption of largemouth bass collected by the USFWS/USACOE, 2003, from Lake Worth for organochlorine contaminants detected above the analytical detection limits (Note - wwt is wet weight; CSF is cancer slope factor; csfna is cancer slope factor not available; and nc is not calculated).

Contaminant (m)	Detection Frequency	Mean Concentration (C) (mg/kg wwt)	Individual Exposure (LE_m) Adult (70 kg)	CSF (mg/kg/day)	Cancer Risk
1,2,3,4 TCB	2/10	0.00044	8.08×10^{-8}	csfna	nc
1,2,4,5 TCB	10/10	0.00241	4.43×10^{-7}	csfna	nc
Chlordane	8/10	0.00134	2.46×10^{-7}	0.35[a]	8.61×10^{-8}
DDE	10/10	0.00262	4.81×10^{-7}	0.34[a]	1.64×10^{-7}
Total PCBs	10/10	0.03454	6.34×10^{-6}	2.00[a]	1.27×10^{-5}
				Cumulative Risk	**1.29×10^{-5}**

[a]Cancer slope factor from USEPA, 2000.

According to the TDH (2000), the criterion used to establish consumption advisories is based on carcinogenic effects resulting in 1 in 10,000 (1×10^{-4}) excess cancers. This risk level is qualitatively interpreted as a low increased risk of developing cancer in a lifetime (TDH, 2000). Collectively, the fish sampled in 2003 did not exceed this threshold (Table 14). However, the smallmouth buffalo collected by the USFWS/USACOE contained possible carcinogenic contaminant levels that greatly exceeded the TDH (2000) criterion (Table 14). Common carp, white bass, channel catfish, and largemouth bass sampled in 2003 contained possible carcinogenic contaminants at levels that were below the TDH (2000) criterion, but exceeded the conservative excess cancer risk value of 1 in 100,000 (1×10^{-5}) (Table 14). The white crappie and freshwater drum sampled in 2003 contained possible carcinogenic contaminants at concentrations where the estimated risks of excess cancer were less than 1 in 100,000 (Table 14).

Table 14. Calculated cumulative cancer risk values and estimated excess cancer probabilities determined from fish collected by the USFWS/USACOE in 2003 from Lake Worth in comparison to cumulative risk and excess cancer values reported by the TDH from fish collected in 1999 from the same reservoir.

Fish	Calculated Cumulative Risk	Estimated Excess Cancer Risk[1]	Percent of Risk attributed to PCBs
Smallmouth Buffalo (2003)	2.39×10^{-4}	1 : 4,184	94%
Common Carp (2003)	5.74×10^{-5}	1: 17,422	97%
Freshwater Drum (2003)	6.50×10^{-6}	1 : 153,846	75%
White Bass (2003)	1.82×10^{-5}	1 : 54,595	97%
White Crappie (2003)	4.43×10^{-6}	1 : 225,733	99%
Channel Catfish (2003)	1.66×10^{-5}	1 : 60,241	88%
Largemouth Bass (2003)	1.29×10^{-5}	1 : 77,519	98%
Total Fish (2003)	4.22×10^{-5}	1 : 23,697	90%
Total Fish (1999)[2]	8.10×10^{-5}	1 : 12,346	99%

[1]Excess cancer estimates determined by dividing one by the cumulative risk value.
[2]From TDH (2000).

Whether collectively or individually by species, total PCBs represented the majority of the potential cancer risk in the fish collected in 2003 (Tables 12, 13A-13G, and 14). Consequently, for comparative purposes with the Lake Worth advisory issued by the TDH in 2000, the maximum number of allowable fish-meals that could be consumed per week without exceeding the 1×10^{-4} cancer risk level for total PCBs (Table 15) was calculated from the 2003 data using the following equations (from USEPA, 2000):

$$CR_{lim} = \frac{ARL \times BW}{CSF \times C_m}$$

where: CR_{lim} = maximum allowable fish consumption rate in kg/day;
ARL = maximum acceptable individual lifetime risk level, unitless; assumed to be 1×10^{-4} (from TDH, 2000);
BW = consumer body weight in kg; assumed to be 15 to 35 kg for children and >35 kg for adults; (from TDH, 2000);
CSF = cancer slope factor in mg/kg/day; assumed to be 2 mg/kg/day for total PCBs (from USEPA,2000);
C_m = measured concentration of contaminant *m* in fish in mg/kg wet weight;

and:

$$CR_{mm} = \frac{CR_{lim} \times T_{ap1}}{MS}$$

where: CR_{mm} = maximum allowable fish consumption rate in meals/month;
CR_{lim} = maximum allowable fish consumption rate in kg/day;
T_{ap1} = time averaging period one; assumed to be 30.44 days/month (from USEPA, 2000);
MS = meal size; assumed to be 0.227 kg (8 ounces) for adults and 0.114 kg (4 ounces) for children; (from TDH, 2000);

and: $$CR_{mw} = \frac{CR_{mm}}{T_{ap2}} \div LC$$

where: CR_{mw} = maximum allowable fish consumption rate in meals/week;
CR_{mm} = maximum allowable fish consumption rate in meals/month;
T_{ap2} = time averaging period two; assumed to be 4.348 weeks/month (from USEPA, 2000);
LC = limited lifetime consumption factor = 30 years/70 years = 0.429; (from Ward, personal communication, 2004).

