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Fish, Benthic-Macroinvertebrate, and Stream-Habitat Data From Two Estuaries Near Galveston Bay, Texas, 2000–2001

Open-File Report 02–024

U.S. Department of the Interior
U.S. Geological Survey

Cover:

Sun setting on Armand Bayou at Bay Area Boulevard (photograph by John C. Rosendale, U.S. Geological Survey, August 2000).

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By Jennifer L. Hogan

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CONTENTS

FIGURES

TABLES

Fish, Benthic-Macroinvertebrate, and Stream-Habitat Data From Two Estuaries Near Galveston Bay, Texas, 2000–2001

By Jennifer L. Hogan

Abstract

This report presents data on the status of fish, macroinvertebrates, and stream habitat collected from 10 sites in the lower (estuarine) parts of Armand and Dickinson Bayous near Galveston Bay, Texas, during summer 2000 and winter 2001. The total number of individual fish caught at the five Armand Bayou sites (2,091) was greater than at the five Dickinson Bayou sites (1,055), but the total number of fish species caught at Dickinson Bayou sites (37) was greater than at Armand Bayou sites (30). The total number of invertebrates (26,641) and the total number of invertebrate taxa (141) were both greater at Armand Bayou sites than at Dickinson Bayou sites (10,467 and 131, respectively). Among habitat data, the average sinuosity of Armand Bayou sites (1.31) was greater than that of Dickinson Bayou sites (1.14). Mean left-bank and right-bank slopes were greater at Armand Bayou sites than at Dickinson Bayou sites, although the Armand Bayou banks were lower and narrower than the Dickinson Bayou banks. The Dickinson Bayou channel was deeper at the sampling sites than the Armand Bayou channel.

INTRODUCTION

Armand and Dickinson Bayous, two estuaries near Galveston Bay, drain urban watersheds near the Houston, Tex., metropolitan area (fig. 1). The natural parts of the bayous are composed of marshes surrounding large prairies and hardwood forests. The two watersheds provide riparian habitat for numerous coastal-influenced communities of wildlife that rely on unique ecosystems for survival, including scores of birds, fish, reptiles, amphibians, and macroinvertebrates. The Armand Bayou watershed contains the Armand Bayou Nature Center, the largest (11.4 square kilometers) urban wildlife and wilderness preserve in the Nation. Armand Bayou is characterized by meandering channels and naturally sloping banks. Horsepen Bayou is a major tributary to Armand Bayou, and its drainage is part of the Armand Bayou drainage. Dickinson Bayou has a fixed channel contained by dike banks that protect the land from bank outflows. Dickinson Bayou has been developed largely for residential use.

In addition to supporting numerous species of wildlife, Armand and Dickinson Bayous help to attenuate floods and control pollution in the Houston metropolitan area. Wetland habitat allows floodwaters to infiltrate and evaporate and can foster natural remediation of contaminants. Because encroaching development and land-surface subsidence in these watersheds might be affecting wildlife habitat, the U.S. Geological Survey, in cooperation with the Houston-Galveston Area Council, conducted a study to obtain baseline data on the status of fish, macroinvertebrates, and stream habitat at selected sites in Armand and Dickinson Bayous. The purpose of this study was to gather data to document current biological conditions and to compare biological conditions in the lower (estuarine) parts of Armand and Dickinson Bayous. This report presents data collected on fish, benthic macroinvertebrates, and stream habitat at five fixed sites in Armand Bayou and at five fixed sites in Dickinson Bayou (table 1).

SITE-SELECTION AND DATA-COLLECTION METHODS

Sampling sites were selected initially using geographic information system (GIS) coverages and maps and chosen specifically by on-site reconnaissance. A reach was selected if it had a full meander—that is, complete or nearly complete “sine wave” curvature.

