Survey of Dioxin and Furan Compounds in Sediments of Florida Panhandle Bay Systems

Publication No. PCFO-EC 02-01

Jon M. Hemming, Ph.D.
Environmental Contaminants Specialist

Michael S. Brim
Coastal Program Coordinator

Robert B. Jarvis
Biological Aide

U.S. Fish and Wildlife Service
Division of Ecological Services
Panama City Field Office
1601 Balboa Avenue
Panama City, Florida 32405

2002

ABSTRACT

A sediment quality survey was conducted in the Florida Panhandle (Panhandle) over a period of 10 years (1992 to 2001). The survey examined which dioxin and furan compounds may be present in sediments of the bay systems, their locations, and concentrations. The U.S. Fish and Wildlife Service (FWS) collected and analyzed 29 sediment samples from 6 bay systems across the Panhandle. Risk associated with dioxin and furan contamination was estimated after 2,3,7,8-tetrachlorodibenzo-*p*-dioxin toxicity equivalents (TEQs) were calculated for 17 dioxin/furan chemical analytes as per the U.S. Environmental Protection Agency (1989). Total dioxin TEQ sediment concentrations ranged from 0.51ng/kg dry weight in Apalachicola Bay to 77.51 ng/kg dry weight in sediments from the Perdido Bay system. Pulp and paper processing facilities were near sampling locations where TEQ concentrations were over 20 ng/kg dry weight with the exception of one site in the Pensacola Bay system. Overall, the concentrations of dioxin TEQs in sediments of Panhandle bay systems were relatively low compared to similar surveys in the Great Lakes area and other bay systems worldwide. However, even sediment dioxin levels in the low range have been associated with biomagnification in the food web that increases risk to birds, fish, and sensitive mammal species. Additionally, there may be a relationship between the volume of freshwater input or the depth and width of Gulf of Mexico (Gulf) to bay passages (inlets) that influences dioxin TEQ concentrations in bay system sediments. The foremost goal of this survey was to provide baseline data necessary to evaluate the current status of, and future research needs for, the protection of fish and wildlife species, especially Federally threatened and endangered species, migratory birds, and anadromous fish. The next step in the evaluation of the bay systems of the Panhandle will be to examine food web effects such as biomagnification, dioxin compound affinity for organic carbon substrates, freshwater input effects, Gulf flushing influence, sediment contamination trends, and current or pending dioxin compound input sources to the bay systems. The relationship between sediment dioxin TEQ concentrations and risk to FWS trust resources can be inferred, but has not been established. Investigation into relationships between contaminated sediments, food fishes, and piscivorous fish and bird species may determine risk to FWS trust resources in the bay systems of the Florida Panhandle.

KEYWORDS: Florida Panhandle, sediment, dioxin, furan, TEQs, bays.

Preface

This report was written primarily for scientific and management purposes. An attempt has been made to present the data in a format that is readily usable by managers who have not had formal training in ecotoxicology. Extensive literature has been reviewed and cited to make clear the subtle impacts and complexities of chemical contaminant interactions with fish and wildlife species. The primary objective of the authors has been to make a positive contribution to the management of bay systems of the Florida Panhandle.

Acknowledgments

Many people played important roles in the completion of this project. To all of them, we are most grateful. In particular we thank: Jim Barkuloo, Florida Wildlife Federation; Gail Carmody, Panama City Field Office Supervisor, U.S. Fish and Wildlife Service; Tom Dillon, National Oceanic and Atmospheric Administration; Ed Keppner, St. Andrew Bay Environmental Study Team; David Burris, Integrated Science & Technology, Inc.; Tom Augspurger, Environmental Contaminants Specialist, U.S. Fish and Wildlife Service; Karen Salomon, Environmental Contaminants Specialist, U.S. Fish and Wildlife Service; Foster L. Mayer, U.S. Environmental Protection Agency, Gulf Ecology Division; Mike Lewis, U.S. Environmental Protection Agency, Gulf Ecology Division; James Harvey, U.S. Environmental Protection Agency, Gulf Ecology Division; Steve McLellan, Tyndall Air Force Base; Jack Anderson, Columbia Analytical Services, Inc.; Marshall Hyatt, U.S. Environmental Protection Agency, Region 4; Wayne Isphording, University of South Alabama; Jim McCarthy, Florida Department of Environmental Protection; Dwain Winters, U.S. Environmental Protection Agency, Washington DC; Phil Cook, U.S. Environmental Protection Agency, Environmental Research Laboratory; Karen Keenleyside, Environment Canada, Water Quality Branch; Dick Snyder, University of West Florida; and Robert Turpin, Escambia County, Florida Neighborhood and Environmental Services Department for their assistance, support and/or peer review of this document. A special thanks to the numerous volunteers who assisted the environmental quality program during evaluations of Perdido, St. Andrew, and St. Joseph bays.

CONTENTS

TABLES

FIGURES

FIGURES (continued)

APPENDICES

Appendix 1: Standard operating procedures for field collection of sediment samples (PCFO-EC SOP 004).

Appendix 2: Laboratory procedures and quality assurance/quality control information for dioxin compound analyses.

Appendix 3: Calculation of 2,3,7,8-tetrachlorodibenzo-*para*-dioxin (TCDD) toxicity equivalents (TEQs).

INTRODUCTION

Northwest Florida Panhandle

The Florida Panhandle, located in northwest Florida, extends from the Aucilla River west to the Florida-Alabama state border. Habitat diversity defines the Panhandle. This diversity has always been heavily influenced by the varied coastal bay systems. Seven unique and productive bay systems can be found in the Panhandle, including (in order from east to west): Apalachee Bay, Apalachicola Bay, St. Joseph Bay, St. Andrew Bay, Choctawhatchee Bay, Pensacola Bay and Perdido Bay (Figure 1). Previous descriptions of these systems have reported great diversity in watershed ecology, land use, hydrologic alteration, morphology, ecological services, and individual importance (Wolfe et al., 1988; Livingston, 1989; Tonsmeir et al., 1996; Thorpe and Ryan, 1996; Thorpe et al., 1997; Thorpe et al., 2000; Keppner and Keppner, 2001; Keppner, 2002). Preservation of the health of these bay systems is paramount to protecting species diversity, rare and sensitive organisms, health of recreational and commercial fisheries, and an acclaimed quality of life the Panhandle makes possible for all its residents.

The integrity of these ecological systems is instrumental to the mission of the U.S. Fish and Wildlife Service and the protection of FWS trust resources (described below). For this reason, surveys are conducted to report the status of such systems. This report describes data from a general survey conducted over 10 years (1992 to 2001) to determine what dioxin and furan compounds may be present in the sediments of the bay systems of the Panhandle, their locations, and concentrations. To this end, the FWS collected 29 composite samples from 6 of the 7 bay systems found across the Panhandle (3 additional samples taken in non-FWS efforts are also reported) and had them analyzed for the chemical contaminants group known as dioxins (described below). Secondarily, this survey was intended to identify bay locations to be used as reference sites for future evaluations and assessments of bay system health.

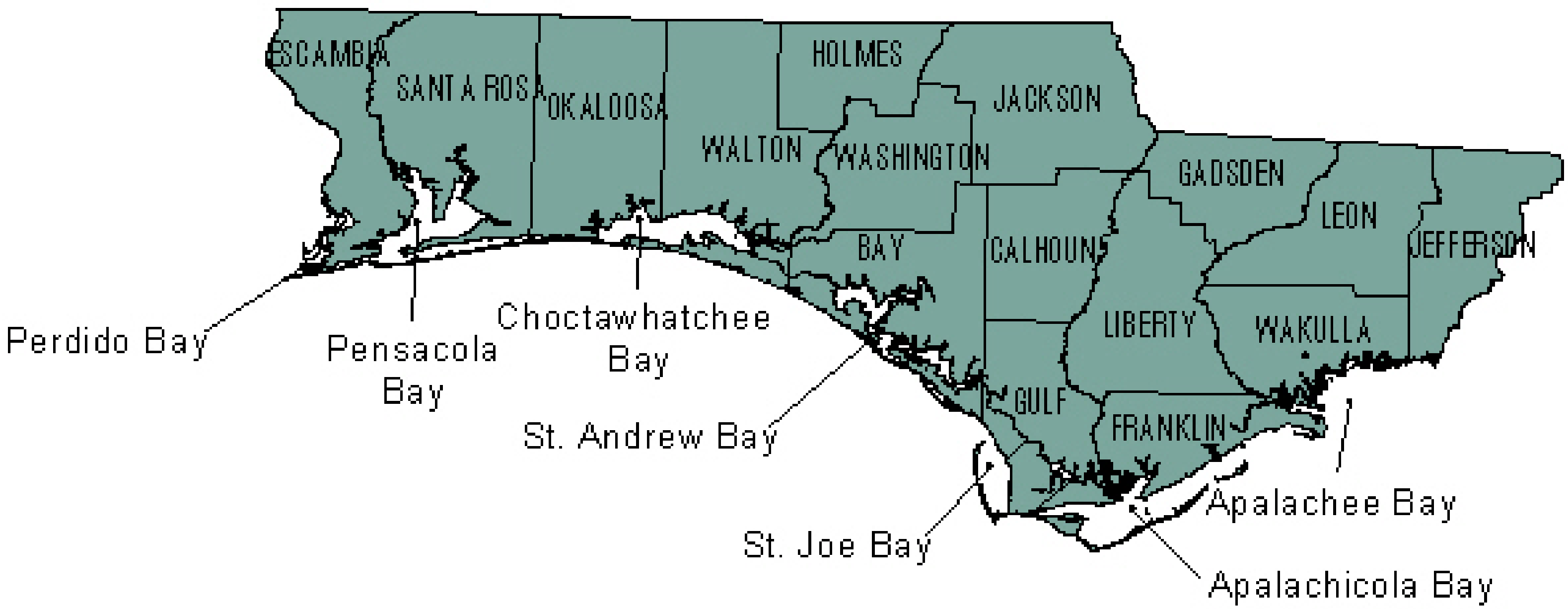

FIGURE 1: Counties and Bay Systems of the Florida Panhandle.

Trust Resource Species

The FWS has responsibility for the protection and conservation of many trust resource species which inhabit the bay ecosystems of the Florida Panhandle for at least part of their life history. Trust resources include Federally listed endangered and threatened species, migratory birds, some marine mammals, anadromous fish (fish species living in marine waters and moving regularly to freshwater areas to spawn, rest, and feed), and interjurisdictional fish (marine fish species being cooperatively managed across state boundaries).

In excess of 170 species of migratory birds have been documented within one Panhandle county (Bay County) alone (Keppner, 2002). Forty-seven percent of migratory birds use Panhandle bay systems for feeding, nesting, and/or resting (Keppner, 1996). All of the bird species are protected under the Migratory Bird Treaty Act of 1918 (16 U.S.C. Sec 703-711). Species associated with Panhandle bay systems include wading birds, waterfowl, shorebirds, and raptors such as the osprey (*Pandion haliaetus*) and bald eagle (*Haliaeetus leucocephalus*). These species rely on quality habitats for their survival including open bay areas, tidal flats and beaches, salt and freshwater marshes, swamps, and even upland forested areas and grassed lands (Keppner, 1996).

Federally listed endangered and threatened species (Endangered Species Act of 1973, as amended; 16 U.S.C. 1531 et seq.) are of particular concern, and include: the *endangered* green turtle (*Chelonia mydas*), leatherback turtle (*Dermochelys coriacea*), and Kemp's ridley turtle (*Lepidochelys kempi*); and the *threatened* bald eagle, loggerhead turtle (*Caretta caretta*), piping plover (*Charadrius melodus*), and Gulf sturgeon (*Acipenser oxyrinchus desotoi*). Several endangered subspecies of beach mice (*Peromyscus polionotus spp.*) inhabit areas of Gulf beachfront areas along the Panhandle. On occasion, the endangered Florida manatee (*Trichechus manatus*) has been known to visit this far north in the Gulf of Mexico and use resources found there.

The FWS also has trust resource responsibilities for anadromous fish under the Anadromous Fish Conservation Act of 1965 (16 U.S.C. Sec 757a-757g). Anadromous fish include striped bass (*Morone saxatilis),* Alabama shad (*Alosa alabamae*) and the threatened Gulf sturgeon *(Acipenser oxyrhinchus desotoi*).

Interjurisdictional fish that use Panhandle bay systems are another group of trust resources. The FWS is involved in their conservation and management via provisions of the Magnuson Fishery Conservation and Management Act of 1976 (16 U.S.C. 1801 et seq.), and the Gulf States Marine Fisheries Compact (PL 81-66; 63 Stat. 70). Under these two laws, fishery management plans have been, and are being, developed. Their development is accomplished through the Gulf of Mexico Fishery Management Council for species in the offshore Federal economic exclusion zone, and through the Gulf States Marine Fisheries Commission for species occupying state coastal waters. The FWS also has responsibilities for interjurisdictional fishes under Executive Order 12962. Currently, management plans are being developed, or have been developed for such species as: Gulf sturgeon, striped mullet (*Mugil cephalus*), Gulf menhaden (*Brevoortia patronus*), red drum (*Sciaenops ocellatus*), black drum (*Pogonia cromis*), striped bass, Spanish mackerel (*Scomberomorus maculatus*), spotted seatrout (*Cynoscion nebulosus*), flounder (*Paralichthys spp.*), blue crab (*Callinectes sapidis*), Gulf shrimp (*Panaeus spp.*), and oyster (*Crassostrea virginica*).

Dioxins

Dioxin compounds have been shown to negatively affect fish and wildlife (Zabel and Petterson, 1996; Elliot et al., 1996; Powell et al., 1997; Auman et al., 1997; Giesy et al., 1997; Jung and Walker, 1997; Rhodes et al., 1997; Woodford et al., 1998; Huange et al., 1999; Brunstrom et al., 2001; Kadokami et al., 2002). Most of these studies reported that developing embryos or juveniles were more vulnerable than adults and that biomagnification (large increases) of these environmental contaminants occurs through trophic (food web) transfer. Bird species have demonstrated detrimental effects associated with exposure to dioxin compounds, especially in piscivorous (fish eating) species. The literature is full of such reports for bald eagles (*Haliaeetus leucocephalus;* Elliot et al., 1995; Whitehead et al., 1995), great blue herons (*Ardea herodias*; Elliott et al., 1989; Sanderson et al., 1994), osprey (*Pandion halieatus*; Whitehead et al. 1995; Woodford et al., 1998), some cormorant species (*Phalacrocorax spp*.; Yamashita et al., 1993; Powell et al., 1997), and common terns (*Sterna hirundo*; Bosveld et al., 1994), among others (Peterson et al., 1993; Auman et al., 1997). Piscivorous bird contamination often comes from eating contaminated fish (Fox et al., 1991; Gilbertson et al., 1991; Peterson et al., 1993; Woodford et al., 1998). Various fish species have also been studied extensively for dioxin compound contamination and have been reported to suffer negative impacts from exposure (Walker et al., 1991; Walker and Peterson, 1991; Zabel et al., 1995; Abbott and Hinton, 1996; Zabel and Petterson et al., 1996; Giesy et al., 1997). Contaminated fish also endanger mink (*Mustela vision*), otter (*Lutra lutra*) and other sensitive mammal species. Some mammal species tend to be highly susceptible to dioxin exposure and fail to produce viable offspring after exposure to environmentally relevant concentrations (Aulerich et al., 1988; Hochstein et al., 1988; Hochstein and Aulerich, 1998; Brunstrom et al., 2001). Dioxins have also been implicated in stresses causing worldwide amphibian deformities and declines (Jung and Walker, 1997; Huange et al., 1999; Kadokami et al., 2002). Although the impact of dioxin contamination has been heavily documented for vertebrate species, studies have been conducted on invertebrate species as well (Hoffman et al., 1995; Rhodes et al., 1997; Landis and Yu, 1999; Marvin et al., 2000).

Dioxins are a group of over 200 related chemical contaminants found in the environment. Natural burning occurrences, such as volcanic eruptions or forest fires can produce dioxins (Hoffman et al., 1995; Ingersoll et al., 1997). However, most dioxins are formed as byproducts of industrial processes such as smelting, bleaching and processing of paper pulp, manufacturing of some herbicides or pesticides, polychlorinated biphenyls (PCBs), pentachlorophenol, and polyvinyl chlorides (PVCs), burning of plastics and toxic waste at high temperatures with waste incinerators or kilns, as well as motor vehicle exhaust, charcoal grills and cigarette smoke (Harte et al., 1991; Hoffman et al., 1995; Schettler et al., 1999; Im et al., 2002). Additionally, dioxins have been reported in municipal wastewater effluents with sources in both the domestic and stormwater influent fractions (Hoffman et al., 1995). Resulting atmospheric concentrations (<6 pg/m^3 range) in the United States are reportedly low (Smith et al., 1989; Harless et al., 1990; Maisel et al., 1990; Hunt et al., 1990; CDEP, 1988; Harless et al., 1991; Edgerton et al., 1989; Eitzer et al., 1989; Hunt et al., 1990). However, atmospheric releases can be traced to water body loading and sediment sequestering (log K_{ow}=6.85, Boethling and Mackay, 2000; log K_{oc}~7, Lodge and Cook, 1989). Dioxin compounds are transferred from the sediment compartment to the food chain rather readily in aquatic systems. It is in the food chain that dioxins can be biologically magnified and cause adverse ecological effects (Hoffman et al., 1995; Rhodes et al., 1997; Woodford et al., 1998; Landis and Yu, 1999; Marvin et al., 2000; Kannan et al., 2001; Im et al., 2002).

"Dioxin" is a general term for a number of related chemical compounds (polychlorinated dibenzo-*para*-dioxins, PCDDs and polychlorinated dibenzofurans, PCDFs) having the same general structure (Figure 2). That structure consists of two benzene rings bonded together by two (dioxins) or one (furans) oxygen atoms (Eisler, 1986). There are numerous potential variations to this molecular structure depending on the attachment of chlorine atoms to carbon atoms on the benzene ring structures. It is the position and number of chlorine atoms on the dioxin molecule that determines particular toxicity of each configuration (Figure 2; Eisler, 1986). Up to eight chlorine atoms can be attached to each molecule. The most toxic form of dioxin is the molecule 2,3,7,8-tetrachlorodibenzo-*para*-dioxin; abbreviated 2,3,7,8-TCDD (Poland and Knutson, 1982; Safe, 1990). In fact, it is one of the most toxic synthetic compounds ever tested under laboratory conditions (Eisler, 1986). Furan molecules are also extremely toxic (Hoffman et al., 1995) and have molecular structures (i.e., placement of chlorine atoms) similar to the dioxin molecule.