Table 15. Number of meals per week that would not exceed the 1 x 10^{-4} cancer risk level for total PCBs in fish collected from Lake Worth by the USFWS/USACOE in 2003 compared to values reported by the TDH (2000) from USGS, 1999 data [Note - wwt is wet weight; Co. is concentration; weight of children ranges from 15 to 35 kg; meal size for children is assumed to be 4 ounces; weight of adults greater than 35 kg; meal size for adults is assumed to be 8 ounces; and Age Range is from TDH (2000)].

Risk-Based Consumption Limits (meals/week)					
Body Weight (kg)	**Age Range (years)**	**Number of meals per week that may be consumed without exceeding the 1 x 10^{-4} cancer risk level for total PCBs.**			
		USFWS Arithmetic Mean Concentration (0.103 mg/kg wwt)	**USFWS 95th Percentile of Mean Co. (0.208 mg/kg wwt)**	**TDH Arithmetic Mean Concentration (0.218 mg/kg wwt)**	**TDH 95th Percentile of Mean Co. (0.316 mg/kg wwt)**
15 kg	3 to 6	1.0	0.5	0.5	0.3
35 kg	10 to 11	2.4	1.2	1.2	0.8
50 kg	adult	1.7	0.9	0.8	0.6
60 kg	adult	2.1	1.0	1.0	0.7
70 kg	adult	2.4	1.2	1.2	0.8
80 kg	adult	2.8	1.4	1.3	0.9
90 kg	adult	3.1	1.6	1.5	1.0
100 kg	adult	3.5	1.7	1.6	1.1

In addition, the 95th percentile of the mean calculated for total PCBs from the 2003 data (0.208 mg/kg wet weight) to assess the non-cancer risks was used in calculating the number of meals allowable that would not be expected to exceed acceptable cancer risk levels (Table 15). This value represents a conservative estimate of the average total PCB concentration to which a person may be exposed.

The calculated number of meals per week that would not exceed the 1 in 10,000 cancer risk level for total PCBs in fish collected in 2003 were approximately two times greater than the estimated number of meals determined by the TDH from the 1999 data (Table 15). The difference in these values correspond to the differences between the mean total PCB concentrations determined from the 2003 and 1999 data. In both cases, segments of the population could consume greater than one fish-meal per week without exceeding the acceptable cancer risk level for total PCBs (Table 15). It should be emphasized, that prior to calculating the number of meals per week that would not exceed acceptable cancer risk levels, all of the other calculated cancer risk values in this report were determined for just one sub-population, adults, and not children. This is because cancer risks are assumed to be based on chronic or lifetime exposure to a given carcinogen (USEPA, 2000). However, to be consistent with the comparison to the TDH 2000 advisory, assumptions for children were included in Table 15.

CONCLUSIONS & RECOMMENDATIONS

Residual organochlorine contamination was detected in every fish sample collected from Lake Worth by the USFWS/USACOE in 2003. In general, the samples with the highest lipid content contained the greatest amount of contaminants. Several residual organochlorine pesticides (aldrin, BHC, DDD, DDT, dieldrin, endosulfan, and mirex) were measured in fish tissues collected from the reservoir in 2003 that were not detected in fish collected in 1999. This can be attributed to more sensitive analytical detection limits being applied in 2003 than were used in 1999 (0.0005 verses 0.005 mg/kg wet weight). Technical chlordane, HCB, and DDE concentrations measured in fish collected in 2003 were slightly higher than those measured in 1999, but as with the 1999 data, the non-cancer health risk hazard quotients calculated for these contaminants were less than unity and the cancer risk levels were less than 1 in 10,000.