Fish data were collected in each reach to determine the fish-community structure (tables 2–3, at end of

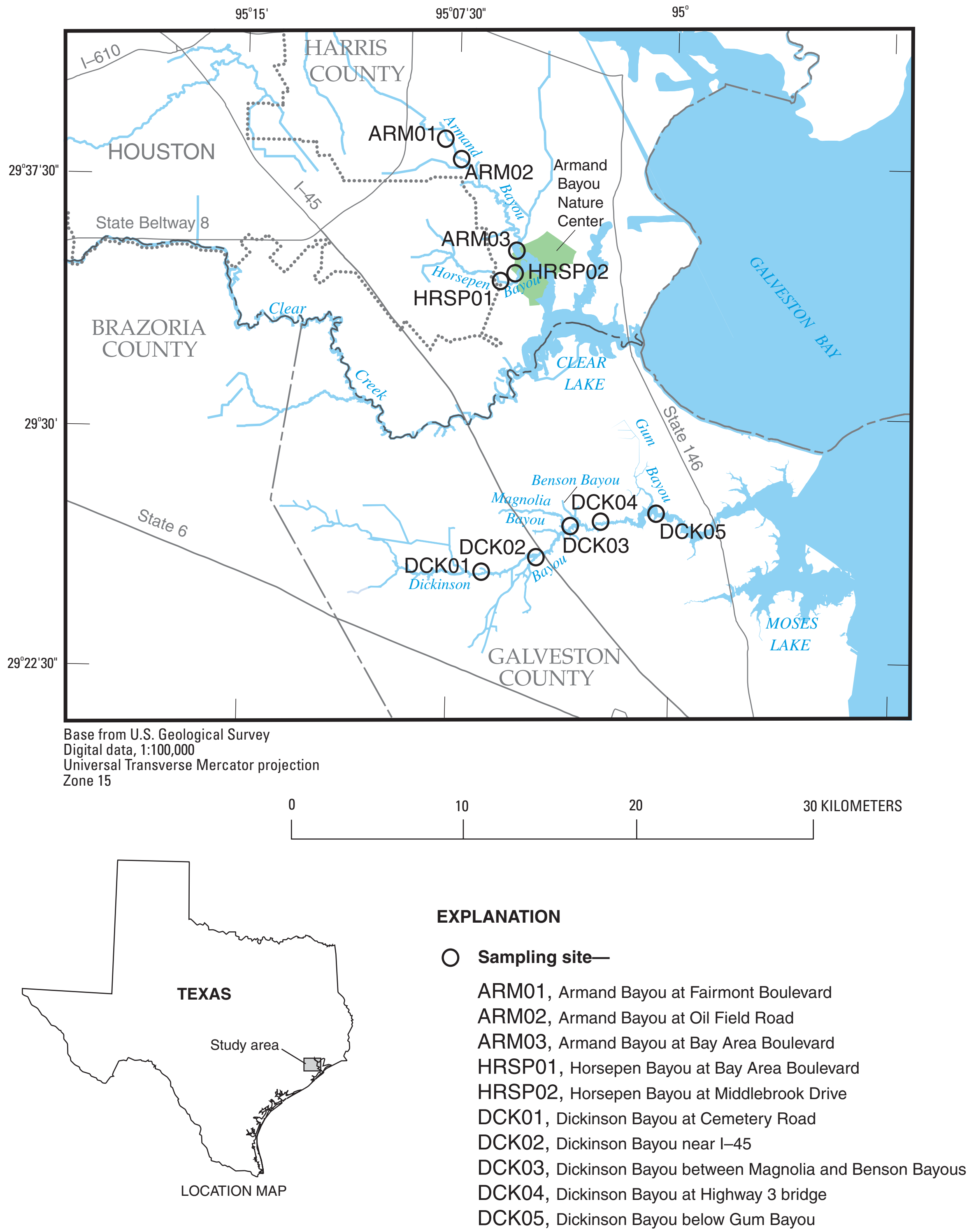

Figure 1. Location of sampling sites in Armand and Dickinson Bayous near Galveston Bay, Texas.

Table 1. Data-collection sites in Armand and Dickinson Bayous near Galveston Bay, Texas