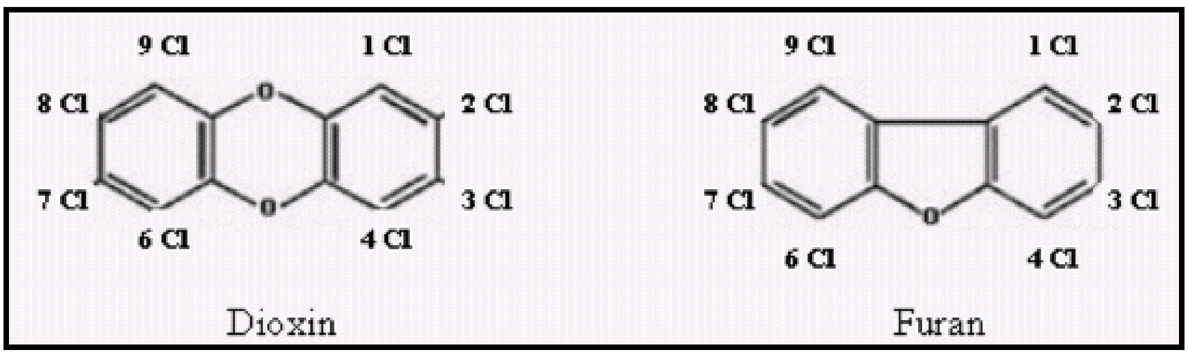

FIGURE 2: Dioxin and furan molecular structures showing possible chlorination points and corresponding assigned numbering.

Molecular structure (chlorine number and arrangement) determines not only how toxic the molecule will be, but also the mechanism by which the molecule will exert its toxicity. There are three proposed modes of action for dioxin compound toxicity (McKinney and Walker, 1994) including: 1) irreversible chemical binding to macromolecules such as deoxyribonucleic acids (DNA) inhibiting their proper biochemical functioning, 2) cellular accumulation to high levels via lipid storage resulting in large stress-induced doses, and 3) irreversible binding to cellular receptors and enzymes inhibiting proper biochemical communication between cells. Overall dioxin compound toxicity is said to be the result of a combination of these mechanisms (Landis and Yu, 1999). The resulting effects include rapid weight loss, reproductive failure or difficulty, immunosuppression, developmental abnormality, cancer, histopathologic alteration (tissue damage), death, and induction of biochemical response (e.g., P450-dependent monooxygenases) (Hoffman et al., 1995).

Because the toxicity of dioxin compounds (as well as other toxic materials) is based on specific molecular interactions, invertebrate and vertebrate species often respond very differently. Although dioxins are typically highly toxic to vertebrates, invertebrates are relatively tolerant of dioxin exposure. Irreversible binding with aryl hydrocarbon cellular receptor results from a strong molecular interaction causing toxicity in vertebrates, but not in aquatic invertebrates because they lack such receptors (Hoffman et al., 1995; Landis and Yu, 1999). For this reason, invertebrate species can live in contaminated sediments without injury and biologically accumulate dioxins from the sediments into their tissues. Once in the invertebrate tissues, dioxins are available to the vertebrates of the food web (Hoffman et al., 1995; Landis and Yu, 1999).

MATERIALS AND METHODS

The FWS adheres to standard operating procedures (SOP) to assure the quality of data that may ultimately be published as a FWS report. However, during a general survey investigation, every field action is not recorded. Instead, the FWS relies on instrument operation manuals, SOPs and other guidance, including State and Federal regulations, to govern its actions in the field.

Sediment sampling was chosen to evaluate dioxin compound contamination of the Florida Panhandle because of the reported tendency of this class of toxics to accumulate in sediments, thus providing an established route of entry into the systems' food webs.

Collection of Sediment Samples

Standard operating procedures for field collection of sediment samples (PCFO-EC SOP 004) are provided in Appendix 1. Table 1 contains site-specific information. Sediment samples were collected from various sites in bay systems of the Florida Panhandle (Figure 3) including: 6 sites in the Perdido Bay system (Figure 4), 2 sites in the Pensacola Bay system (Figure 5), 1 site in the Choctawhatchee Bay system (Figure 6), 1 site in the coastal Lake Powell and 15 sites in the St. Andrew Bay system (Figure 7), 6 sites in St. Joseph Bay (Figure 8), and 1 site in St. George Sound (Figure 9). Sampling collection and analysis was often done in conjunction with other work. The number of samples taken at any particular site was limited by financial resources required to have samples analyzed.

Sediment samples were composite 1-liter samples consisting of five 200 ml sub-samples. Samples were collected using a standard ponar 316 stainless steel grab. Depth of sediment samples collected by the grab depended on the type of sediment at each station (maximum depth in silt ~10 cm). Samples collected in the field were immediately put into laboratory-certified, chemically cleaned, 1-liter amber glass jars with teflon-lined lids, and placed on ice in coolers. Samples were temporarily stored at the Panama City Field Office in freezers at -23° C until shipment to analytical laboratories. Sediment samples were analyzed for dioxin and furan compounds. Additional samples were analyzed for particle size and total organic carbon (TOC).

TABLE 1: Sample information for sediment samples taken by the U.S. Fish and Wildlife Service in the Florida Panhandle: sampling locations in bay systems, collection date, sample identification number, and sampling site latitude and longitude (degrees, minutes, hundredths of minute).

Sampling Location	**Bay System**	**Date**	**Sample ID**	**Latitude**	**Longitude**
Perdido Bay	Perdido	07-95	95PB1DL	30.19.96	87.28.94
11 Mile Creek	Perdido	05-92	92EM1D1	30.27.20	87.22.58
11 Mile Creek	Perdido	05-92	92EM2D1	30.27.37	87.22.65
11 Mile Creek	Perdido	05-92	92EM3D1	30.27.70	87.22.62
11 Mile Creek	Perdido	05-92	92EM4D1	30.28.03	87.22.07
11 Mile Creek	Perdido	05-92	92EM5D1	30.28.23	87.21.93
Pensacola Bay	Pensacola	08-97	PB01DL	30.24.00	87.10.00
Santa Rosa Sound	Pensacola	07-95	95SRS01DL	30.21.08	87.06.66
Choctawhatchee Bay	Choctawhatchee	08-97	CB01DL	30.26.00	86.20.00
Lake Powell	Coastal Lake	08-97	LP01DL	30.16.34	85.58.39
Lower St. Andrew Bay	St. Andrew	07-95	SAB01DL	30.08.47	85.40.90
Lower St. Andrew Bay	St. Andrew	07-95	95SAB1DL	30.05.94	85.39.78
Lower St. Andrew Bay	St. Andrew	07-95	95SAB1DL DUPLICATE		
West Bay	St. Andrew	08-97	SABW01DL	30.13.78	85.44.13
West Bay	St. Andrew	07-01	WB01DL	30.15.40	85.49.80

TABLE 1 (continued): Sample information for sediment samples taken by the U.S. Fish and Wildlife Service in the Florida Panhandle: sampling locations in bay systems, collection date, sample identification number, and sampling site latitude and longitude (degrees, minutes, hundredths of minute).

Sampling Location	**Bay System**	**Date**	**Sample ID**	**Latitude**	**Longitude**
East Bay	St. Andrew	09-98	107DL	30.06.36	85.33.49
East Bay	St. Andrew	08-97	SABE01DL	30.06.49	85.35.23
East Bay	St. Andrew	09-92	COE-PC1	30.08.03	85.37.37
East Bay	St. Andrew	09-92	COE-PC2	30.07.46	85.38.02
Watson Bayou	St Andrew	1994	94WB48D	30.08.25	85.38.08
Martin Lake	St. Andrew	09-98	106DL	30.08.84	85.36.37
Martin Lake	St. Andrew	09-94	94LM49D	30.08.64	85.36.46
Martin Lake	St. Andrew	09-98	95DB	30.07.90	85.36.37
Lake Charles	St. Andrew	09-97	MRLKUP	30.09.18	85.36.06
Deer Point Reservoir	St. Andrew	07-01	DPR01DL	30.16.51	85.35.38
St. Joe Bay	St. Joe	1993	SJBB3	29.51.00	85.23.00
St. Joe Bay	St. Joe	1993	SJBB6	29.48.00	85.23.00
St. Joe Bay	St. Joe	1992	SJBD3	29.51.00	85.21.00
St. Joe Bay	St. Joe	1992	SJBD6	29.48.00	85.21.00
St. Joe Bay	St. Joe	1992	SJBF5	29.49.00	85.19.00
St. Joe Bay	St. Joe	1993	93R01D	29.45.30	85.21.30
St. George Sound	Apalachicola	07-95	95SGS1DL	29.45.79	84.43.25

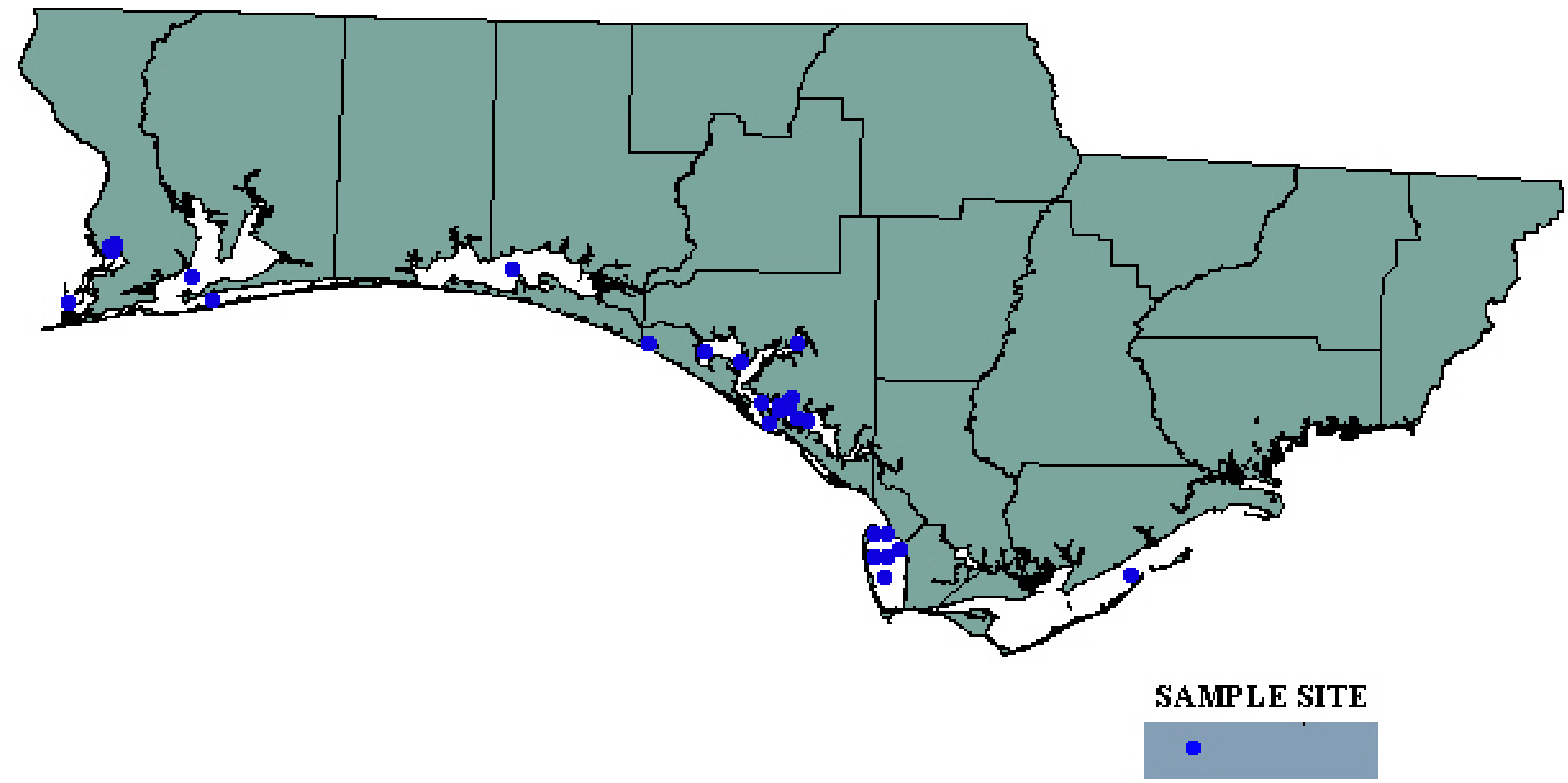

FIGURE 3: Distant perspective on the 32 sampling locations in Florida Panhandle.

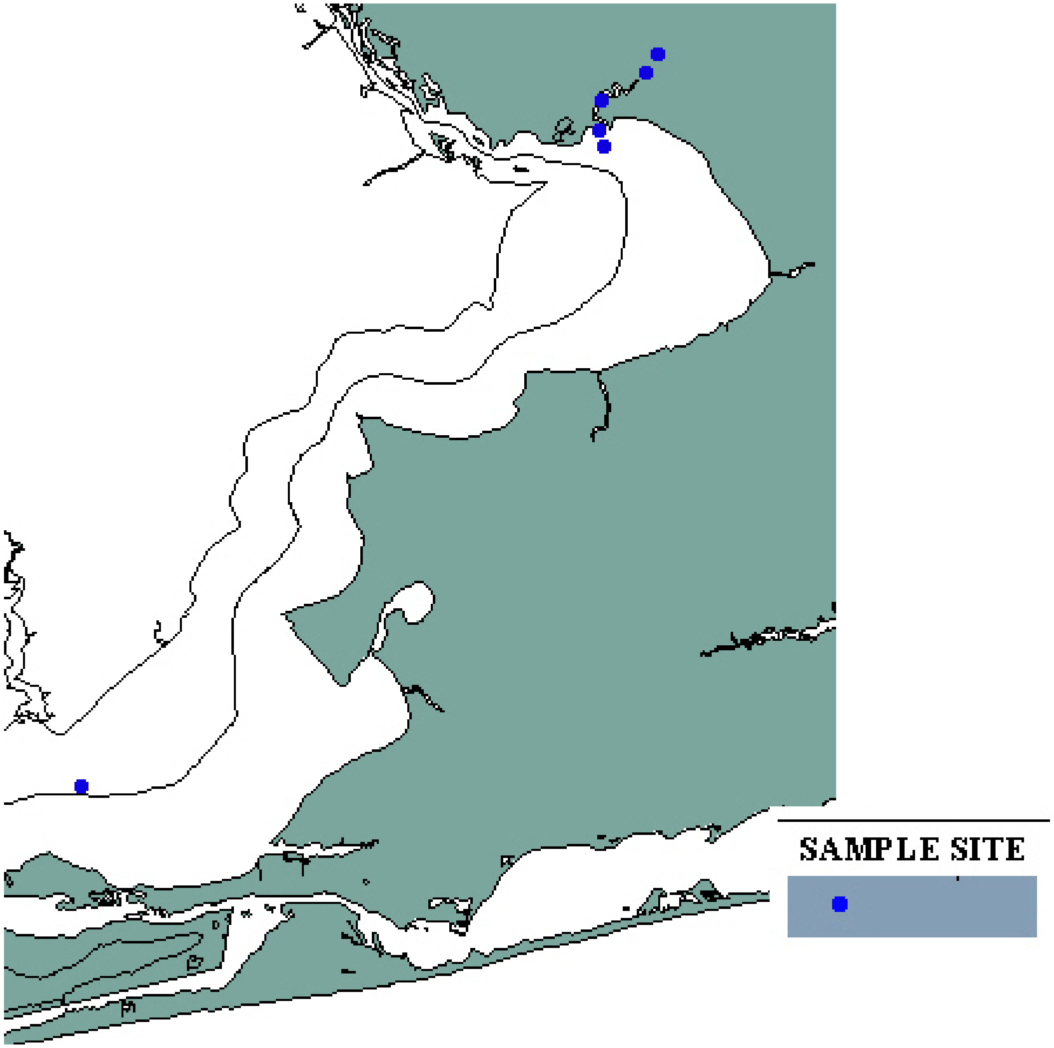

FIGURE 4: Sampling sites in the Perdido Bay system.

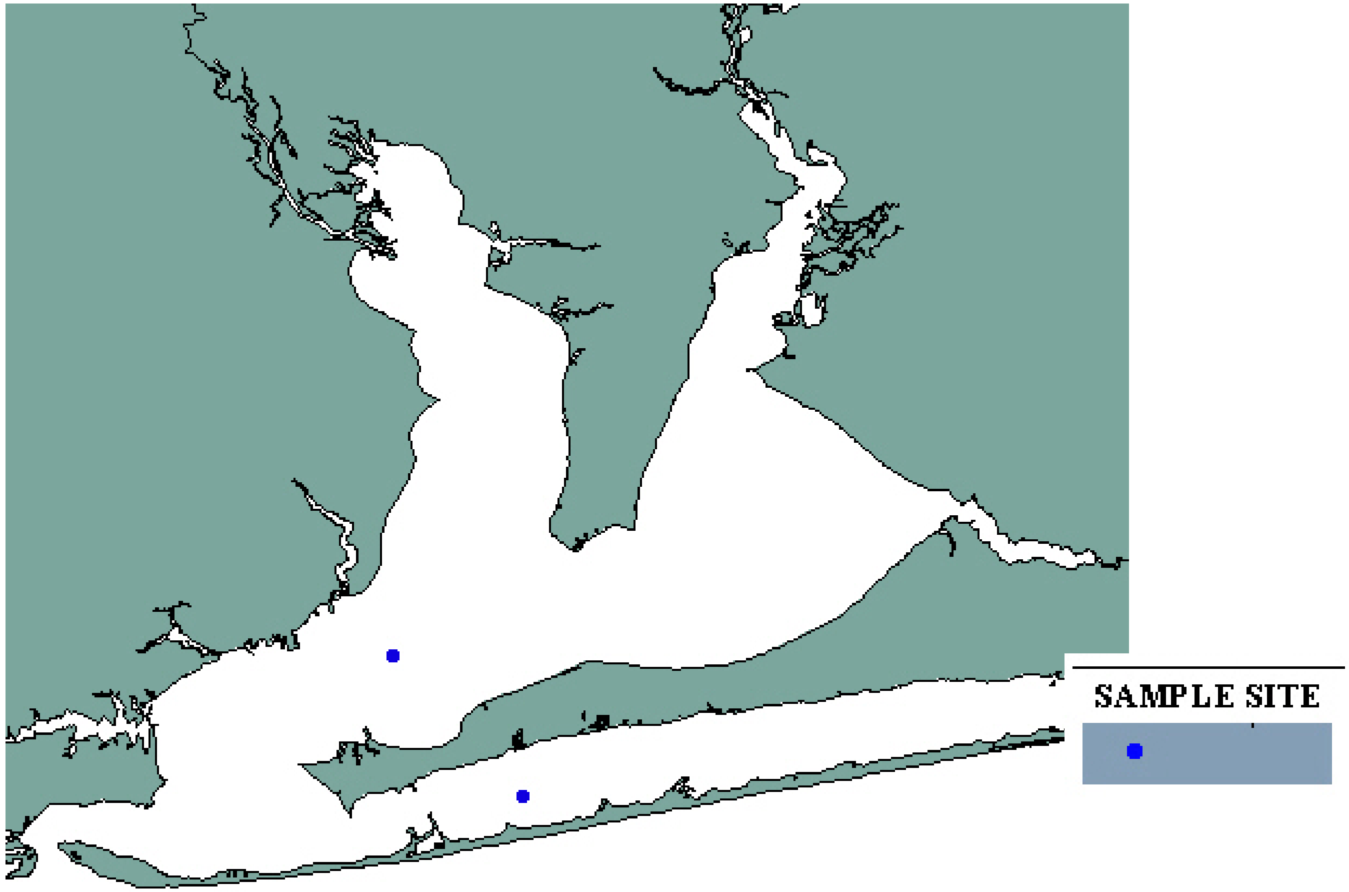

FIGURE 5: Sampling sites in the Pensacola Bay system.