All of the fish collected from the reservoir in 2003 contained detectable amounts of total PCBs, but, overall, these fish appeared to contain lower total PCB levels than the fish sampled in 1999. Two game fish species (largemouth bass and channel catfish) and two rough fish species (common carp and freshwater drum) sampled in 2003 contained lower concentrations than those measured in the same species in 1999. However, one game fish species (white crappie) and one rough fish species (smallmouth buffalo) sampled in 2003 contained higher concentrations than those detected in 1999. The difference in total PCBs detected in white crappie in 2003 verses the levels measured in 1999 may be attributed to more sensitive analytical detection limits being used in 2003 (0.005 verses 0.05 mg/kg wet weight). In contrast, the smallmouth buffalo collected in 2003 contained elevated total PCB levels not only in comparison to data collected in 1999, but also in comparison to current human health screening criteria. As with the 1999 results, the non-cancer health risk hazard indices calculated for total PCBs from the 2003 data exceeded unity and still preclude adults and children from consuming one fish-meal per week to avoid exceeding the minimum risk level. The cancer risk levels associated with consuming fish collected in 2003 were similar to those determined from the 1999 data, in that both resulted in excess cancer values of less than 1 in 10,000.

The temporal trend of organochlorine contaminants in fish inhabiting Lake Worth based on the 2003 results in comparison to the 1999 results is not readily evident. Some constituents were detected at lower levels in fish collected in 2003 than in fish from 1999 (ie., total PCBs in largemouth bass), whereas some contaminants were detected at higher levels in 2003 (ie., total PCBs in smallmouth buffalo). Therefore, it is recommended that additional fish sampling be conducted at the reservoir. This sampling should target the same species and number of fish that were collected in 1999 and 2003 and focus on the same area of the reservoir sampled.

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APPENDIX A
(ANALYTICAL METHODS)

LABORATORY: Geochemical & Environmental Research Group, Texas A&M

Muscle tissue samples (fillets) were prepared in the laboratory using a stainless steel knife which was decontaminated with water, Micro™, methylene chloride, and acetone after each fillet.

Method Code: 001

Analytical method for analyses of organics [1,2,3,4-terachlorobenzene, 1,2,4,5-tetrachlorobenzene, aldrin, hexachlorobenzene (HCB), heptachlor, alpha-hexachlorocyclohexane (αBHC), alpha (α) chlordane, beta-hexachlorocyclohexane (βBHC), *cis*-nonachlor, delta- hexachlorocyclohexane (δBHC), dieldrin, endosulfan II, endrin, gamma-hexachlorocyclohexane (γBHC), gamma (γ) chlordane, heptachlor epoxide, mirex, *o,p*'-dichloro-diphenyl-dichloroethane (o,p'-DDD), *o,p*'-dichloro-diphenyl-dichloroethylene (o,p'-DDE), *o,p*'-dichloro-diphenyl-trichloroethane (o,p'-DDT), *oxy*chlordane, *p,p*'-dichloro-diphenyl-dichloroethane (p,p'-DDD), *p,p*'-dichloro-diphenyl-dichloroethylene (p,p'-DDE), *p,p*'-dichloro-diphenyl-trichloroethane (p,p'-DDT), pentachloro-anisole, toxaphene, and *trans*-nonachlor, chlorpyrifos, and PCBs (Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260, total PCBs, and 96 PCB congeners)] in tissue:

The tissue samples were extracted by the NOAA Status and Trends Method (MacLeod et al., 1985) with minor revisions (Brooks et al., 1989; Wade et al., 1988). Briefly, the tissue samples were homogenized with a Teckmar Tissumizer. A 1 to 10-gram sample (wet weight) was extracted with the Teckmar Tissumizer by adding surrogate standards, Na2SO4, and methylene chloride in a centrifuge tube. The tissue extracts were purified by silica/alumina column chromatography to isolate the aliphatic and PAH/pesticide/PCB fractions. The PAH/pesticide/PCB fraction was further purified by HPLC in order to remove interfering lipids.

The quantitative analyses were performed by capillary gas chromatography (CGC) with a flame ionization detector for aliphatic hydrocarbons, CGC with electron capture detector for pesticides and PCB's, and a mass spectrometer detector in the SIM mode for aromatic hydrocarbons (Wade et al., 1988).

There are specific cases where analytes requested for the pesticide and PCB analyses and are known to co-elute with other analytes in the normal CGC with electron capture. These include the pesticide Endosulfan I and the PCB congeners 114 and 157. In these cases, the samples will be analyzed by CGC with a mass spectrometer detector in the SIM mode.

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Method Code: 003

Analytical method for % Dry Weight, % Moisture, and % Lipids:

Approximately 1 gram of wet sample is weighed into a clean, labeled, preweighed 10 ml beaker. The beaker is placed in a forced air oven at approximately 75 degrees Celsius for 24 hours. The beaker with the dry sample is then weighed and the % dry weight is calculated by the formula:

$$\frac{(\text{wt. dry sample and beaker}) - (\text{wt. beaker})\ (100)}{(\text{wt. wet sample and beaker}) - (\text{wt. beaker})}$$