Sampling site	Data collected: Fish	Data collected: Benthic macroin-vertebrates	Data collected: Habitat	Downstream reach boundary coordinates: Latitude	Downstream reach boundary coordinates: Longitude
Armand Bayou sites					
ARM01, Armand Bayou at Fairmont Boulevard	√	√	√	(1)	(1)
ARM02, Armand Bayou at Oil Field Road	√	√	√	29°36'38.21"	95°05'49.28"
ARM03, Armand Bayou at Bay Area Boulevard	√	√	√	29°35'18.52"	95°04'58.97"
HRSP01, Horsepen Bayou at Bay Area Boulevard	√	√	√	29°34'48.62"	95°06'04.85"
HRSP02, Horsepen Bayou at Middlebrook Drive	√	√	√	29°34'50.98"	95°05'27.56"
Dickinson Bayou sites					
DCK01, Dickinson Bayou at Cemetery Road	√	√	√	29°25'28.97"	95°07'37.06"
DCK02, Dickinson Bayou near I–45	√	√	√	29°26'25.87"	95°04'47.41"
DCK03, Dickinson Bayou between Magnolia and Benson Bayous	√	√	√	29°27'18.47"	95°03'43.64"
DCK04, Dickinson Bayou at Highway 3 bridge	√	√	√	29°27'22.55"	95°02'50.16"
DCK05, Dickinson Bayou below Gum Bayou	√	√	√	29°27'34.76"	95°00'13.46"

[1] Global positioning system coordinates could not be obtained to determine latitude and longitude because of dense ground cover.

report). Fish were collected using five methods: electrofishing, fyke nets (16 meters long with 1.3-centimeter bar mesh and a 0.9- by 1.8-meter door), gill nets, seining, and trawling. Backpack electrofishing or barge electrofishing was used in shallow areas without boat access, as described in Meador, Cuffney, and Gurtz (1993). Boat electrofishing was used primarily in deep reaches with boat access. Fyke nets typically were set overnight and run the following morning. Gill netting was used in areas of high salinity that yielded low fish catches with electrofishing. Gill nets were either 46 meters long with six 7.6-meter panels that had a 1.3- to 7.6-centimeter bar mesh or 91 meters long with a standard 10-centimeter bar mesh. Gill nets normally were set overnight for 8 hours and checked at about 3-hour intervals throughout the night or were set overnight and checked the following morning. Fish were sampled during summer 2000 and winter 2001 to track seasonal changes and to increase the number of species captured.

During processing, fish were contained in a large aerated holding tub to increase fish survivability. Each fish was measured, weighed, identified, and promptly released. Unidentifiable fish were preserved in 10-percent buffered formalin for later identification.

Benthic macroinvertebrates also were collected from each reach to determine community structure (tables 4–5, at end of report). Macroinvertebrates were collected from a depositional targeted habitat (DTH) in each reach by compositing five 6- by 6-inch box-core samples collected throughout the reach. Macroinvertebrates also were collected from a qualitative multi-habitat (QMH) by sweeping large rectangular-framed dip nets beneath overhanging vegetation or snags. Each 210-micrometer-mesh dip net was fitted with a 210-micrometer-mesh plankton bucket, and five samples were composited for the QMH benthic sample.

After benthic samples were collected, the composited sample was sieved through a 210-micrometer-mesh sieve. Woody debris was removed from the benthic sample with forceps and by rinsing to prevent discarding aquatic organisms. Benthic macroinvertebrates were transferred to a 1-liter polyethylene sample jar and preserved in a 70-percent ethanol solution. Samples were shipped to a laboratory for identification and enumeration. For each sample, a technician randomly selected 500 macroinvertebrates from randomly selected grids for enumeration and identification to the lowest taxon, as described in Cuffney and others (1993).

Stream-habitat data also were collected from each site to determine the physical condition of the area and factors that affect the physical condition of the reach (Meador, Hupp, Cuffney, and Gurtz, 1993) (table 6, at end of report). Each site was divided into four transects with two boundaries. At each transect, the following data were collected: global positioning system (GPS) location, mean right- and left-bank slope, mean bank slope, channel width, number of undercut banks, mean right- and left-bank height, mean-bank-height-to-width ratio, mean wetted channel width, mean depth, and mean velocity. For each reach, linear and curvilinear reach length, sinuosity[1], number of snags, structure index[2], and number of bars were recorded. A laser-operated total station was used to survey the entire reach, including all transects. Before surveying, the total station was referenced to a benchmark or to an installed marker. All survey data were stored in an attached datalogger that receives data directly from the total station. Data were transferred to an electronic spreadsheet to compute linear reach length, curvilinear reach length, bank height, bank width, bank slope, wetted channel width, mean depth, and frequency of in-channel structures.

[1] Sinuosity is the ratio of the curvilinear reach length to the linear reach length.