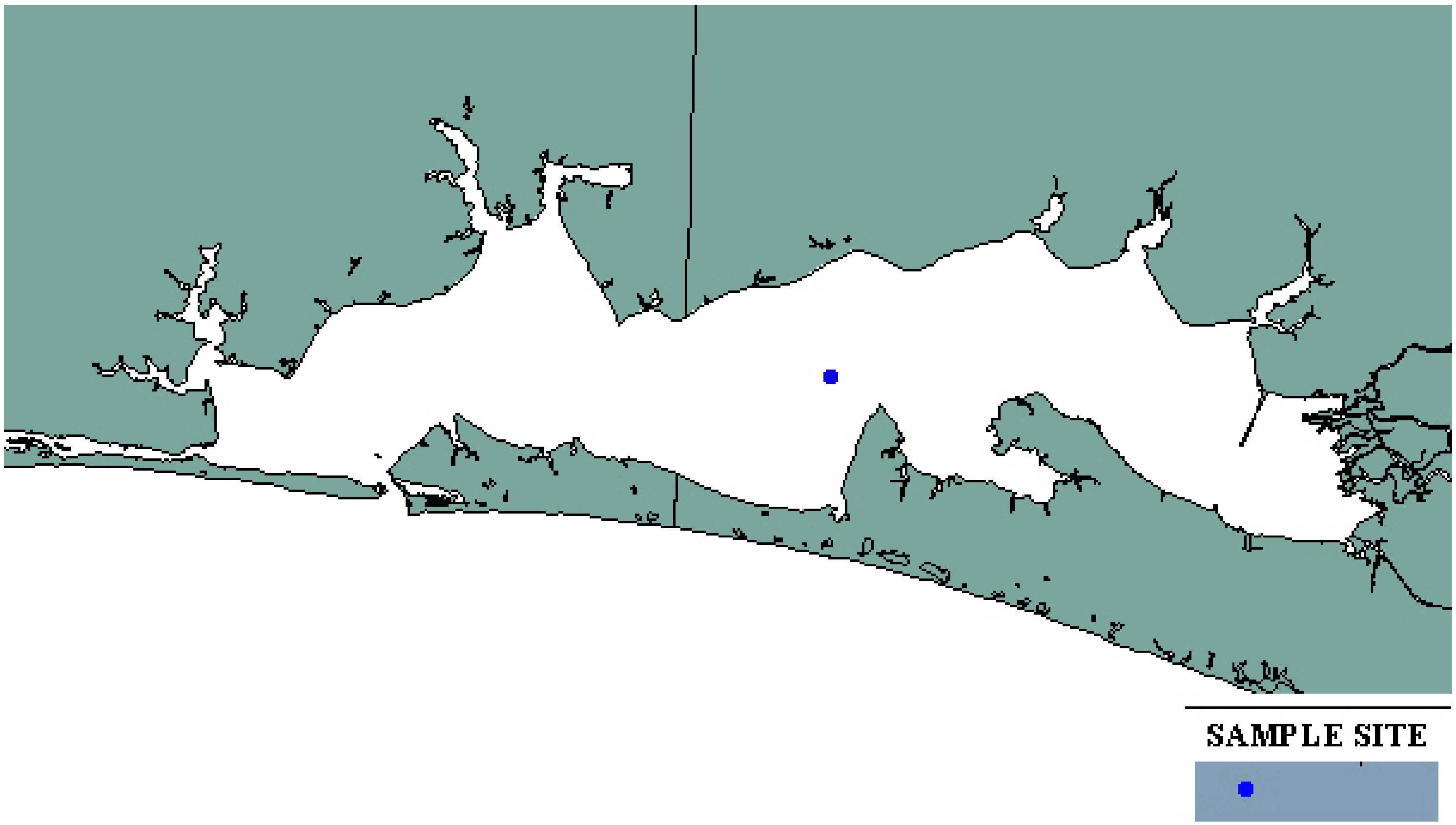

FIGURE 6: Sampling site in the Choctawhatchee Bay system.

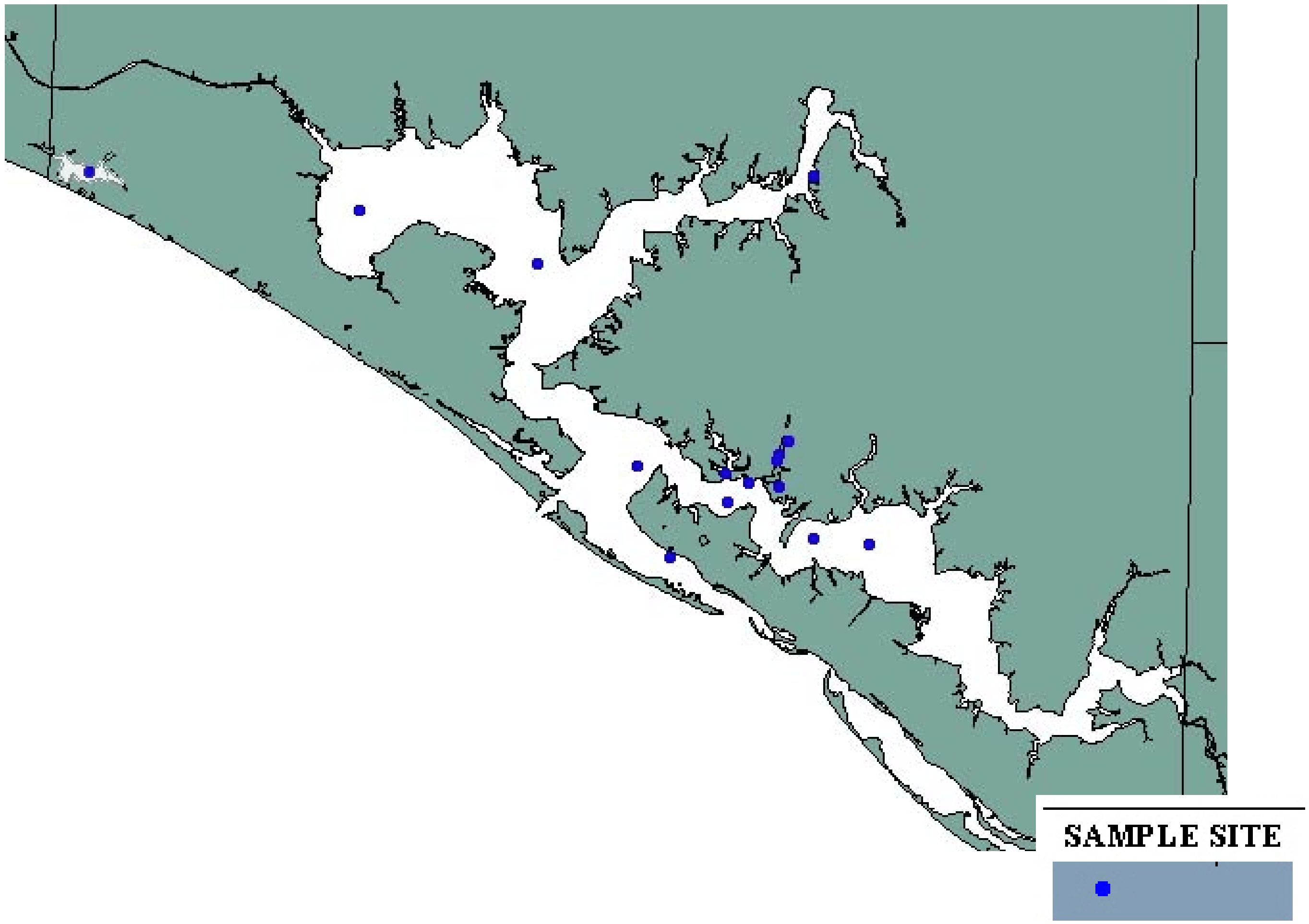

FIGURE 7: Sampling sites in the St. Andrew Bay system .

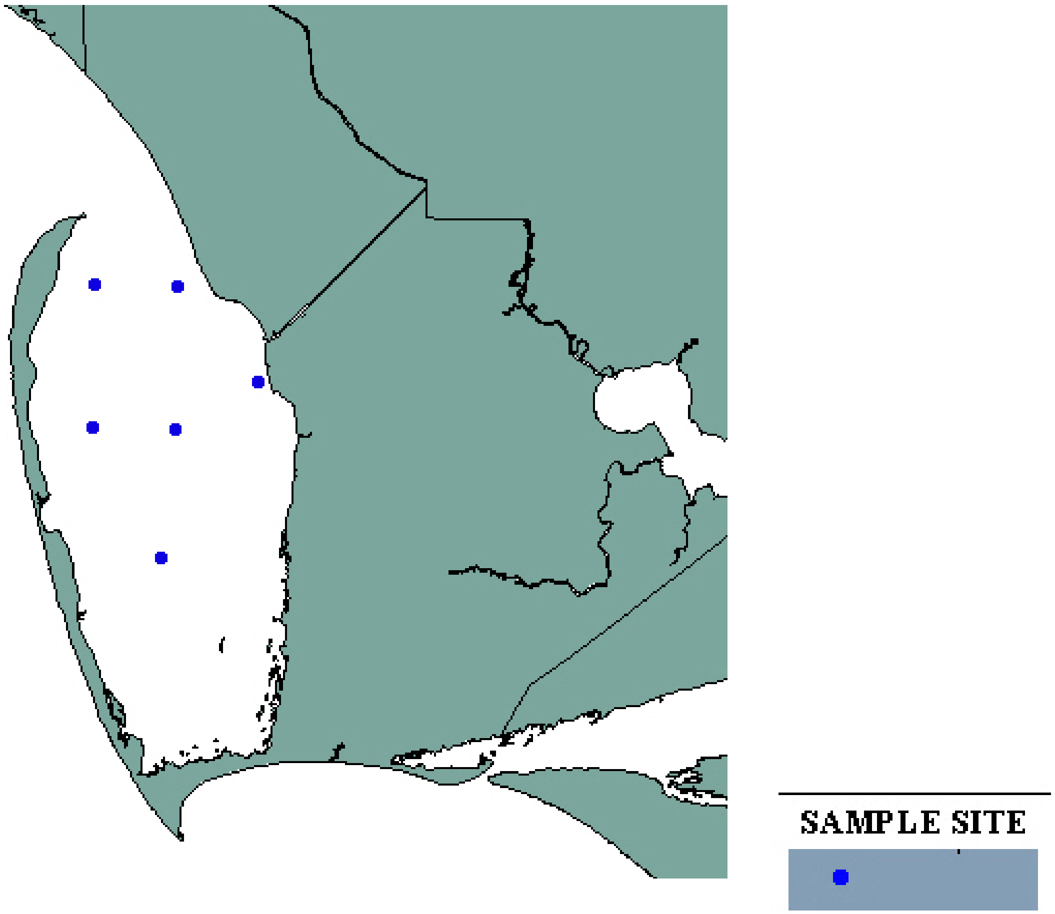

FIGURE 8: Sampling sites in the St. Joseph Bay system .

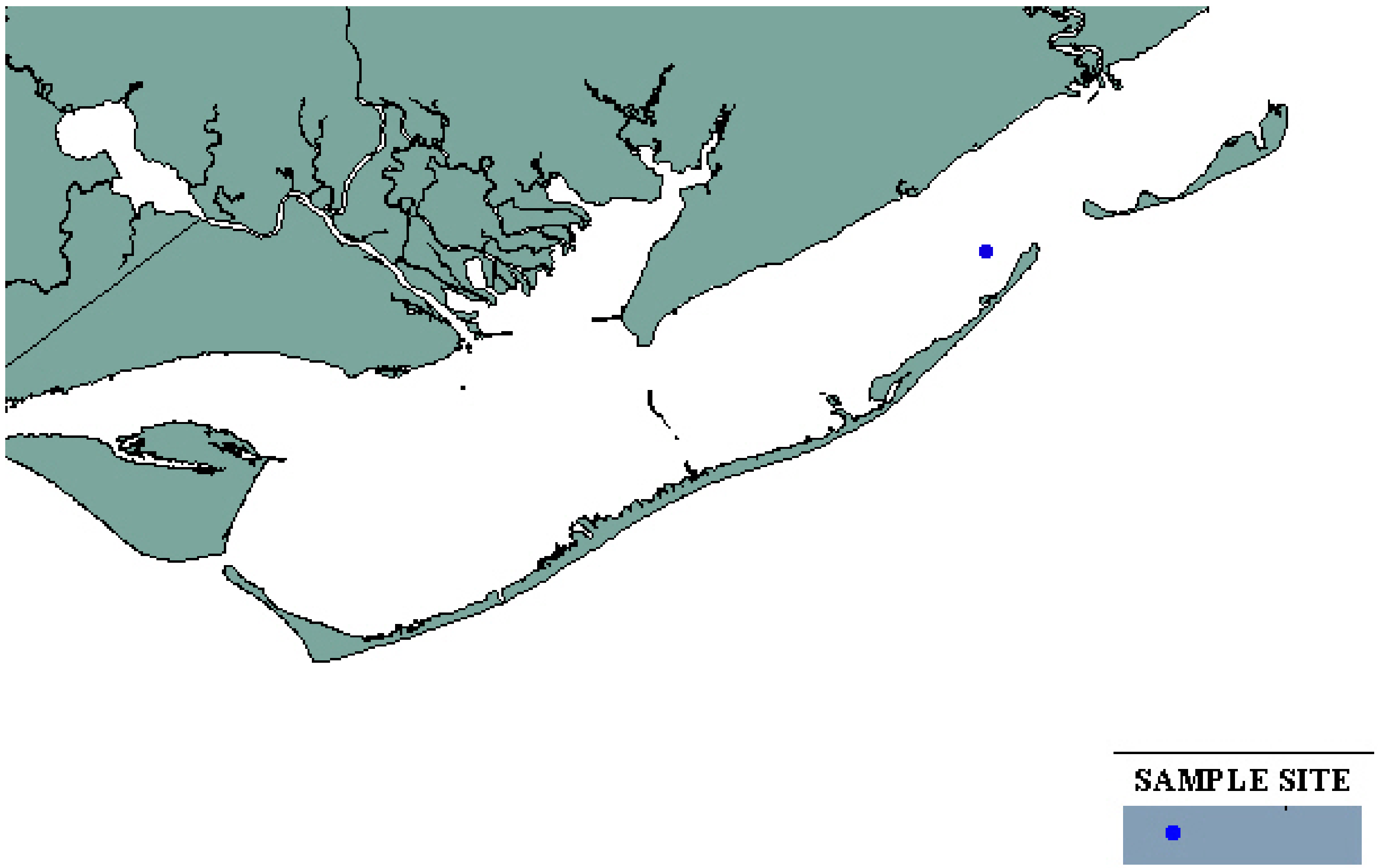

FIGURE 9: Sampling site in the Apalachicola Bay system (St. George Sound) .

Sediment Samples Analyzed for Particle Size and Organic Carbon

Sediment particle size and total organic carbon analyses were performed by Tierra Consulting Company, Mobile, Alabama. Sediment particle size was classified in accordance with the Standard Geological Soils Classification. Particle sizes were defined as: sand (2000 - 62.5 microns); silt (62.5 - 4 microns); and clay (less than 4 microns).

Sediment Samples Analyzed for Dioxin Compounds

Sediment samples were analyzed for the presence of 17 individual dioxins and furan compounds. Analyses of dioxin compounds were shipped to Triangle Laboratories, Inc., Research Triangle Park, North Carolina, or to Geochemical and Environmental Research Group, Texas A&M University, College Station, Texas. Laboratory procedures and quality assurance/quality control information for dioxin compound analyses are provided in Appendix 2.

Calculation of Toxicity Equivalents (TEQ values) of Dioxin Compounds

Toxicity equivalency (TEQ) was calculated using procedures developed by the Environmental Protection Agency (1989). In this report, all dioxin and furan toxicity is expressed as Toxicity Equivalents (i.e., total toxicity) of the seventeen 2,3,7,8-substituted dioxin and furan isomer molecules in a sample. Dioxin compounds do not exhibit high toxicity through the commonly reported modes of action unless chlorine molecules occupy the second, third, seventh and eighth carbon locations. Chlorine substitution at these locations result in a molecular conformation that differs from those molecules without chlorine molecules at these locations, and thus behave differently when in the presence of biochemical molecules.

TEQ is calculated by multiplying the absolute concentration of each isomer by a numeric factor that expresses the concentration in terms of the most toxic dioxin molecule, 2,3,7,8-TCDD (tetrachlorodibenzodioxin), which is given a value of one. For example, a dioxin molecule with chlorine atoms at all eight available positions of attachment, called octochlorodibenzo-*p*-dioxin (OCDD) is only 1/1,000 as toxic as 2,3,7,8-TCDD. If the concentration of OCDD in a sample is 4,300 parts per trillion, the conversion to TEQ in terms of the most toxic form (2,3,7,8-TCDD) would be calculated by multiplying 4,300 by 0.001 which means that the OCDD in the sample is estimated to exhibit 4.3 TEQs. By multiplying the concentrations of the other remaining dioxin and furan compounds in a sample by each appropriate conversion factor, and then by adding up all the converted values, we can calculate the total toxicity of the sample (i.e., the TEQ) in terms of the most toxic form, 2,3,7,8-TCDD.