[2] Structure index (unitless) is the ratio of the frequency of in-channel structures for a reach to the curvilinear reach length.

FISH, BENTHIC-MACROINVERTEBRATE, AND STREAM-HABITAT DATA

The total number of individual fish caught at Armand Bayou sites (2,091) was greater than at Dickinson Bayou sites (1,055), but the total number of fish species caught at Dickinson Bayou sites (37) was greater than at Armand Bayou sites (30). The total number of invertebrates (26,641) and the total number of invertebrate taxa (141) were both greater at Armand Bayou sites than at Dickinson Bayou sites (10,467 and 131, respectively). Among habitat data, the average sinuosity of Armand Bayou sites (1.31) was greater than that of Dickinson Bayou sites (1.14). Mean left-bank and right-bank slopes were greater at Armand Bayou sites than at Dickinson Bayou sites, although the Armand Bayou banks were lower and narrower than the Dickinson Bayou banks. The Dickinson Bayou channel was deeper at the sampling sites than the Armand Bayou channel.

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Meador, M.R., Hupp, C.R., Cuffney, T.F., and Gurtz, M.E., 1993, Methods for characterizing stream habitat as part of the National Water-Quality Assessment Program: U.S. Geological Survey Open-File Report 93–408, 48 p.

Table 2. Fish taxa and individual counts of fish collected in Armand Bayou near Galveston Bay, Texas

Group	Common name	Family	Scientific name	Sampling site					Total
				ARM01	ARM02	ARM03	HRSP01	HRSP02	
Anchovies		Engraulidae							
	Bay anchovy		*Anchoa mitchilli*	0	0	2	0	0	2
Gars		Lepisosteidae							
	Spotted gar		*Lepisosteus oculatus*	0	19	70	28	28	145
	Longnose gar		*Lepisosteus osseus*	0	3	2	21	4	30
	Alligator gar		*Lepisosteus spatula*	0	0	3	10	0	13
Herrings		Clupeidae							
	Gulf menhaden		*Brevoortia patronus*	0	321	39	131	35	526
	Gizzard shad		*Dorosoma cepedianum*	0	115	645	100	10	870
Tarpons		Elopidae							
	Ladyfish		*Elops saurus*	0	0	41	0	0	41
Lefteye flounders		Bothidae							
	Southern flounder		*Paralichthys lethostigma*	0	0	8	0	0	8
Soles		Soleidae							
	Lined sole		*Achirus lineatus*	0	1	0	0	0	1
Suckers		Catostomidae							
	Smallmouth buffalo		*Ictiobus bubalus*	0	1	3	0	1	5
Bullhead catfish		Ictaluridae							
	Yellow bullhead		*Ameiurus natalis*	1	0	0	0	0	1
	Blue catfish		*Ictalurus furcatus*	0	5	35	7	5	52
	Channel catfish		*Ictalurus punctatus*	0	2	5	7	6	20
Sea catfish		Ariidae							
	Hardhead catfish		*Arius felis*	0	0	21	0	0	21
	Gafftopsail catfish		*Bagre marinus*	0	0	1	0	0	1
Sunfishes		Centrarchidae							
	Green sunfish		*Lepomis cyanellus*	4	0	0	0	0	4
	Bluegill		*Lepomis macrochirus*	1	2	0	1	0	4
	Longear sunfish		*Lepomis megalotis*	10	0	0	0	0	10
	Largemouth bass		*Micropterus salmoides*	0	1	0	1	3	5
	White crappie		*Poxomis annularis*	0	7	1	1	0	9
	Black crappie		*Poxomis nigromaculatus*	0	1	0	0	0	1
Porgies		Sparidae							
	Pinfish		*Lagodon rhomboides*	0	0	2	0	0	2
Mullets		Mugilidae							
	Striped mullet		*Mugil cephalus*	0	16	75	6	10	107
Drums		Sciaenidae							
	Sand seatrout		*Cynoscion arenarius*	0	0	2	0	0	2
	Spot		*Leiostomus xanthurus*	0	1	0	0	0	1
	Atlantic croaker		*Micropogonias undulatus*	0	0	5	0	0	5
	Black drum		*Pogonias cromis*	0	0	1	0	0	1
	Red drum		*Sciaenops ocellatus*	0	0	2	0	0	2
Livebearers		Peociliidae							
	Western mosquitofish		*Gambusia affinis*	151	0	0	0	0	151
	Sailfin molly		*Poecilia latipinna*	51	0	0	0	0	51
Number of fish				218	495	963	313	102	2,091
Number of fish species				6	14	20	11	9	30