RESULTS

Dioxin (2378-TCDD) toxicity equivalents (TEQs) were calculated for 17 dioxin and furan metabolic analytes found in sediment samples collected in bay systems of the Florida Panhandle (individual analytes included in TEQ calculations can be found by sampling site in Appendix 3). A distant perspective of dioxin TEQs in sediments from the bay systems of the Panhandle is provided in Figure 10. Individual bay system dioxin levels are depicted by location and dioxin TEQ contamination risk in the following figures:

Figure 11: 6 sites in the Perdido Bay system.
Figure 12: 2 sites in the Pensacola Bay system.
Figure 13: 1 site in the Choctawhatchee Bay system.
Figure 14: 1 site in Lake Powell and 15 sites in the St. Andrew Bay system.
Figure 15 6 sites in St. Joseph Bay.
Figure 16: 1 site in St. George Sound.

Assignment of risk levels were based on U.S. Environmental Protection Agency (US EPA) estimated risk to aquatic life associated with dioxin exposure (US EPA, 1993). These risk levels were evaluated relative to locally pertinent U.S. Fish and Wildlife trust resources, migratory birds and anadromous fishes. Table 2 is a table excerpt from US EPA Interim Report on Data and Methods for Assessment of 2,3,7,8-Teterachlorodibenzo-*p*-dioxin Risk to Aquatic Life and Associated Wildlife, 1993 (EPA/600/R93/055). With reference to the sediment concentration risk estimate column, also in parts per trillion units, relative risk levels were applied to survey results as follows: 0-10 ppt = no risk, 10.01-20 ppt = lowest possible risk level, 20.01-30 ppt = possible risk, 30.01-50 ppt = possible/probable risk, and 50.01-80 ppt= risk to some portion of trust resource populations if they directly use the specific sampling area. It should be noted that extremely sensitive fish fry (young) responses listed in the US EPA report were not applied to this relative risk rating system. The exclusion was based on survey areas being unlikely to possess anadromous (fresh spawning, FWS trust resource) fish fry in this sensitive life stage. Tables 3 contains information regarding nominal sampling area, sample identification number, sample moisture, percent total organic carbon (TOC), percent sand, percent silt, percent clay, and total toxicity equivalents (TEQs) relative to 2,3,7,8-tetrachlorodibenzodioxin in ng/kg dry weight or parts per trillion (ppt).

TABLE 2: Excerpt from U.S. Environmental Protection Agency Interim Report on Data and Methods for Assessment of 2,3,7,8-Teterachlorodibenzo-*p*-dioxin Risk to Aquatic Life and Associated Wildlife, 1993. Relative risk estimates for each environmental compartment are based on total TEQs in parts per trillion.

Environmental concentrations associated with TCDD risk to aquatic life and associated wildlife (Table reproduced from Table 5.1, US EPA, 1993).

Organism	Fish Concentration (pg/g)	Sediment Concentration (pg/g dry wt.)	Water Concentration (pg/L)	
			POC=0.2	POC=1.0
Low Risk				
Fish	50	60	0.6	3.1
Mammalian Wildlife	0.7	2.5	0.008	0.04
Avian Wildlife	6	21	0.07	0.35
High Risk to Sensitive Species				
Fish	80	100	1	5
Mammalian Wildlife	7	25	0.08	0.4
Avian Wildlife	60	210	0.7	3.5

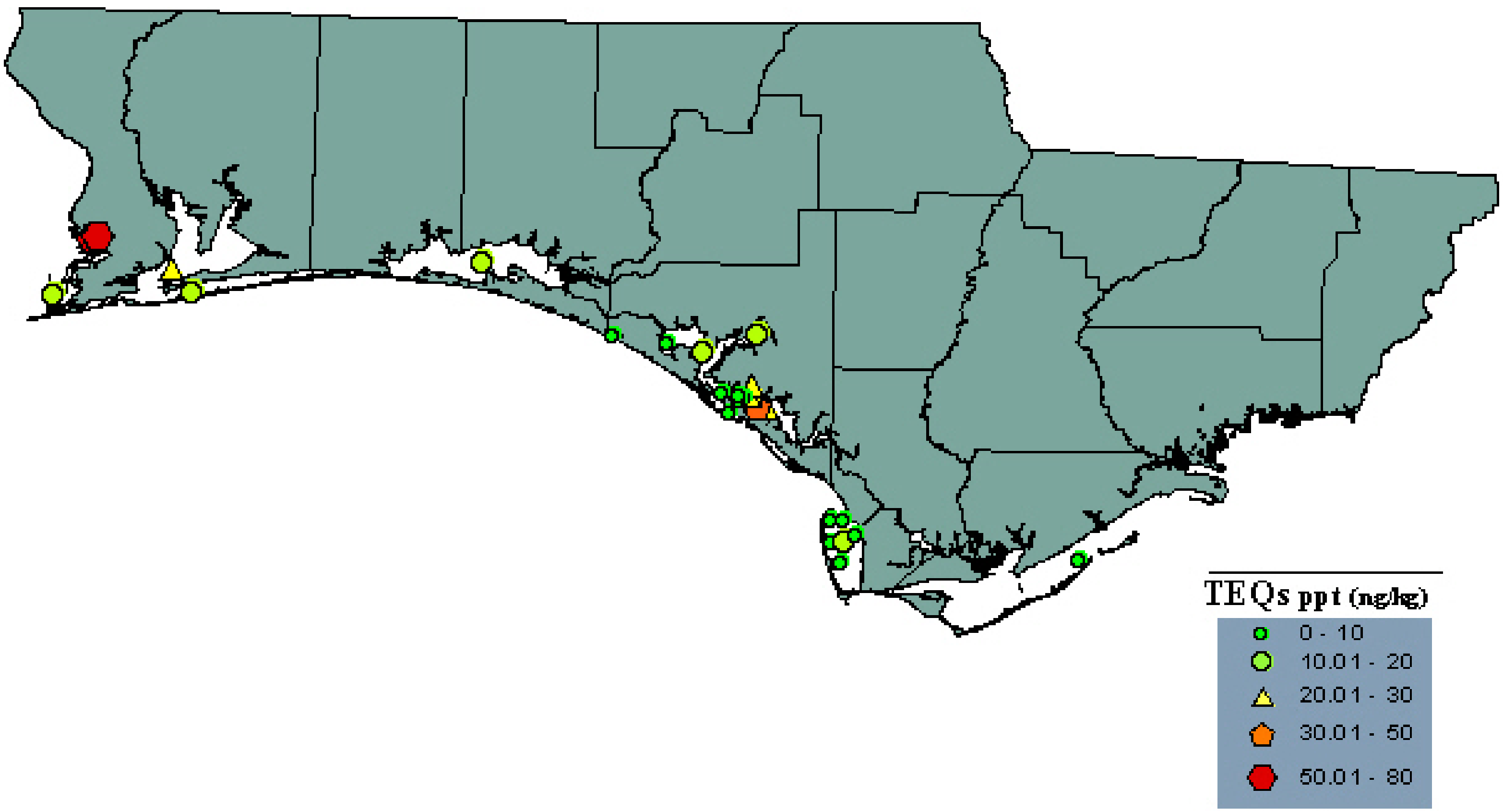

FIGURE 10: Dioxin toxicity equivalents (TEQs) calculated for 17 dioxin and furan metabolic analytes found in sediment samples collected from 32 sites in the Florida Panhandle.

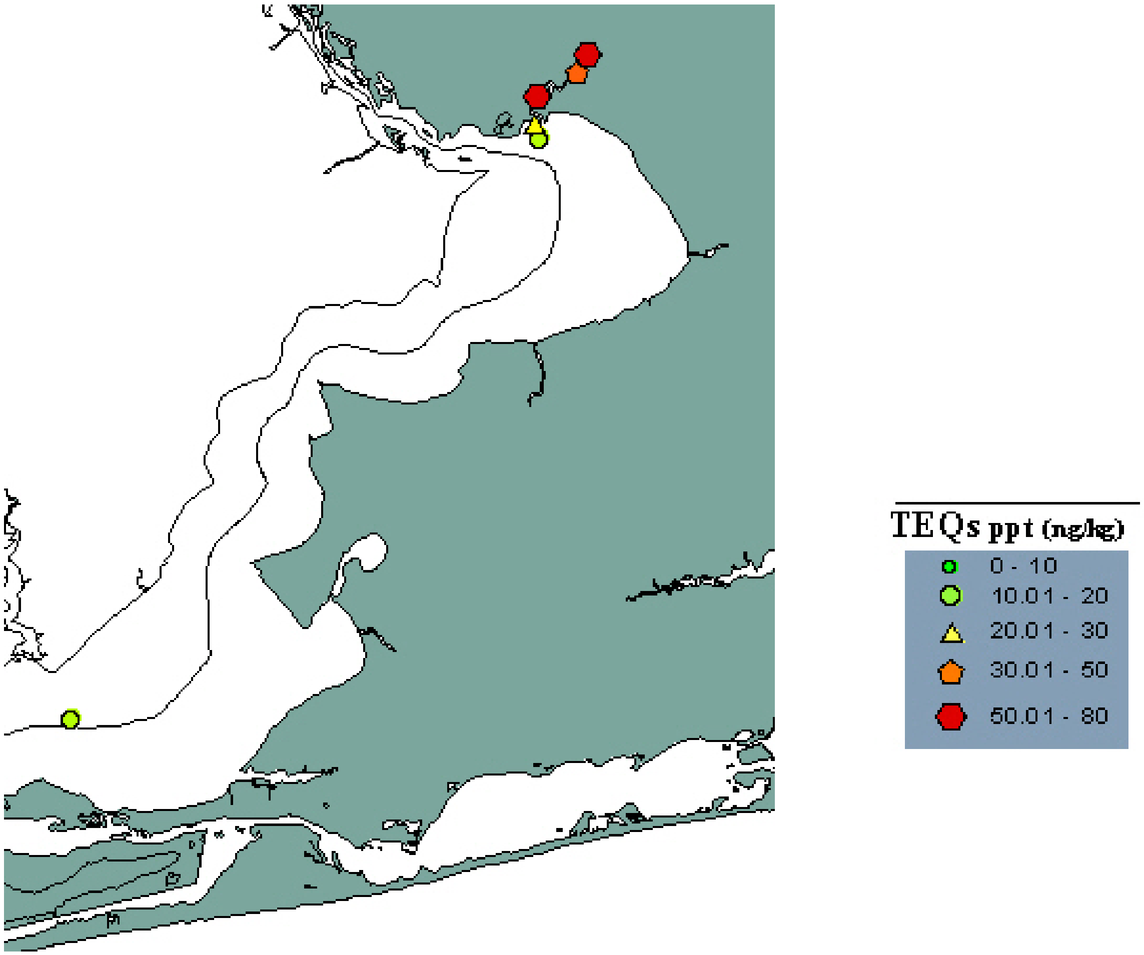

FIGURE 11: Dioxin toxicity equivalents (TEQs) calculated for 17 dioxin and furan metabolic analytes found in sediment samples collected from 6 sites in the Perdido Bay system.

FIGURE 12: Dioxin toxicity equivalents (TEQs) calculated for 17 dioxin and furan metabolic analytes found in sediment samples collected from 2 sites in the Pensacola Bay system.

FIGURE 13: Dioxin toxicity equivalents (TEQs) calculated for 17 dioxin and furan metabolic analytes found in a sediment sample collected from 1 site in the Choctawhatchee Bay system.

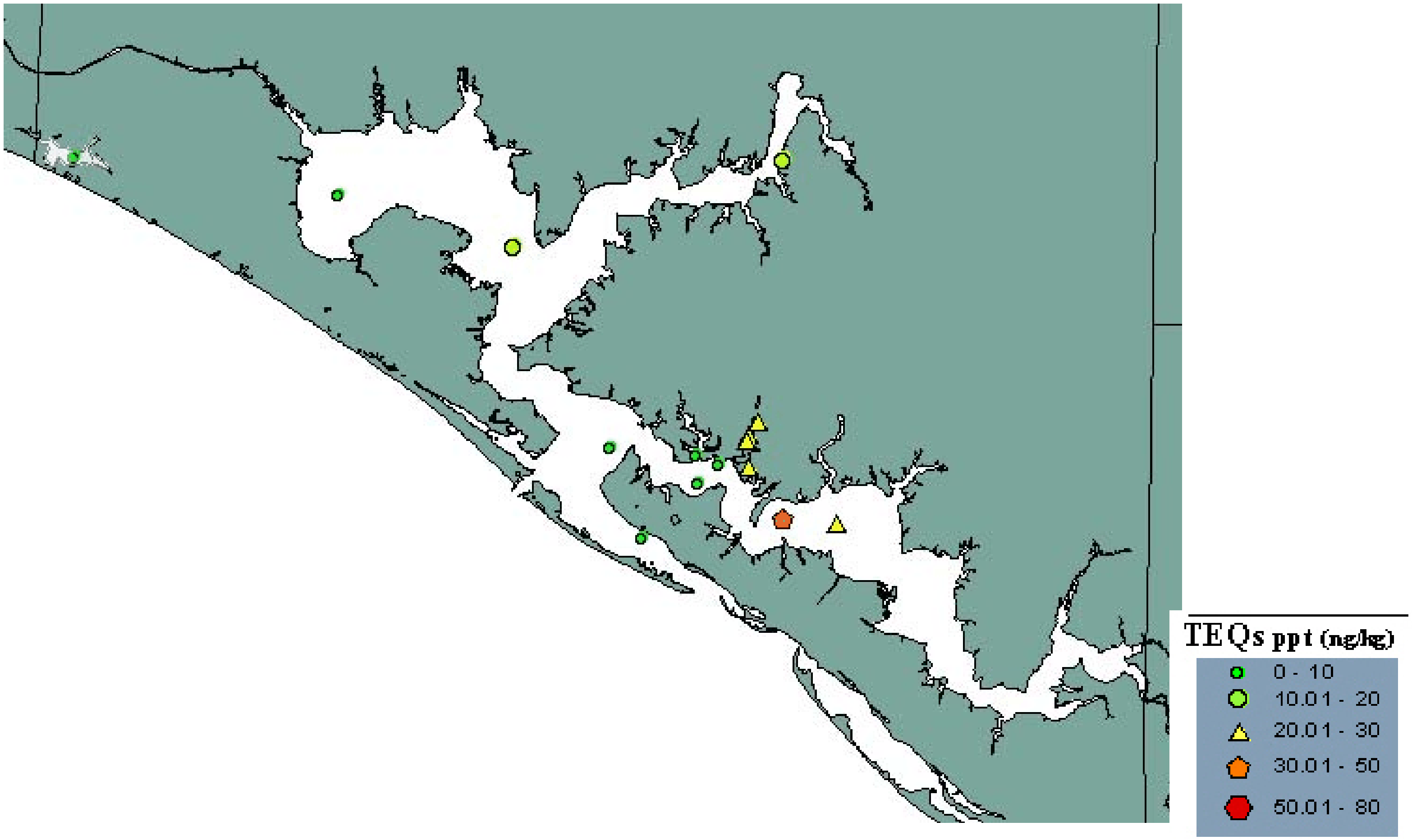

FIGURE 14: Dioxin toxicity equivalents (TEQs) calculated for 17 dioxin and furan metabolic analytes found in sediment samples collected from 1 site in the coastal marine Lake Powell and 15 sites in the St. Andrew Bay system.

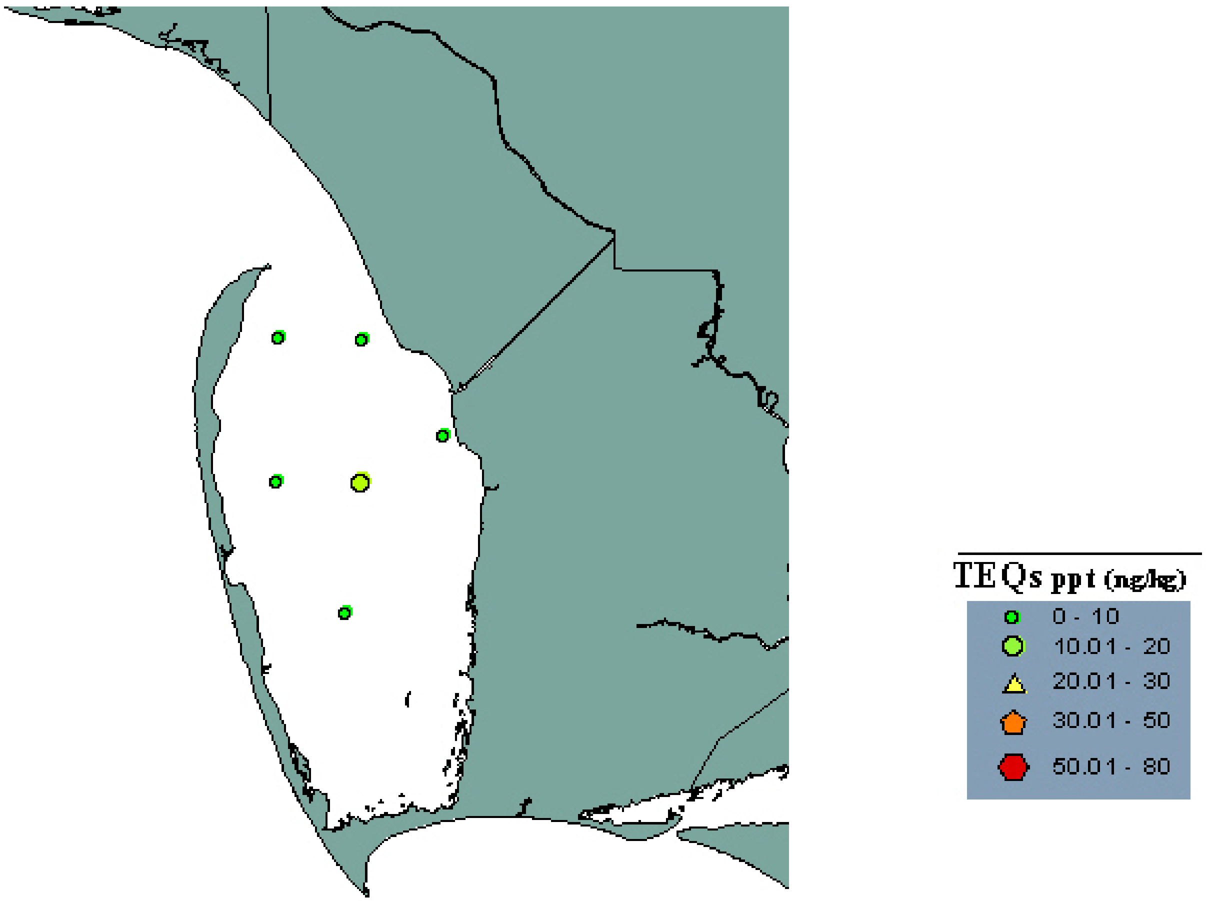

FIGURE 15: Dioxin toxicity equivalents (TEQs) calculated for 17 dioxin and furan metabolic analytes found in sediment samples collected from 6 sites in St. Joseph Bay.