Table 3. Fish taxa and individual counts of fish collected in Dickinson Bayou near Galveston Bay, Texas

Group	Common name	Family	Scientific name	Sampling site					Total
				DCK01	DCK02	DCK03	DCK04	DCK05	
Gars		Lepisosteidae							
	Spotted gar		*Lepisosteus oculatus*	1	16	8	11	14	50
	Longnose gar		*Lepisosteus osseus*	1	1	3	0	0	5
	Alligator gar		*Lepisosteus spatula*	0	5	5	1	1	12
Herrings		Clupeidae							
	Gulf menhaden		*Brevoortia patronus*	0	14	0	20	109	143
	Gizzard shad		*Dorosoma cepedianum*	4	1	5	1	323	334
	Threadfin shad		*Dorosoma petenense*	0	0	0	0	1	1
	Bay anchovies		*Anchoa mitchilli*	0	0	0	0	45	45
Tarpons		Elopidae							
	Ladyfish		*Elops saurus*	0	0	8	0	36	44
	Tarpon		*Megalops atlanticus*	0	2	0	0	0	2
Lefteye flounders		Bothidae							
	Southern flounder		*Paralichthys lethostigma*	0	0	0	0	9	9
Suckers		Catostomidae							
	Smallmouth buffalo		*Ictiobus bubalus*	6	0	0	0	4	10
Carps and minnows		Cypriniformes							
	Grass carp		*Ctenopharyngodon idella*	0	0	1	0	0	1
	Common carp		*Cyprinus carpio*	5	0	0	0	1	6
Bullhead catfish		Ictaluridae							
	Blue catfish		*Ictalurus furcatus*	1	0	0	1	4	6
	Channel catfish		*Ictalurus punctatus*	3	0	2	1	2	8
Sea catfish		Ariidae							
	Hardhead catfish		*Arius felis*	0	0	0	1	53	54
	Gafftopsail catfish		*Bagre marinus*	0	0	0	0	1	1
Sunfishes		Centrarchidae							
	Green sunfish		*Lepomis cyanellus*	2	0	0	0	0	2
	Warmouth		*Lepomis gulosus*	1	0	0	0	0	1
	Bluegill		*Lepomis macrochirus*	2	0	0	0	0	2
	White crappie		*Poxomis annularia*	5	0	0	0	0	5
Porgies		Sparidae							
	Sheepshead		*Archosargus probatocephalus*	0	0	0	0	2	2
	Pinfish		*Lagodon rhomboides*	0	0	0	0	1	1
Mullets		Mugilidae							
	Striped mullet		*Mugil cephalus*	1	22	28	2	61	114

Table 3. Fish taxa and individual counts of fish collected in Dickinson Bayou near Galveston Bay, Texas—Continued

Group	Common name	Family	Scientific name	Sampling site					Total
				DCK01	DCK02	DCK03	DCK04	DCK05	
Drums		Sciaenidae							
	Freshwater drum		*Aplodinotus grunniens*	1	0	0	0	1	2
	Sand seatrout		*Cynoscion arenarius*	0	0	0	0	29	29
	Silver seatrout		*Cynoscion nothus*	0	0	0	0	1	1
	Spotted seatrout		*Cynoscion nebulosus*	0	0	0	0	4	4
	Spot		*Leiostomus xanthurus*	0	0	0	0	1	1
	Atlantic croaker		*Micropogonias undulatus*	0	0	0	1	18	19
	Black drum		*Pogonias cromis*	0	0	1	0	19	20
	Red drum		*Sciaenops ocellatus*	0	0	2	0	15	17
Jacks		Carangidae							
	Crevalle jack		*Caranx hippos*	0	0	0	0	2	2
Killifishes		Cyprinodontidae							
	Sheepshead minnow		*Cyprinodon variegatus*	0	0	0	0	1	1
Livebearers		Poeciliidae							
	Sailfin molly		*Poecilia latipinna*	0	0	0	0	6	6
Silversides		Atherinidae							
	Inland silverside		*Menidia beryllina*	0	0	0	0	40	40
	Brook silverside		*Labidesthes sicculus*	0	0	0	0	55	55
Number of fish				33	61	63	39	859	1,055
Number of fish species				13	7	10	9	30	37