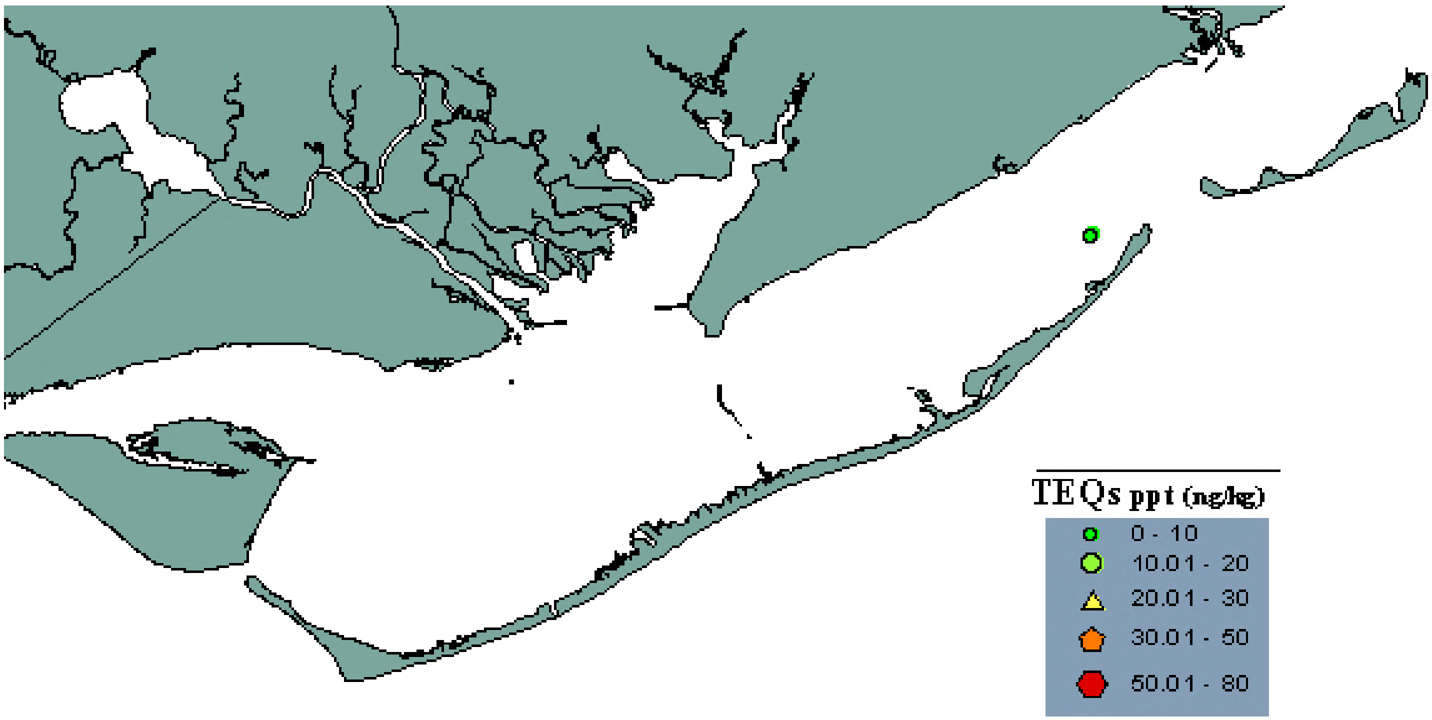

FIGURE 16: Dioxin toxicity equivalents (TEQs) calculated for 17 dioxin and furan metabolic analytes found in a sediment sample collected from 1 site in St. George Sound.

TABLE 3: Sample information for sediment samples taken by the U.S. Fish and Wildlife Service in the Florida Panhandle: nominal sampling area, sample identification number, sample moisture, percent total organic carbon (TOC), percent sand, percent silt, percent clay, and total toxicity equivalents (TEQs) relative to 2,3,7,8-tetrachlorodibenzodioxin in ng/kg dry weight or parts per trillion (ppt).

Sampling Location	**Sample ID**	**Moisture**	**% TOC**	**% Sand**	**% Silt**	**% Clay**	**TEQs**
Perdido Bay	95PB1DL	71.4	1.3	5.2	44.8	50	14.75
11 Mile Creek	92EM1D1	NA	NA	NA	NA	NA	18.9
11 Mile Creek	92EM2D1	NA	NA	NA	NA	NA	25.79
11 Mile Creek	92EM3D1	NA	NA	NA	NA	NA	50.32
11 Mile Creek	92EM4D1	NA	NA	NA	NA	NA	37.83
11 Mile Creek	92EM5D1	NA	NA	NA	NA	NA	77.51
Pensacola Bay	PB01DL	70	3.44	3.7	23.6	72.7	23.8
Santa Rosa Sound	95SRS01DL	73.9	1.21	8.7	45.1	46.2	13.57
Choctawhatchee Bay	CB01DL	72.1	3.24	0.8	53	46.2	11.6
Lake Powell	LP01DL	79.4	4.84	13.5	31.5	55	8.56
Lower St. Andrew Bay	SAB01DL	77.8	5.38	16.3	24.9	58.7	5.8
Lower St. Andrew Bay	95SAB1DL	79.7	1.04	6.1	38.7	55.2	1.99
Lower St. Andrew Bay	DUPLICATE 95SAB1DL	NA	NA	NA	NA	NA	7.2
West Bay	SABW01DL	76.2	4.83	1	24.2	74.8	14.35
West Bay	WB01Dl	NA	5.15	33.7	7.07	59.23	0.79

NA = Data not available.

TABLE 3 (continued): Sample information for sediment samples taken by the U.S. Fish and Wildlife Service in the Florida Panhandle: nominal sampling area, sample identification number, sample moisture, percent total organic carbon (TOC), percent sand, percent silt, percent clay, and total toxicity equivalents (TEQs) relative to 2,3,7,8-tetrachlorodibenzodioxin in ng/kg dry weight or parts per trillion (ppt).

Sampling Location	Sample ID	Moisture	% TOC	% Sand	% Silt	% Clay	TEQs
East Bay	107DL	74.8	2.17	4.33	32.63	63.04	26.76
East Bay	SABE01DL	75.3	5.95	2	39.5	58.5	32.73
East Bay	COE-PC1	NA	1.06	78	5	13	6.15
East Bay	COE-PC2	NA	2.14	63	14	22	5.77
Watson Bayou	94WB48D	NA	NA	NA	NA	NA	14.8
Martin Lake	106DL	80.1	3.56	2.31	41.81	55.88	21.67
Martin Lake	94LM49D	85.2	NA	NA	NA	NA	21.44
Martin Lake	95DB	76.7	15.49	2.86	59.36	37.78	21.26
Martin Lake	MRLKUP	80					20.03
Deer Point Reservoir	DPR01DL	80.4	5.05	23	13.15	63.8	17.45
St. Joe Bay	SJBB3	NA	4.38	6.06	35.25	58.69	5.64
St. Joe Bay	SJBB6	NA	0.01	13.06	32.17	51.38	9.75
St. Joe Bay	SJBD3	NA	1.1	55.21	12.06	32.47	2.91
St. Joe Bay	SJBD6	NA	0.07	24.53	35.44	40.03	10.9
St. Joe Bay	SJBF5	NA	0.6	96.53	0	0	9.89
St. Joe Bay	93R01D	NA	5.31	98.07	0	0	7.7
St. George Sound	95SGS1DL	32	0.4	83.7	3.8	12.5	0.506

NA = Data not available.

DISCUSSION

This report summarizes the U.S. Fish and Wildlife Service's evaluation of dioxin and furan compounds found in the bay systems of the Florida Panhandle. The data within the report reflect limited sampling and analyses between 1992 and 2001. Our objective was to provide survey information from which to determine the need for additional monitoring and for use in developing management strategies.

Although the data are limited, our discussion serves a secondary purpose of increasing public awareness of dioxin compound contamination in the Florida Panhandle bay systems. Variability exists in the dioxin sediment concentrations in bay systems across the Panhandle (Figure 17).

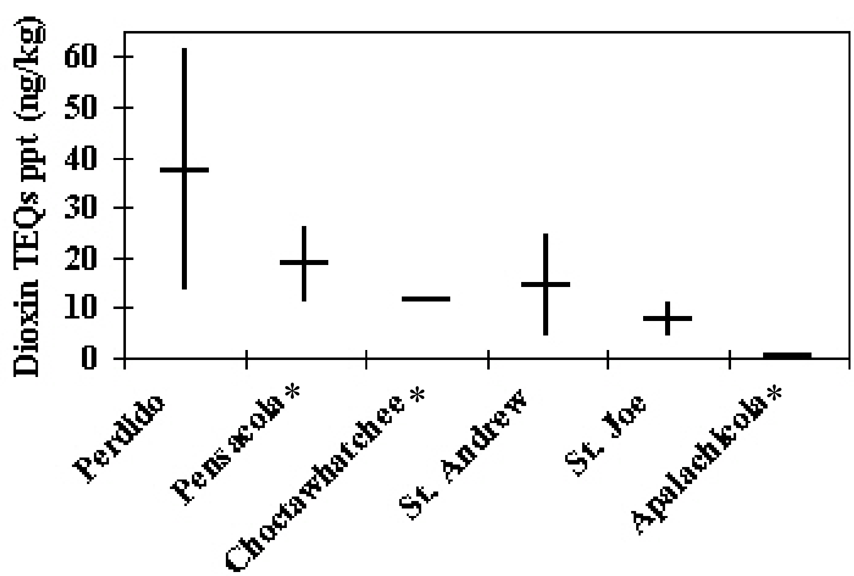

FIGURE 17: Mean (+/- 1 Standard Deviation) dioxin toxicity equivalents calculated for 17 dioxin and furan metabolic analytes found in sediment samples collected from 32 sites in the Florida Panhandle.

* Bay systems with one (Choctawhatchee and Apalachicola) or two (Pensacola) samples collected and analyzed.

All sediment samples collected and analyzed showed dioxin equivalent (TEQ) levels to be below that which would directly pose high risk (US EPA, 1993) to identified trust resources of the U.S. Fish and Wildlife Service in the Panhandle. Three bay systems in the Panhandle possessed sediments (11 samples) containing dioxin compounds exceeding sediment levels capable of posing low risk to some species of birds (US EPA, 1993, Table 2). This preliminary survey report attempts to assess direct risk to species of particular concern of the FWS. However, more complex risk assessments have not been included such as effects of increases in dioxin exposure through food web effects, increased toxicity through interactions with other contaminants, toxicity to more sensitive wildlife species, and interactions of trust resources with these environments at more sensitive life stages (Zabel and Petterson, 1996; Elliot et al., 1996; Powell et al., 1997; Auman et al., 1997; Giesy et al., 1997; Jung and Walker, 1997; Rhodes et al., 1997; Woodford et al., 1998; Huange et al., 1999; Brunstrom et al., 2001; Kadokami et al., 2002). Risk to specific wildlife was evaluated using the US EPA Interim Report on Data and Methods for Assessment of 2,3,7,8-Teterachlorodibenzo-*p*-dioxin Risk to Aquatic Life and Associated Wildlife, 1993.

The Perdido Bay system had the highest sediment dioxin TEQ concentrations ranging from 14.75 ppt in the open bay to 77.51 ppt in Eleven Mile Creek, a freshwater tributary to this system. The highest TEQ concentrations found during this survey were in Eleven Mile Creek. All four samples taken in Eleven Mile Creek possessed TEQs in excess of levels that pose low risk to some bird species (Whitehead et al., 1995; Elliott et al., 1989; Sanderson et al., 1994; Woodford et al., 1998) and high risk to sensitive mammal species (Aulerich et al., 1988; Hochstein et al., 1988; Hochstein and Aulerich, 1998; Brunstrom et al., 2001). Sensitive mammal species such as mink and otter relatives may more likely be present in the freshwater tributary than the open bay. Additionally, there was an apparent trend of increasing TEQ concentrations with distance from the bay site to upstream sites in Eleven Mile Creek (Figure 11). A pulp and paper mill is located on the creek and the plant's effluent is released into Eleven Mile Creek. Pulp and paper mill production processes have been linked to dioxin compound contamination in excess of nonpoint source deposition levels, especially in cases where softwood pulps are used (Kuehl et al., 1987; Buser et al., 1989; Hoffman et al., 1995; Woodford et al., 1998). Pulp and paper mills release dioxin contamination in pulp, effluent and sludge portions of processing reported at mean concentrations of 12, 0.06 and 95 ppt 2,3,7,8-TCDD and 137, 0.5, and 806 ppt 2,3,7,8-TCDF, respectively (Hoffman et al., 1995). With the evident upstream trend, the source of at least part of the dioxin compound contamination of this bay system is likely attributable to historic pulp and paper mill effluent. A trend of decreasing concentration with distance from point sources is not unusual for dioxin compound contamination (Kannan et al., 2001; Im et al., 2002). However, environmental concentrations around this plant may be decreasing because many pulp and paper plants, like this one, recently converted to processing methods (chlorine dioxide from elemental chlorine) estimated to greatly reduce dioxin formation and releases. Within the limitations of the data collected, higher levels of TEQs were apparently isolated to Eleven Mile Creek and the trust resources therein at the time of sampling.

The Pensacola Bay system was evaluated by only two sediment samples, one in Pensacola Bay and one in Santa Rosa Sound. The Pensacola Bay site sediments possessed TEQs (23.80 ppt) at a level in excess of that which may pose low risk to some bird species, but below that which may pose risk to sensitive fish species. Escambia River, a large freshwater input to the bay system, has several permitted industrial dischargers, including a pulp and paper mill, several chemical plants, coal fired power plants, etc. A spill of polychlorinated biphenyls (PCBs) from a local chemical company into the system in 1969 may be a contributing factor to TEQ concentrations in Pensacola Bay sediments. Dioxin compounds are found as impurities of PCB formulations because they are unintentionally created during PCB manufacture and use (Hoffman et al., 1995). Given the limitations of the data, including a lack of sampling in the upper bay system and the Escambia River, this one sample may not be representative of the system. TEQs in sediment taken from Santa Rosa Sound, more distant from industrial tributaries and containing less organic materials, were lower (13.57 ppt) and not expected to adversely affect trust resources.

Choctawhatchee Bay system dioxin TEQ levels were based on one sediment sample that, within limits of the available data, showed no risk to FWS trust resources with a TEQ concentration of 11.60. However, with the reported use of agent orange (a chemical defoliant with dioxin impurities; Harte et al., 1991) on the local Eglin Air Force Base, the limitations of the data are clear.

The St. Andrew Bay system was the most surveyed for dioxin contamination with 15 sites in the bay system proper and one site in a nearby coastal lake – Lake Powell. St. Andrew Bay contained sites with sediment TEQs in excess of levels that are reported to pose low risk to some species, such as migratory birds, and high risk to sensitive mammal species. Sediment TEQs for the Lake Powell site were low (8.56 ppt) and not expected to adversely affect trust resources. Similarly, the majority of sites in the bay (9 samples) had sediment TEQs at low levels ranging from 0.79 to 17.45 ppt. However, a group of sites in the eastern portion (East Bay) of the bay system showed higher TEQ levels ranging from 21.26 to 32.73 ppt. Four of the six sites with higher TEQs were located in the freshwater impoundment – Martin Lake (formally estuarine Martin Bayou, dammed in the 1950s). Two other sites with higher TEQs were east of Martin Lake in East Bay, including the site with the highest TEQ level for this system (32.73 ppt). Conversely, similar sites to the west of Martin Lake (3 samples) showed much lower TEQ levels. Located proximate to Martin Lake is a pulp and paper mill. While this may provide a potential point source of dioxin contamination to Martin Lake and East Bay, it does not reveal why TEQ levels are elevated east, but not west, of the factory site. This mill also recently converted to processing methods estimated to reduce dioxin production, thus potentially diminishing a dioxin source in the bay system.

All sediment samples taken from the St. Joseph Bay system possessed TEQ levels below expected risk levels (range 2.91-10.90 ppt) for trust resources. This bay system is different from the systems previously described for two reasons. First, the bay has relatively little freshwater input, as well as a relatively wide passage to the Gulf of Mexico that facilitates flushing with fresh Gulf waters (Figure 15). Secondly, this system presented a deviation for the pulp and paper processing works point source trend shown for Perdido Bay and St. Andrew Bay. Directly adjacent to St. Joe Bay, proximal to the sediment samples taken, was a pulp and paper processing plant. However, no increases in sediment dioxin TEQs were evident from samples taken with all sites being similar in sediment dioxin load. Since the organic content of these samples was similar to St. Andrew Bay samples but the TEQs less, it is possible that the larger water exchange or flushing with Gulf of Mexico waters kept accumulation of dioxin TEQs to a minimum. In addition, it has been proposed that years of shrimp trawling may have mixed the sediments and distributed dioxin compounds over a wide area (20,000 acres) and diluted contamination sediments with underlying cleaner bay sediments (Brim, 2000). The plant ceased operation in the late 1990s.

The lowest measured level of dioxin TEQs in sediment samples taken across the bay systems of the Panhandle was found in St. George Sound of the Apalachicola Bay system. However, the sediment sample with a dioxin TEQ concentration of 0.51 ppt was the only sample taken in that bay system and may not be representative of sediment input from the Apalachicola River.