Table 4. Taxonomic classification of benthic macroinvertebrates and counts of individual taxa for sites in Armand Bayou near Galveston Bay, Texas

[Number of individuals per taxon shown for each site and habitat type. QMH, qualitative multi-habitat; DTH, depositional targeted habitat]

Class	Order	Family	Subfamily	Genus or scientific name	Sampling site and habitat type										Total
					ARM01 QMH	ARM01 DTH	ARM02 QMH	ARM02 DTH	ARM03 QMH	ARM03 DTH	HRSP01 QMH	HRSP01 DTH	HRSP02 QMH	HRSP02 DTH	
Arachnoidea	Acari			*Acari*	2	4	0	0	47	0	39	2	14	0	108
	Acari	Oribatei		*Oribatei*	0	1	0	0	0	0	0	0	0	0	1
	Hydrachnellae	Arrenuridae		*Arrenurus* sp.	1	1	0	0	0	0	0	0	0	0	2
Bivalvia				*Bivalvia*	0	0	0	0	0	0	7	0	18	6	31
	Veneroida			*Sphaerium* sp.	20	134	0	0	0	0	0	0	0	0	154
	Veneroida	Sphaeriidae	Pisidiinae	*Pisidium* sp.	82	26	0	0	0	0	0	4	0	0	112
Branchiobdellida				*Branchiobdellida*	1	0	0	0	0	0	0	0	0	0	1
Crustacea (Malacostraca)	Amphipoda			*Amphipoda*	0	0	0	0	8	0	0	0	0	0	8
	Amphipoda	Aoridae		*Grandidierella bonnieroides* (Stephensen)	0	0	0	0	0	4	0	0	0	0	4
	Amphipoda	Corophiidae		*Apocorophium* sp.	0	0	0	1	0	2	0	0	0	2	5
	Amphipoda	Hyalellidae		*Hyalella azteca* (Saussure)	0	0	16	0	0	0	0	0	0	0	16
	Capitellida	Capitellidae		*Mediomastus ambiseta* (Hartman)	0	0	0	0	0	4	0	0	0	0	4
	Decapoda	Cambaridae		*Cambaridae*	1	0	5	0	0	0	0	0	0	0	6
		Cambaridae	Cambarinae	*Procambarus* sp.	0	0	0	0	0	0	0	0	1	0	1
	Decapoda	Palaemonidae		*Palaemonetes kadiakensis*	3	0	0	0	0	0	0	0	0	0	3
				Palaemonetes kadiakensis (Rathbun)	0	0	83	0	0	0	3	0	35	0	121
				Palaemonetes pugio (Holthuis)	0	0	0	0	14	0	0	0	0	0	14
				Palaemonetes sp.	0	0	8	0	0	0	0	0	0	0	8
	Mysida	Mysidae		*Taphromysis louisianae* (Banner)	0	0	602	2	267	15	343	3	20	19	1,271
Crustacea (Ostracoda)				*Ostracoda*	8	1	0	0	0	0	0	0	0	0	9
Gastropoda				*Gastropoda*	0	0	0	0	0	0	32	0	0	0	32
	Basommatophora	Ancylidae		*Ferrissia* sp.	5	3	4	0	0	0	0	0	0	0	12
	Basommatophora	Lymnaeidae		*Lymnaeidae*	0	0	0	0	0	0	0	0	0	6	6
				Pseudosuccinea columella (Say)	0	0	0	0	0	0	0	0	9	0	9
	Basommatophora	Physidae		*Physidae*	3	4	0	0	0	0	0	0	0	0	7
		Physidae	Physinae	*Physella* sp.	0	0	140	0	0	0	347	0	54	0	541
	Basommatophora	Planorbidae		*Biomphalaria havanensis* (Pfeiffer)	0	0	24	0	0	0	693	1	26	0	744
				Planorbella sp.	0	1	0	0	0	0	7	0	0	0	8
				Planorbidae	2	0	0	0	0	0	567	1	6	0	576
	Mesogastropoda	Hydrobiidae		*Hydrobiidae*	165	73	124	0	19	2	333	3	66	6	791
	Mesogastropoda	Thiaridae		*Melanoides* sp.	0	0	0	0	0	0	42	0	0	0	42
Hirudinea				*Hirudinea*	1	0	0	0	0	0	0	0	0	0	1
	Pharyngobdellida	Erpobdellidae		*Erpobdellidae*	0	2	0	0	0	0	0	0	0	0	2
	Rhynchobdellida	Glossiphoniidae		*Helobdella* sp.	0	1	0	0	0	0	0	0	0	0	1