The need to periodically monitor dioxin compound levels in the Panhandle is evident from the vast natural resources found there. Although the concentrations are not high compared to similar recent studies (Table 4), there are site-specific dioxin elevations that may be cause for concern due to the nature of the contaminant class. Atmospheric dioxin concentrations have been reported to be low (<6 pg/m^3 range) in the United States (Smith et al., 1989; Harless et al., 1990; Maisel et al., 1990; Hunt et al., 1990; CDEP, 1988;

Harless et al., 1991; Edgerton et al., 1989; Eitzer et al., 1989; Hunt et al., 1990). However, because of the particular physical and chemical properties of dioxin compounds (log K_{ow}=6.85, log K_{oc}~7) atmospheric releases accumulate in the organic compartments of aquatic systems, especially sediments (Lodge and Cook, 1989; Boethling and Mackay, 2000). The sediment compartment of aquatic systems have a tendency to transfer dioxin compounds to other organic compartments such as living organisms. It is the transfer of dioxins from the sediment to living organisms, or the food web, that results in biomagnification (increased body concentrations) and reported adverse ecological effects (Hoffman et al., 1995; Rhodes et al., 1997; Woodford et al., 1998; Landis and Yu, 1999; Marvin et al., 2000; Kannan et al., 2001; Im et al., 2002). As with many contaminants that have an affinity for organic compartments, environmental exposures are generally indiscriminate.

Table 4: Sediment total toxicity equivalents (TEQs) concentrations relative to 2,3,7,8-tetrachlorodibenzodioxin in ng/kg dry weight or parts per trillion (ppt) for surveys similar to the U.S. Fish and Wildlife Service survey in the Florida Panhandle: water body, location, year, sediment TEQs range in ppt.

Water Body	Location	Year	TEQs
Lake Ontario[A]	New York	1962-1987	68-500
Newark Bay[A]	New Jersey	1948-1969	730-7,600
Lake Ontario[B]	Canada	2000	37509
Detroit/Rouge Rivers[C]	Michigan	2001	3-62
Masan Bay[D]	Korea	2002	1-76
Panhandle Bay Systems	Florida	2002	1-78

[A] U.S. Environmental Protection Agency. 1993. EPA/600/R93/055.

[B] Marvin et al. 2000. Environmental Toxicology and Chemistry 19(2), 344-351.

[C] Kannan et al. 2001. Environmental Toxicology and Chemistry 20 (9), 1878-1889.

[D] Im et al. 2002. Environmental Toxicology and Chemistry 21(2), 245-252.

Trust Resource Implications

Biological accumulation of dioxin compounds can endanger FWS trust resources and/or their close genetic relatives, particularly in the more sensitive developmental stages (Zabel and Petterson, 1996; Elliot et al., 1996; Powell et al., 1997; Auman et al., 1997; Giesy et al., 1997; Jung and Walker, 1997; Rhodes et al., 1997; Woodford et al., 1998; Huange et al., 1999; Brunstrom et al., 2001; Kadokami et al., 2002). The detrimental consequences of dioxin contamination have been repeatedly demonstrated for piscivorous (fish eating) bird species including: bald eagles (*Haliaeetus leucocephalus;* Elliot et al., 1995; Whitehead et al., 1995), great blue herons (*Ardea herodias*; Elliott et al., 1989; Sanderson et al., 1994), osprey (*Pandion halieatus*; Whitehead et al., 1995; Woodford et al., 1998), cormorant species (*Phalacrocorax spp*.; Yamashita et al., 1993; Powell et al., 1997), and common terns (*Sterna hirundo*; Bosveld et al., 1994), among others (Peterson et al., 1993; Auman et al., 1997). Piscivorous bird contamination can often be traced to the food web and contaminated fish on which the birds feed (Fox et al., 1991; Gilbertson et al., 1991; Peterson et al, 1993; Woodford et al., 1998). Some fish species have also been reported to suffer negative impacts of dioxin compound accumulation at concentrations lower than birds, despite the fact that fish are often lower on the food chain than piscivorous birds and would theoretically have lower dioxin concentration in their bodies (Walker et al., 1991; Walker and Peterson, 1991; Zabel et al., 1995; Abbott and Hinton, 1996; Zabel and Petterson, 1996; Giesy et al., 1997). These same food web connections deliver dioxin contamination to mammals. Some mammal species are highly susceptible to dioxin exposure and suffer complete reproductive failure after exposure to environmentally relevant concentrations (Aulerich et al., 1988; Hochstein et al., 1988; Hochstein and Aulerich, 1998; Brunstrom et al., 2001). Owing to their indiscriminate nature, dioxins have also been associated with worldwide amphibian deformities and declines (Jung and Walker, 1997; Huange et al., 1999; Kadokami et al., 2002).

CONCLUSIONS

Overall, the concentrations of dioxin compounds in sediments of the Panhandle bay system are comparable to recent surveys in the Great Lakes area and bay systems worldwide (Table 4; Smith et al., 1990; Brown et al., 1994; Hoffman et al., 1995; Woodford et al., 1998; Marvin et al., 2000; Kannan et al., 2001; Im et al., 2002). However, levels such as these have been associated with biomagnification in the food web (Smith et al., 1990; Jones et al., 1993; Marvin et al., 2000) to levels posing risk to both bird and fish species, not to mention the more sensitive mammal species (US EPA, 1993).

There was apparent variability in dioxin TEQ sediment concentrations in the bay systems of the Panhandle. This may have been due to the variable industrial presence and urbanization, but was at least partly a reflection of very limited sampling in some bay systems. The volume of freshwater input and width of Gulf of Mexico to bay passages may also have been a contributing factor. The next step in the evaluation of the bay systems of the Panhandle will be to examine each of the above components.

The relationship between the sediment dioxin TEQ concentrations found and actual risk to FWS trust resources can be inferred, but has not been established. The foremost goal of this report is to provide information and to stimulate future investigation when necessary to protect and recover FWS trust resources. Investigation into relationships between contaminated food fish and piscivorous fish and birds species is needed to address actual risk to FWS trust resources.

RECOMMENDATIONS

The following recommendations are offered for consideration.

1. Conduct additional sampling in lower Perdido Bay, Pensacola Bay, Santa Rosa Sound, Choctawhatchee Bay, East Bay of St. Andrew Bay, and Apalachicola Bay.

2. Evaluate the effectiveness of chlorine-dioxide substitution for elemental chlorine as a means of reducing dioxin inputs to the bay systems of the Florida Panhandle.

3. Evaluate local air emission sources to determine if dioxin compounds are being released from municipal and medical waste incinerators

4. Monitor the biological tissues (especially reproductive tissues or eggs) of some resident piscivorous birds, in particular, the brown pelican and osprey.

5. Monitor the biological tissues (including unfertilized eggs) of coastal resident marine species, particularly spotted seatrout, flounder, redfish, and long-lived, deep-water clam species.

6. Monitor population abundance and fish prey of river otter, Florida mink, and bottlenose dolphins.

7. Conduct vertical analysis of sediment cores for dioxin compounds at certain geographic sites near paper mills, chemical manufacturing plants, and prior to significant dredging activities.

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APPENDICES

Appendix 1
Standard operating procedures for field collection of sediment samples (PCFO-EC SOP 004).

Appendix 2
Laboratory procedures and quality assurance/quality control information for dioxin compound analyses

Appendix 3
Calculation of 2,3,7,8 tetrachlorodibenzo-*para*-dioxin (TCDD) toxicity equivalents (TEQs)

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	95PB1-DL		
Waterbody:	PERDIDO BAY		
Sample Type:	SEDIMENT		
Sample Moisture:	71.4		
Sediment grain %:	5.2	44.8	50
Total Org Carbon %:	1.3		
Collection date:	Jul-95		
***Latitude:	30.19.96		
***Longitude:	87.28.94		
Loran Reading:			
Loran Reading:			
Depth:	14		
Chem Lab:	TRIANGLE		

Analyte	PPT	TEF	TE
2378-TCDD		1	0
12378-PeCDD	3.7	0.5	1.85
123478-HxCDD	6	0.1	0.6
123678-HxCDD	14.4	0.1	1.44
123789-HxCDD	23.3	0.1	2.33
1234678-HpCDD	396	0.01	3.96
OCDD	3600	0.001	3.6
@2378-TCDF	2.2	0.1	0.22
12378-PeCDF		0.05	0
23478-PeCDF		0.5	0
123478-HxCDF		0.1	0
123678-HxCDF	1.5	0.1	0.15
234678-HxCDF	3.1	0.1	0.31
123789-HxCDF		0.1	0
1234678-HpCDF	25.8	0.01	0.258
1234789-HpCDF		0.01	0
OCDF	29.5	0.001	0.0295
TOTAL 2378-TCDD			14.7475

* Interim Procedures for Estimating Risks Associated Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016, U.S. Environmental Protection Calculations for sediments, use dry

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number: 92EM1D1

Waterbody: Eleven Mile Creek, 0.1 mile from creek mouth in bay.
Sample Type: Sediment
Sample Moisture:
Sediment grain %:
Total Org Carbon %:
Collection date: May, 1992
***Latitude: 30-27-20
***Longitude: 87-22-58
Loran Reading:
Loran Reading:
Depth:
Chem Lab: Triangle Laboratories of RTP, Inc.

Analyte	PPT	TEF	TE
2378-TCDD	3.7	1	3.7
12378-PeCDD	1.7	0.5	0.85
123478-HxCDD	3.5	0.1	0.35
123678-HxCDD	14.2	0.1	1.42
123789-HxCDD	16.3	0.1	1.63
1234678-HpCDD	393	0.01	3.93
OCDD	3870	0.001	3.87
@2378-TCDF	6.9	0.1	0.69
12378-PeCDF	1.3	0.05	0.065
23478-PeCDF	1	0.5	0.5
123478-HxCDF	4.1	0.1	0.41
123678-HxCDF	1.8	0.1	0.18
234678-HxCDF	4	0.1	0.4
123789-HxCDF	1.8	0.1	0.18
1234678-HpCDF	48.4	0.01	0.484
1234789-HpCDF	4.6	0.01	0.046
OCDF	198	0.001	0.198

TOTAL 2378-TCDD EQUIVALENTS: 18.903

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* Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016, U.S. Environmental Protection Agency.
Calculations for sediments, use dry weights.
Calculations for biotic tissue, use wet weights.

empc - estimated maximum possible concentration

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number: 92EM2D1

Waterbody:	Eleven Mile Creek, 0.1 mile up creek from mouth.
Sample Type:	Sediment
Sample Moisture:	
Sediment grain %:	
Total Org Carbon %:	
Collection date:	May, 1992
***Latitude:	30-27-37
***Longitude:	87-22-65
Loran Reading:	
Loran Reading:	
Depth:	
Chem Lab:	Triangle Laboratories of RTP, Inc.

Analyte	PPT	TEF	TE
2378-TCDD	4.9	1	4.9
12378-PeCDD	2.6	0.5	1.3
123478-HxCDD	6.8	0.1	0.68
123678-HxCDD	20.2	0.1	2.02
123789-HxCDD	22.3	0.1	2.23
1234678-HpCDD	506	0.01	5.06
OCDD	4880	0.001	4.88
@2378-TCDF	14.1	0.1	1.41
12378-PeCDF	1.3	0.05	0.065
23478-PeCDF	1.6	0.5	0.8
123478-HxCDF	6	0.1	0.6
123678-HxCDF	2.2	0.1	0.22
234678-HxCDF	5.2	0.1	0.52
123789-HxCDF	1.2	0.1	0.12
1234678-HpCDF	70.7	0.01	0.707
1234789-HpCDF	4.8	0.01	0.048
OCDF	229	0.001	0.229

TOTAL 2378-TCDD EQUIVALENTS: 25.789

* Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016, U.S. Environmental Protection Agency.
Calculations for sediments, use dry weights.
Calculations for biotic tissue, use wet weights.

empc = estimated maximum possible concentration

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number: 92EM3D1

Waterbody: Eleven Mile Creek, 0.7 mile up creek from
Sample Type: Sediment
Sample Moisture:
Sediment grain %:
Total Org Carbon %:
Collection date: May,
***Latitude: 30-27-70
***Longitude: 87-22-62
Loran Reading:
Loran Reading:
Depth:
Chem Lab: Triangle Laboratories of RTP,

Analyte	PPT	TEF	TE
2378-TCDD	19.7	1	19.7
12378-PeCDD	3.4	0.5	1.7
123478-HxCDD	7.9	0.1	0.79
123678-HxCDD	39.8	0.1	3.98
123789-HxCDD	33.4	0.1	3.34
1234678-HpCDD	683	0.01	6.83
OCDD	5900	0.001	5.9
@2378-TCDF	32.2	0.1	3.22
12378-PeCDF	2.2	0.05	0.11
23478-PeCDF	2.4	0.5	1.2
123478-HxCDF	8.4	0.1	0.84
123678-HxCDF	2.9	0.1	0.29
234678-HxCDF	8.3	0.1	0.83
123789-HxCDF	1.6	0.1	0.16
1234678-HpCDF	104	0.01	1.04
1234789-HpCDF	6.8	0.01	0.068
OCDF	326	0.001	0.326

TOTAL 2378-TCDD EQUIVALENTS: 50.324

* Interim Procedures for Estimating Risks Associated
Exposures to Mixtures of Chlorinated Dibenzo-p-
and Dibenzofurans (CDDs and CDFs) and 1989
EPA/625/3-89/016, U.S. Environmental Protection
Calculations for sediments, use dry weights.
Calculations for biotic tissue, use wet

empc = estimated maximum possible concentration

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	92EM4D1
Waterbody:	Eleven Mile Creek, 1.7 miles up creek from mouth.
Sample Type:	Sediment
Sample Moisture:	
Sediment grain %:	
Total Org Carbon %:	
Collection date:	May,
***Latitude:	30-28-03
***Longitude:	87-22-07
Loran Reading:	
Loran Reading:	
Depth:	
Chem Lab:	Triangle Laboratories of RTP,

Analyte	PPT	TEF	TE
2378-TCDD	18.5	1	18.5
12378-PeCDD	1.9	0.5	0.95
123478-HxCDD	4.1	0.1	0.41
123678-HxCDD	21.9	0.1	2.19
123789-HxCDD	18.4	0.1	1.84
1234678-HpCDD	431	0.01	4.31
OCDD	4190	0.001	4.19
@2378-TCDF	26	0.1	2.6
12378-PeCDF	1.6	0.05	0.08
23478-PeCDF	1.2	0.5	0.6
123478-HxCDF	5.1	0.1	0.51
123678-HxCDF	2	0.1	0.2
234678-HxCDF	4.5	0.1	0.45
123789-HxCDF	1.3	0.1	0.13
1234678-HpCDF	58.9	0.01	0.589
1234789-HpCDF	5.9	0.01	0.059
OCDF	226	0.001	0.226

TOTAL 2378-TCDD EQUIVALENTS: 37.834

* Interim Procedures for Estimating Risks Associated
Exposures to Mixtures of Chlorinated Dibenzo-p-
and Dibenzofurans (CDDs and CDFs) and 1989
EPA/625/3-89/016, U.S. Environmental Protection
Calculations for sediments, use dry weights.
Calculations for biotic tissue, use wet

empc = estimated maximum possible concentration

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	92EM5D1
Waterbody:	Eleven Mile Creek, 2.2 miles up creek from
Sample Type:	Sediment
Sample Moisture:	
Sediment grain %:	
Total Org Carbon %:	
Collection date:	May,
***Latitude:	30-28-23
***Longitude:	87-21-93
Loran Reading:	
Loran Reading:	
Depth:	
Chem Lab:	Triangle Laboratories of RTP, Inc.

Analyte		PPT	TEF	TE
2378-TCDD		25.7	1	25.7
12378-PeCDD		6.9	0.5	3.45
123478-HxCDD		11.3	0.1	1.13
123678-HxCDD		73.3	0.1	7.33
123789-HxCDD		59.5	0.1	5.95
1234678-HpCDD		1100	0.01	11
OCDD		9770	0.001	9.77
@2378-TCDF		52.1	0.1	5.21
12378-PeCDF	empc	2.3	0.05	0.115
23478-PeCDF		3.9	0.5	1.95
123478-HxCDF		13.8	0.1	1.38
123678-HxCDF		5	0.1	0.5
234678-HxCDF		13.1	0.1	1.31
123789-HxCDF		3.4	0.1	0.34
1234678-HpCDF		166	0.01	1.66
1234789-HpCDF		7.5	0.01	0.075
OCDF		640	0.001	0.64
TOTAL 2378-TCDD EQUIVALENTS:				77.51

* Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016, U.S. Environmental Protection
Calculations for sediments, use dry weights.
Calculations for biotic tissue, use wet weights.

empc = estimated maximum possible concentration

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	PB01DL
Waterbody:	Pensacola Bay, Escambia County, FL
Sample Type:	Sediment
Sample Moisture:	70.0
Sediment grain %:	sand 3.7, silt 23.6, clay 72.7
Total Org Carbon %:	3.44
Collection date:	August 5, 1997
***Latitude:	30-24-00
***Longitude:	87-10-00
Loran Reading:	
Loran Reading:	
Depth:	24 feet (7.3 meters)
Chem Lab:	Triangle Laboratories

Analyte	PPT	TEF	TE
2378-TCDD	0.67	1	0.67
12378-PeCDD	2.4	0.5	1.2
123478-HxCDD	7	0.1	0.7
123678-HxCDD	16.3	0.1	1.63
123789-HxCDD	37.1	0.1	3.71
1234678-HpCDD	586	0.01	5.86
OCDD	7870	0.001	7.87
@2378-TCDF	2.8	0.1	0.28
12378-PeCDF	1.5	0.05	0.075
23478-PeCDF	0	0.5	0
123478-HxCDF	4	0.1	0.4
123678-HxCDF	2.5	0.1	0.25
234678-HxCDF	5.1	0.1	0.51
123789-HxCDF	0.81	0.1	0.081
1234678-HpCDF	45.1	0.01	0.451
1234789-HpCDF	3.4	0.01	0.034
OCDF	79.4	0.001	0.0794
TOTAL 2378-TCDD			23.8004

* Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016, U.S. Environmental Protection Agency.
Calculations for sediments, use dry weights.
Calculations for biotic tissue, use wet weights.

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	95SRS01DL		
Waterbody:	SANTA ROSA SOUND		
Sample Type:	SEDIMENT		
Sample Moisture:	73.9		
Sediment grain %:	8.7	45.1	46.2
Total Org Carbon %:	1.21		
Collection date:	Jul-95		
***Latitude:	30.21.08		
***Longitude:	87.06.66		
Loran Reading:			
Loran Reading:			
Depth:	21'		
Chem Lab:	TRIANGLE		

Analyte	PPT	TEF	TE
2378-TCDD		1	0
12378-PeCDD		0.5	0
123478-HxCDD	6.3	0.1	0.63
123678-HxCDD	11.6	0.1	1.16
123789-HxCDD	22.2	0.1	2.22
1234678-HpCDD	441	0.01	4.41
OCDD	4360	0.001	4.36
@2378-TCDF	1.8	0.1	0.18
12378-PeCDF		0.05	0
23478-PeCDF		0.5	0
123478-HxCDF		0.1	0
123678-HxCDF	1.2	0.1	0.12
234678-HxCDF	2.6	0.1	0.26
123789-HxCDF		0.1	0
1234678-HpCDF	20.7	0.01	0.207
1234789-HpCDF		0.01	0
OCDF	27.7	0.001	0.0277
TOTAL 2378-TCDD			13.5747

* Interim Procedures for Estimating Risks Associated
Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins
and Dibenzofurans (CDDs and CDFs) and 1989 Update.
EPA/625/3-89/016, U.S. Environmental Protection
Calculations for sediments, use dry
Calculations for biotic tissue, use wet

*CALCULATION OF TOXICITY EQUIVALENTS

Sample ID Number: CB01DL

Waterbody:	Choctawhatchee Bay
Sample Type:	Sediment
Sample Moisture:	72.1
Sediment grain %:	sand 0.8, silt 53.0, clay 46.2
Total Org Carbon %:	3.24
Collection date:	August 5, 1997
***Latitude:	30-26-00
***Longitude:	86-20-00
Loran Reading:	13007.0
Loran Reading:	47161.8
Depth:	24 feet (7.3 meters)
Chem Lab:	Triangle Laboratories

Analyte	PPT	TEF	TE
2378-TCDD	0	1	0
12378-PeCDD	0	0.5	0
123478-HxCDD	0	0.1	0
123678-HxCDD	6.2	0.1	0.62
123789-HxCDD	18.4	0.1	1.84
1234678-HpCDD	268	0.01	2.68
OCDD	6160	0.001	6.16
@2378-TCDF	0	0.1	0
12378-PeCDF	0	0.05	0
23478-PeCDF	0	0.5	0
123478-HxCDF	1.4	0.1	0.14
123678-HxCDF	0.78	0.1	0.078
234678-HxCDF	0	0.1	0
123789-HxCDF	0	0.1	0
1234678-HpCDF	7.2	0.01	0.072
1234789-HpCDF	0	0.01	0
OCDF	9.2	0.001	0.0092
TOTAL 2378-TCDD			11.5992

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* Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016, U.S. Environmental Protection Agency.
Calculations for sediments, use dry weights.
Calculations for biotic tissue, use wet weights.

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	LP01DL
Waterbody:	Lake Powell, Bay County, FL
Sample Type:	Sediment
Sample Moisture:	79.4 %
Sediment grain %:	sand 13.5, silt 31.5, clay 55.0
Total Org Carbon %:	4.84
Collection date:	August 4, 1997
***Latitude:	30-16-34
***Longitude:	85-58-39
Loran Reading:	14003.8
Loran Reading:	47087.1
Depth:	12 feet (3.6 meters)
Chem Lab:	Triangle Laboratories

Analyte	PPT	TEF	TE
2378-TCDD	0.5	1	0.5
12378-PeCDD	0	0.5	0
123478-HxCDD	3.9	0.1	0.39
123678-HxCDD	5.8	0.1	0.58
123789-HxCDD	16	0.1	1.6
1234678-HpCDD	188	0.01	1.88
OCDD	2490	0.001	2.49
@2378-TCDF	3.7	0.1	0.37
12378-PeCDF	0	0.05	0
23478-PeCDF	0.66	0.5	0.33
123478-HxCDF	1.3	0.1	0.13
123678-HxCDF	0.65	0.1	0.065
234678-HxCDF	1.3	0.1	0.13
123789-HxCDF	0	0.1	0
1234678-HpCDF	8.7	0.01	0.087
1234789-HpCDF	0	0.01	0
OCDF	10.9	0.001	0.0109
TOTAL 2378-TCDD			8.5629

* Interim Procedures for Estimating Risks Associated Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016, U.S. Environmental Protection
Calculations for sediments, use dry
Calculations for biotic tissue, use wet

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number: SAB-01-DL

Waterbody:	Lower St. Andrew Bay
Sample Type:	Sediment
Sample Moisture:	77.8
Sediment grain %:	
Total Org Carbon %:	
Collection date:	July 27,
***Latitude:	
***Longitude:	
Loran Reading:	
Loran Reading:	
Depth:	43 feet
Chem Lab:	

Analyte	PPT	TEF	TE
2378-TCDD	0.55	1	0.55
12378-PeCDD	0.91	0.5	0.455
123478-HxCDD	2.2	0.1	0.22
123678-HxCDD	4.8	0.1	0.48
123789-HxCDD	7.8	0.1	0.78
1234678-HpCDD	123	0.01	1.23
OCDD	1160	0.001	1.16
@2378-TCDF	3	0.1	0.3
12378-PeCDF	0.58	0.05	0.029
23478-PeCDF	0.48	0.5	0.24
123478-HxCDF	0.93	0.1	0.093
123678-HxCDF	0.68	0.1	0.068
234678-HxCDF	0.96	0.1	0.096
123789-HxCDF		0.1	0
1234678-HpCDF	7.7	0.01	0.077
1234789-HpCDF	0.42	0.01	0.0042
OCDF	14.4	0.001	0.0144
TOTAL 2378-TCDD			5.7966

* Interim Procedures for Estimating Risks Associated Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016, U.S. Environmental Protection
Calculations for sediments, use dry
Calculations for biotic tissue, use wet

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	95SAB1DL		
Waterbody:	LOWER ST ANDREW		
Sample Type:	SEDIMENT		
Sample Moisture:	79.7		
Sediment grain %:	6.1	38.7	55.2
Total Org Carbon %:	1.04		
Collection date:	Jul-95		
***Latitude:	30.05.94		
***Longitude:	85.39.78		
Loran Reading:			
Loran Reading:			
Depth:	28		
Chem Lab:	TRIANGLE		

Analyte	PPT	TEF	TE
2378-TCDD		1	0
12378-PeCDD	0.54	0.5	0.27
123478-HxCDD	1	0.1	0.1
123678-HxCDD		0.1	0
123789-HxCDD	3.6	0.1	0.36
1234678-HpCDD	56.2	0.01	0.562
OCDD	513	0.001	0.513
@2378-TCDF	1.5	0.1	0.15
12378-PeCDF		0.05	0
23478-PeCDF		0.5	0
123478-HxCDF		0.1	0
123678-HxCDF		0.1	0
234678-HxCDF		0.1	0
123789-HxCDF		0.1	0
1234678-HpCDF	2.7	0.01	0.027
1234789-HpCDF		0.01	0
OCDF	4.8	0.001	0.0048
TOTAL 2378-TCDD			1.9868

* Interim Procedures for Estimating Risks Associated
Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins
and Dibenzofurans (CDDs and CDFs) and 1989 Update.
EPA/625/3-89/016, U.S. Environmental Protection
Calculations for sediments, use dry
Calculations for biotic tissue, use wet

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	95SAB1DL DUPLICATE		
Waterbody:	LOWER ST ANDREW		
Sample Type:	SEDIMENT		
Sample Moisture:	79.7		
Sediment grain %:	6.1	38.7	55.2
Total Org Carbon %:	1.04		
Collection date:	Jul-95		
***Latitude:	30.05.94		
***Longitude:	85.39.78		
Loran Reading:			
Loran Reading:			
Depth:	28		
Chem Lab:	TRIANGLE		

Analyte	PPT	TEF	TE
2378-TCDD		1	0
12378-PeCDD		0.5	0
123478-HxCDD	4.2	0.1	0.42
123678-HxCDD	7	0.1	0.7
123789-HxCDD	12	0.1	1.2
1234678-HpCDD	192	0.01	1.92
OCDD	1730	0.001	1.73
@2378-TCDF	3.7	0.1	0.37
12378-PeCDF	0.9	0.05	0.045
23478-PeCDF		0.5	0
123478-HxCDF	3.1	0.1	0.31
123678-HxCDF	1.2	0.1	0.12
234678-HxCDF	2.4	0.1	0.24
123789-HxCDF		0.1	0
1234678-HpCDF	12.6	0.01	0.126
1234789-HpCDF		0.01	0
OCDF	21.6	0.001	0.0216
TOTAL 2378-TCDD			7.2026

* Interim Procedures for Estimating Risks Associated
Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins
and Dibenzofurans (CDDs and CDFs) and 1989 Update.
EPA/625/3-89/016, U.S. Environmental Protection
Calculations for sediments, use dry
Calculations for biotic tissue, use wet

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	SABW01DL
Station Number	105
Waterbody:	St. Andrew Bay, West Bay
Sample Type:	Sediment
Sample Moisture:	76.2
Sediment grain %:	sand 1.0, silt 24.2, clay 74.8
Total Org Carbon %:	4.83
Collection date:	August 4, 1997
***Latitude:	30-13-78
***Longitude:	85-44-13
Loran Reading:	14116.4
Loran Reading:	47048.4
Depth:	24 feet (7.3 meters)
Chem Lab:	Triangle Laboratories

Analyte	PPT	TEF	TE
2378-TCDD	1.4	1	1.4
12378-PeCDD	2.8	0.5	1.4
123478-HxCDD	5.2	0.1	0.52
123678-HxCDD	11.2	0.1	1.12
123789-HxCDD	19.4	0.1	1.94
1234678-HpCDD	233	0.01	2.33
OCDD	2500	0.001	2.5
@2378-TCDF	10	0.1	1
12378-PeCDF	0	0.05	0
23478-PeCDF	2.2	0.5	1.1
123478-HxCDF	3	0.1	0.3
123678-HxCDF	1.4	0.1	0.14
234678-HxCDF	3.1	0.1	0.31
123789-HxCDF	0	0.1	0
1234678-HpCDF	23	0.01	0.23
1234789-HpCDF	1.5	0.01	0.015
OCDF	48.1	0.001	0.0481
TOTAL 2378-TCDD			14.3531

* Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016, U.S. Environmental Protection Agency.
Calculations for sediments, use dry weights.
Calculations for biotic tissue, use wet weights.

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	WB01DL		
Waterbody:	West Bay		
Sample Type:	Sediment		
Sample Moisture:			
Sediment grain %:	33.7	7.07	59.23
Total Org Carbon %:	5.15		
Collection date:	Jul-01		
***Latitude:	30.15.40		
***Longitude:	85.49.80		
Loran Reading:			
Loran Reading:			
Depth:	10 ft		
Chem Lab:	Triangle		

Analyte	PPT	TEF	TE
2378-TCDD		1	0
12378-PeCDD	0.18	0.5	0.09
123478-HxCDD		0.1	0
123678-HxCDD	0.6	0.1	0.06
123789-HxCDD	1.6	0.1	0.16
1234678-HpCDD	17.6	0.01	0.176
OCDD	217	0.001	0.217
@2378-TCDF	0.4	0.1	0.04
12378-PeCDF		0.05	0
23478-PeCDF		0.5	0
123478-HxCDF	0.17	0.1	0.017
123678-HxCDF	0.1	0.1	0.01
234678-HxCDF	0.1	0.1	0.01
123789-HxCDF		0.1	0
1234678-HpCDF	0.86	0.01	0.0086
1234789-HpCDF		0.01	0
OCDF	2.1	0.001	0.0021
TOTAL 2378-TCDD			0.7907

* Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016, U.S. Environmental Protection Agency. Calculations for sediments, use dry weights.

*CALCULATION OF TOXICITY EQUIVALENTS

'**Sample ID Number:	107DL
'Waterbody:	East Bay
'Sample Type:	Sediment
'Sample Moisture:	74.8
'Sediment grain %:	sand 4.33% silt 32.63% clay 63.04%
Total Org Carbon %:	2.17%
Collection date:	9/16/98
' ***Latitude:	30-06-36
***Longitude:	85-33-49
Loran Reading:	14163.9
Loran Reading:	46960.3
Depth:	23'
Chem Lab:	Triangle Lab

Analyte	PPT	TEF	TE
2378-TCDD	4.3	1	4.3
12378-PeCDD	5	0.5	2.5
123478-HxCDD	6.3	0.1	0.63
123678-HxCDD	21.2	0.1	2.12
123789-HxCDD	24.9	0.1	2.49
1234678-HpCDD	369	0.01	3.69
OCDD	3480	0.001	3.48
@2378-TCDF	32.6	0.1	3.26
12378-PeCDF	3	0.05	0.15
23478-PeCDF	4.1	0.5	2.05
123478-HxCDF	6.2	0.1	0.62
123678-HxCDF	3.3	0.1	0.33
234678-HxCDF	5.7	0.1	0.57
123789-HxCDF	0	0.1	0
1234678-HpCDF	41.2	0.01	0.412
1234789-HpCDF	3.6	0.01	0.036
OCDF	122	0.001	0.122
TOTAL 2378-TCDD			26.76

* Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016, U.S. Environmental Protection Agency.
Calculations for sediments, use dry weights.
Calculations for biotic tissue, use wet weights.

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	SABE01DL
Station Number	97
Waterbody:	St. Andrew Bay, East Bay
Sample Type:	Sediment
Sample Moisture:	75.3
Sediment grain %:	sand 2.0, silt 39.5, clay 58.5
Total Org Carbon %:	5.95
Collection date:	August 4, 1997
***Latitude:	30-06-49
***Longitude:	85-35-23
Loran Reading:	14151.9
Loran Reading:	46966.1
Depth:	29 feet (8.8 meters)
Chem Lab:	Triangle Laboratories

Analyte	PPT	TEF	TE
2378-TCDD	6.5	1	6.5
12378-PeCDD	4.1	0.5	2.05
123478-HxCDD	7.4	0.1	0.74
123678-HxCDD	23	0.1	2.3
123789-HxCDD	26.6	0.1	2.66
1234678-HpCDD	432	0.01	4.32
OCDD	4550	0.001	4.55
@2378-TCDF	56.3	0.1	5.63
12378-PeCDF	0	0.05	0
23478-PeCDF	3.6	0.5	1.8
123478-HxCDF	5.2	0.1	0.52
123678-HxCDF	2.2	0.1	0.22
234678-HxCDF	5.9	0.1	0.59
123789-HxCDF	0	0.1	0
1234678-HpCDF	59.2	0.01	0.592
1234789-HpCDF	4	0.01	0.04
OCDF	219	0.001	0.219
TOTAL 2378-TCDD			32.731

* Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016, U.S. Environmental Protection Agency.
Calculations for sediments, use dry weights.
Calculations for biotic tissue, use wet weights.

*CALCULATION OF TOXICITY

**Sample ID	COE-PC1		
Waterbody:	East Bay		
Sample Type:	Sediment		
Sample Moisture:			
Sediment grain %:	78	5	13
Total Org Carbon	1.06		
Collection date:	Sep-92		
***Latitude:	30.08.03		
***Longitude:	85.37.37		
Loran Reading:			
Loran Reading:			
Depth:			
Chem Lab:			

Analyte	PPT	TEF	TE
2378-TCDD	0.86	1	0.86
12378-PeCDD	0.72	0.5	0.36
123478-	0.74	0.1	0.074
123678-	4.97	0.1	0.497
123789-	3.05	0.1	0.305
1234678-	123.52	0.01	1.2352
OCDD	1717.2	0.001	1.7172
@2378-TCDF	5.88	0.1	0.588
12378-PeCDF		0.05	0
23478-PeCDF		0.5	0
123478-	0.81	0.1	0.081
123678-	0.78	0.1	0.078
234678-	0.76	0.1	0.076
123789-		0.1	0
1234678-	18.33	0.01	0.1833
1234789-	1.05	0.01	0.0105
OCDF	88.83	0.001	0.08883
TOTAL 2378-TCDD			6.15403

* Interim Procedures for Estimating Risks Associated
Exposures to Mixtures of Chlorinated Dibenzo-p-
and Dibenzofurans (CDDs and CDFs) and 1989
EPA/625/3-89/016, U.S. Environmental Protection
Calculations for sediments, use dry

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	COE-PC2		
Waterbody:	East Bay		
Sample Type:	Sediment		
Sample Moisture:			
Sediment grain %:	63	14	22
Total Org Carbon %:	2.14		
Collection date:	Sep-92		
***Latitude:	30.07.46		
***Longitude:	85.38.02		
Loran Reading:			
Loran Reading:			
Depth:			
Chem Lab:			

Analyte	PPT	TEF	TE
2378-TCDD	1.45	1	1.45
12378-PeCDD	0.74	0.5	0.37
123478-HxCDD	0.87	0.1	0.087
123678-HxCDD	3.74	0.1	0.374
123789-HxCDD	3.21	0.1	0.321
1234678-HpCDD	94.74	0.01	0.9474
OCDD	1026.32	0.001	1.02632
@2378-TCDF	9.21	0.1	0.921
12378-PeCDF	0.45	0.05	0.0225
23478-PeCDF		0.5	0
123478-HxCDF	0.71	0.1	0.071
123678-HxCDF		0.1	0
234678-HxCDF		0.1	0
123789-HxCDF		0.1	0
1234678-HpCDF	11.63	0.01	0.1163
1234789-HpCDF	0.92	0.01	0.0092
OCDF	57.89	0.001	0.05789
TOTAL 2378-TCDD			5.77361

* Interim Procedures for Estimating Risks Associated
Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins
and Dibenzofurans (CDDs and CDFs) and 1989 Update.
EPA/625/3-89/016, U.S. Environmental Protection
Calculations for sediments, use dry

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	94WB48D
Waterbody:	WATSON BAYOU
Sample Type:	SEDIMENT
Sample Moisture:	
Sediment grain %:	
Total Org Carbon %:	
Collection date:	1994
***Latitude:	30.08.25
***Longitude:	85.38.05
Loran Reading:	
Loran Reading:	
Depth:	22 FT
Chem Lab:	GERG

Analyte	PPT	TEF	TE
2378-TCDD	2.39	1	2.39
12378-PeCDD	2.57	0.5	1.285
123478-HxCDD	2.86	0.1	0.286
123678-HxCDD	12.9	0.1	1.29
123789-HxCDD	9.48	0.1	0.948
1234678-HpCDD	210	0.01	2.1
OCDD	2136	0.001	2.136
@2378-TCDF	18.3	0.1	1.83
12378-PeCDF	1.21	0.05	0.0605
23478-PeCDF	2.45	0.5	1.225
123478-HxCDF	2.86	0.1	0.286
123678-HxCDF	1.72	0.1	0.172
234678-HxCDF	3.47	0.1	0.347
123789-HxCDF		0.1	0
1234678-HpCDF	34.8	0.01	0.348
1234789-HpCDF	1.79	0.01	0.0179
OCDF	74.6	0.001	0.0746
TOTAL 2378-TCDD			14.796

* Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016, U.S. Environmental Protection Agency. Calculations for sediments, use dry weights.

*CALCULATION OF TOXICITY EQUIVALENTS

'**Sample ID Number: 106DL

'Waterbody: Martin Lake
'Sample Type: Sediment
'Sample Moisture: 80.1%
'Sediment grain %: gravel, 0% sand, 2.31% silt, 41.81% clay, 55.88%
Total Org Carbon %: 3.56%
Collection date: 09/25/98
' ***Latitude: 30-08-84
***Longitude: 85-36-37
Loran Reading: 14154.6
Loran Reading: 46989.9
Depth: 9'
Chem Lab: Triangle Lab

Analyte	PPT	TEF	TE	
2378-TCDD	0	1	0	EMPC 0.56
12378-PeCDD	3	0.5	1.5	
123478-HxCDD	5.9	0.1	0.59	
123678-HxCDD	16	0.1	1.6	
123789-HxCDD	20.6	0.1	2.06	
1234678-HpCDD	375	0.01	3.75	
OCDD	5580	0.001	5.58	
@2378-TCDF	3.3	0.1	0.33	
12378-PeCDF	2.6	0.05	0.13	
23478-PeCDF	5.3	0.5	2.65	
123478-HxCDF	11.6	0.1	1.16	
123678-HxCDF	0	0.1	0	EMPC 8.4
234678-HxCDF	10.6	0.1	1.06	
123789-HxCDF	0	0.1	0	EMPC 0.47
1234678-HpCDF	108	0.01	1.08	
1234789-HpCDF	6.2	0.01	0.062	
OCDF	122	0.001	0.122	
TOTAL 2378-TCDD			21.674	

* Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016, U.S. Environmental Protection Agency.
Calculations for sediments, use dry weights.
Calculations for biotic tissue, use wet weights.

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	94LM49D
Waterbody:	Martin Lake
Sample Type:	Sediment
Sample Moisture:	85.2%
Sediment grain %:	NA
Total Org Carbon %:	NA
Collection date:	09/01/94
***Latitude:	30-08-64
***Longitude:	85-36-46
Loran Reading:	14152.9
Loran Reading:	49988.2
Depth:	2.4 meters
Chem Lab:	GERG TexAM

Analyte	PPT	TEF	TE
2378-TCDD	1.21	1	1.21
12378-PeCDD	5.68	0.5	2.84
123478-HxCDD	5.29	0.1	0.529
123678-HxCDD	18.1	0.1	1.81
123789-HxCDD	17	0.1	1.7
1234678-HpCDD	311	0.01	3.11
OCDD	3873	0.001	3.873
@2378-TCDF	6.13	0.1	0.613
12378-PeCDF	2.87	0.05	0.1435
23478-PeCDF	5.16	0.5	2.58
123478-HxCDF	6.68	0.1	0.668
123678-HxCDF	7.6	0.1	0.76
234678-HxCDF	7.78	0.1	0.778
123789-HxCDF	0	0.1	0
1234678-HpCDF	69.9	0.01	0.699
1234789-HpCDF	4.67	0.01	0.0467
OCDF	83.9	0.001	0.0839
TOTAL 2378-TCDD			21.4441

* Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016, U.S. Environmental Protection Agency.
Calculations for sediments, use dry weights.
Calculations for biotic tissue, use wet weights.

*CALCULATION OF TOXICITY EQUIVALENTS

'**Sample ID Number:	95DB
'Waterbody:	Martin Lake
'Sample Type:	Sediment
'Sample Moisture:	76.7
'Sediment grain %:	gravel, 0.0% sand, 2.86% silt, 59.36% clay, 37.78%
Total Org Carbon %:	15.49%
Collection date:	09/15/98
' ***Latitude:	30-07-90
***Longitude:	85-36-37
Loran Reading:	14146.3
Loran Reading:	46980.9
Depth:	8'
Chem Lab:	Triangle Lab

Analyte	PPT	TEF	TE	
2378-TCDD	0.8	1	0.8	
12378-PeCDD	5	0.5	2.5	
123478-HxCDD	0	0.1	0	EMPC 5.1
123678-HxCDD	26	0.1	2.6	
123789-HxCDD	14.9	0.1	1.49	
1234678-HpCDD	295	0.01	2.95	
OCDD	3410	0.001	3.41	
@2378-TCDF	6.8	0.1	0.68	
12378-PeCDF	4.4	0.05	0.22	
23478-PeCDF	5.4	0.5	2.7	
123478-HxCDF	11.7	0.1	1.17	
123678-HxCDF	6.2	0.1	0.62	
234678-HxCDF	9.3	0.1	0.93	
123789-HxCDF	0	0.1	0	EMPC 4.6
1234678-HpCDF	105	0.01	1.05	
1234789-HpCDF	0	0.01	0	
OCDF	141	0.001	0.141	
TOTAL 2378-TCDD			21.261	

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Calculations for sediments, use dry weights.
Calculations for biotic tissue, use wet weights.

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID	MrtLkUp	6725	USEPA Tillman	McAdams
Waterbody:	Lake Charles		Martin Springfield,	Florida
Sample Type:	sediment			
Sample Moisture:	80			
Sediment grain %:	NA		**Contractor:**	
Total Org Carbon %:	NA		**Zenon**	
Collection date:	March, '97			
***Latitude:	30-09-18			
***Longitude:	85-36-06			
Loran Reading:	NA			
Loran Reading:	NA			
Depth:	4-6'			
Chem Lab:	EPA/Zenon			

Analyte	PPT	TEF	TE
2378-TCDD	1.9	1	1.9
12378-PeCDD	3.1	0.5	1.55
123478-HxCDD	6.4	0.1	0.64
123678-HxCDD	18	0.1	1.8
123789-HxCDD	33	0.1	3.3
1234678-HpCDD	620	0.01	6.2
OCDD	8400	0.001	8.4
@2378-TCDF	0	0.1	0
12378-PeCDF	0	0.05	0
23478-PeCDF	0	0.5	0
123478-HxCDF	0	0.1	0
123678-HxCDF	6.1	0.1	0.61
234678-HxCDF	4.3	0.1	0.43
123789-HxCDF	0	0.1	0
1234678-HpCDF	99	0.01	0.99
1234789-HpCDF	6.2	0.01	0.062
OCDF	150	0.001	0.15
TOTAL 2378-TCDD			26.032

* Interim Procedures for Estimating Risks Associated
Exposures to Mixtures of Chlorinated Dibenzo-p-
and Dibenzofurans (CDDs and CDFs) and 1989 Update.
EPA/625/3-89/016, U.S. Environmental Protection
Calculations for sediments, use dry weights.
Calculations for biotic tissue, use wet weights.

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	DPR-01-DL
Waterbody:	Deer Point Reservoir
Sample Type:	Sediment
Sample Moisture:	80.4
Sediment grain %:	
Total Org Carbon %:	
Collection date:	July 27, 2001
***Latitude:	
***Longitude:	
Loran Reading:	
Loran Reading:	
Depth:	10 feet
Chem Lab:	Triangle Lab

Analyte	PPT	TEF	TE
2378-TCDD	3.2	1	3.2
12378-PeCDD	5.9	0.5	2.95
123478-HxCDD	4.8	0.1	0.48
123678-HxCDD	6.5	0.1	0.65
123789-HxCDD	16.3	0.1	1.63
1234678-HpCDD	84.7	0.01	0.847
OCDD	1810	0.001	1.81
@2378-TCDF	2.3	0.1	0.23
12378-PeCDF	7.6	0.05	0.38
23478-PeCDF	3.9	0.5	1.95
123478-HxCDF	4.7	0.1	0.47
123678-HxCDF	5.2	0.1	0.52
234678-HxCDF	5	0.1	0.5
123789-HxCDF	16.7	0.1	1.67
1234678-HpCDF	7.1	0.01	0.071
1234789-HpCDF	8	0.01	0.08
OCDF	14.9	0.001	0.0149
TOTAL 2378-TCDD			17.4529

* Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016, U.S. Environmental Protection Agency.
Calculations for sediments, use dry weights.
Calculations for biotic tissue, use wet weights.

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	B3
Waterbody:	ST JOE
Sample Type:	SEDIMENT
Sample Moisture:	
Sediment grain %:	
Total Org Carbon %:	4.38
Collection date:	1993
***Latitude:	29.51.00
***Longitude:	85.23.00
Loran Reading:	
Loran Reading:	
Depth:	
Chem Lab:	

Analyte	PPT	TEF	TE
2378-TCDD		1	0
12378-PeCDD	1.4	0.5	0.7
123478-HxCDD	3	0.1	0.3
123678-HxCDD	5	0.1	0.5
123789-HxCDD	11.5	0.1	1.15
1234678-HpCDD	120	0.01	1.2
OCDD	1490	0.001	1.49
@2378-TCDF	0.97	0.1	0.097
12378-PeCDF		0.05	0
23478-PeCDF	0.4	0.5	0.2
123478-HxCDF		0.1	0
123678-HxCDF		0.1	0
234678-HxCDF		0.1	0
123789-HxCDF		0.1	0
1234678-HpCDF		0.01	0
1234789-HpCDF		0.01	0
OCDF	6.8	0.001	0.0068
TOTAL 2378-TCDD			5.6438

* Interim Procedures for Estimating Risks Associated Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016, U.S. Environmental Protection
Calculations for sediments, use dry
Calculations for biotic tissue, use wet

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number: B6

Waterbody: ST JOE
Sample Type: SEDIMENT
Sample Moisture:
Sediment grain %:
Total Org Carbon %: 0.01
Collection date: 1993
***Latitude: 29.48.00
***Longitude: 85.23.00
Loran Reading:
Loran Reading:
Depth:
Chem Lab:

Analyte	PPT	TEF	TE
2378-TCDD	0.55	1	0.55
12378-PeCDD	3.3	0.5	1.65
123478-HxCDD	4.9	0.1	0.49
123678-HxCDD	8.1	0.1	0.81
123789-HxCDD	18.1	0.1	1.81
1234678-HpCDD	161	0.01	1.61
OCDD	1670	0.001	1.67
@2378-TCDF	2	0.1	0.2
12378-PeCDF		0.05	0
23478-PeCDF	0.87	0.5	0.435
123478-HxCDF	1.4	0.1	0.14
123678-HxCDF		0.1	0
234678-HxCDF	2.1	0.1	0.21
123789-HxCDF		0.1	0
1234678-HpCDF	16.9	0.01	0.169
1234789-HpCDF		0.01	0
OCDF	7.3	0.001	0.0073
TOTAL 2378-TCDD			9.7513

* Interim Procedures for Estimating Risks Associated
Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins
and Dibenzofurans (CDDs and CDFs) and 1989 Update.
EPA/625/3-89/016, U.S. Environmental Protection
Calculations for sediments, use dry
Calculations for biotic tissue, use wet

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	D3
Waterbody:	ST JOE
Sample Type:	SEDIMENT
Sample Moisture:	
Sediment grain %:	
Total Org Carbon %:	1.1
Collection date:	1992
***Latitude:	29.51.00
***Longitude:	85.221.00
Loran Reading:	
Loran Reading:	
Depth:	
Chem Lab:	

Analyte	PPT	TEF	TE
2378-TCDD		1	0
12378-PeCDD		0.5	0
123478-HxCDD	2	0.1	0.2
123678-HxCDD	2.8	0.1	0.28
123789-HxCDD	6.8	0.1	0.68
1234678-HpCDD	75.1	0.01	0.751
OCDD	798	0.001	0.798
@2378-TCDF		0.1	0
12378-PeCDF		0.05	0
23478-PeCDF		0.5	0
123478-HxCDF	0.52	0.1	0.052
123678-HxCDF		0.1	0
234678-HxCDF	0.9	0.1	0.09
123789-HxCDF		0.1	0
1234678-HpCDF	5.1	0.01	0.051
1234789-HpCDF		0.01	0
OCDF	4.4	0.001	0.0044
TOTAL 2378-TCDD			2.9064

* Interim Procedures for Estimating Risks Associated
Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins
and Dibenzofurans (CDDs and CDFs) and 1989 Update.
EPA/625/3-89/016, U.S. Environmental Protection
Calculations for sediments, use dry
Calculations for biotic tissue, use wet

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	D6
Waterbody:	ST JOE
Sample Type:	SEDIMENT
Sample Moisture:	
Sediment grain %:	
Total Org Carbon %:	0.07
Collection date:	1992
***Latitude:	29.48.00
***Longitude:	85.21.00
Loran Reading:	
Loran Reading:	
Depth:	
Chem Lab:	

Analyte	PPT	TEF	TE
2378-TCDD		1	0
12378-PeCDD	4	0.5	2
123478-HxCDD	7.3	0.1	0.73
123678-HxCDD	9.9	0.1	0.99
123789-HxCDD	21.6	0.1	2.16
1234678-HpCDD	223	0.01	2.23
OCDD	2150	0.001	2.15
@2378-TCDF	2.1	0.1	0.21
12378-PeCDF	0.6	0.05	0.03
23478-PeCDF		0.5	0
123478-HxCDF	1.6	0.1	0.16
123678-HxCDF		0.1	0
234678-HxCDF		0.1	0
123789-HxCDF		0.1	0
1234678-HpCDF	23	0.01	0.23
1234789-HpCDF		0.01	0
OCDF	12.1	0.001	0.0121
TOTAL 2378-TCDD			10.9021

* Interim Procedures for Estimating Risks Associated
Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins
and Dibenzofurans (CDDs and CDFs) and 1989 Update.
EPA/625/3-89/016, U.S. Environmental Protection
Calculations for sediments, use dry
Calculations for biotic tissue, use wet

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number: F5

Waterbody:	ST JOE
Sample Type:	SEDIMENT
Sample Moisture:	
Sediment grain %:	
Total Org Carbon %:	0.6
Collection date:	1992
***Latitude:	29.49.00
***Longitude:	85.19.00
Loran Reading:	
Loran Reading:	
Depth:	
Chem Lab:	

Analyte	PPT	TEF	TE
2378-TCDD		1	0
12378-PeCDD		0.5	0
123478-HxCDD		0.1	0
123678-HxCDD	8.2	0.1	0.82
123789-HxCDD	17.4	0.1	1.74
1234678-HpCDD	238	0.01	2.38
OCDD	3060	0.001	3.06
@2378-TCDF	3.4	0.1	0.34
12378-PeCDF		0.05	0
23478-PeCDF		0.5	0
123478-HxCDF	3.3	0.1	0.33
123678-HxCDF		0.1	0
234678-HxCDF	4.1	0.1	0.41
123789-HxCDF		0.1	0
1234678-HpCDF	77.3	0.01	0.773
1234789-HpCDF		0.01	0
OCDF	41.9	0.001	0.0419
TOTAL 2378-TCDD			9.8949

* Interim Procedures for Estimating Risks Associated
Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins
and Dibenzofurans (CDDs and CDFs) and 1989 Update.
EPA/625/3-89/016, U.S. Environmental Protection
Calculations for sediments, use dry
Calculations for biotic tissue, use wet

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	93R01D
Waterbody:	ST JOE
Sample Type:	SEDIMENT
Sample Moisture:	32
Sediment grain %:	
Total Org Carbon %:	0.4
Collection date:	1993
***Latitude:	29.45.79
***Longitude:	84.43.25
Loran Reading:	
Loran Reading:	
Depth:	
Chem Lab:	

Analyte	PPT	TEF	TE
2378-TCDD	0.51	1	0.51
12378-PeCDD	2.5	0.5	1.25
123478-HxCDD	3.3	0.1	0.33
123678-HxCDD	6.8	0.1	0.68
123789-HxCDD	13	0.1	1.3
1234678-HpCDD	126	0.01	1.26
OCDD	1030	0.001	1.03
@2378-TCDF	1.8	0.1	0.18
12378-PeCDF	0.53	0.05	0.0265
23478-PeCDF	1.1	0.5	0.55
123478-HxCDF	1.3	0.1	0.13
123678-HxCDF	1.1	0.1	0.11
234678-HxCDF	1.9	0.1	0.19
123789-HxCDF		0.1	0
1234678-HpCDF	14.6	0.01	0.146
1234789-HpCDF		0.01	0
OCDF	8	0.001	0.008
TOTAL 2378-TCDD			7.7005

* Interim Procedures for Estimating Risks Associated
Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins
and Dibenzofurans (CDDs and CDFs) and 1989 Update.
EPA/625/3-89/016, U.S. Environmental Protection
Calculations for sediments, use dry
Calculations for biotic tissue, use wet

*CALCULATION OF TOXICITY EQUIVALENTS

**Sample ID Number:	95SGS1DL		
Waterbody:	ST GEORGE SOUND		
Sample Type:	SEDIMENT		
Sample Moisture:	32		
Sediment grain %:	83.7	3.8	12.5
Total Org Carbon %:	0.4		
Collection date:	Jul-95		
***Latitude:	29.45.79		
***Longitude:	84.43.25		
Loran Reading:			
Loran Reading:			
Depth:	21		
Chem Lab:	TRIANGLE		

Analyte	PPT	TEF	TE
2378-TCDD		1	0
12378-PeCDD		0.5	0
123478-HxCDD		0.1	0
123678-HxCDD		0.1	0
123789-HxCDD		0.1	0
1234678-HpCDD		0.01	0
OCDD	506	0.001	0.506
@2378-TCDF		0.1	0
12378-PeCDF		0.05	0
23478-PeCDF		0.5	0
123478-HxCDF		0.1	0
123678-HxCDF		0.1	0
234678-HxCDF		0.1	0
123789-HxCDF		0.1	0
1234678-HpCDF		0.01	0
1234789-HpCDF		0.01	0
OCDF		0.001	0
TOTAL 2378-TCDD			0.506

* Interim Procedures for Estimating Risks Associated
Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins
and Dibenzofurans (CDDs and CDFs) and 1989 Update.
EPA/625/3-89/016, U.S. Environmental Protection
Calculations for sediments, use dry
Calculations for biotic tissue, use wet