Table 4. Taxonomic classification of benthic macroinvertebrates and counts of individual taxa for sites in Armand Bayou near Galveston Bay, Texas—Continued

Class	Order	Family	Subfamily	Genus or scientific name	Sampling site and habitat type										Total
					ARM01 QMH	ARM01 DTH	ARM02 QMH	ARM02 DTH	ARM03 QMH	ARM03 DTH	HRSP01 QMH	HRSP01 DTH	HRSP02 QMH	HRSP02 DTH	
Insecta	Coleoptera			*Cybister* sp.	1	0	0	0	0	0	0	0	0	0	1
				Helophorus sp.	1	0	0	0	0	0	0	0	0	0	1
				Hydroporinae	1	0	0	0	0	0	0	0	0	0	1
	Coleoptera	Curculionidae		*Curculionidae*	0	0	8	0	5	0	0	0	0	0	13
	Coleoptera	Dytiscidae	Copelatus	*Copelatus* sp.	0	0	0	0	0	0	7	0	0	0	7
	Coleoptera	Elmidae		*Elmidae*	0	0	0	0	0	0	11	0	0	0	11
				Stenelmis sp.	7	30	0	0	0	0	0	0	0	0	37
	Coleoptera	Haliplidae		*Peltodytes* sp.	13	3	0	0	0	0	43	0	0	0	59
	Coleoptera	Hydrophilidae		*Berosus* sp.	3	1	12	2	0	0	11	0	0	0	29
				Enochrus sp.	0	0	0	0	0	0	63	0	0	0	63
	Coleoptera	Noteridae		*Notomicrus* sp.	0	0	0	0	0	0	7	0	0	0	7
	Collembola			*Collembola*	0	0	19	0	25	2	42	0	16	0	104
	Diptera			*Odontomyia/Hedriodiscus* sp.	2	1	0	0	0	0	0	0	0	0	3
	Diptera	Ceratopogonidae		*Ceratopogonidae*	0	0	0	2	10	0	32	1	7	6	58
				Ceratopogoninae	2	0	0	0	0	0	0	0	0	0	2
	Diptera	Ceratopogonidae	Ceratopogoninae	*Probezzia* sp.	0	0	0	0	14	0	0	0	0	2	16
				Bezzia/Palpomyia sp.	0	0	8	0	0	0	0	0	0	0	8
				Ceratopogon sp.	0	0	4	6	5	0	0	0	0	6	21
			Dasyheleinae	*Dasyhelea* sp.	0	0	0	2	22	0	147	0	0	0	171
			Forcipomyiinae	*Forcipomyia* sp.	0	0	0	0	0	0	0	0	6	0	6
	Diptera	Chironomidae		*Axarus* sp.	0	3	0	0	0	0	0	0	0	0	3
				Chironomidae	0	0	0	0	19	0	0	0	0	0	19
				Parachironomus frequens gr.	10	0	0	0	0	0	0	0	0	0	10
				Polypedilum flavum	1	0	0	0	0	0	0	0	0	0	1
				Pseudochironomus sp.	2,278	0	0	0	0	0	0	0	0	0	2,278
				Thienemanniella gr. sp.	0	1	0	0	0	0	0	0	0	0	1
				Zavrelimyia sp.	9	0	0	0	0	0	0	0	0	0	9
	Diptera	Chironomidae	Chironominae	*Chironominae*	0	0	24	0	8	2	273	1	2	0	310
				Chironomini	0	0	203	0	19	0	7	0	72	0	301
				Apedilum sp.	1	0	0	0	0	0	11	0	0	0	12
				Chironomus sp.	4	2	0	0	0	4	0	0	0	2	12
				Clinotanypus	1	0	0	0	0	0	0	0	0	0	1
				Dicrotendipes sp.	5	3	456	4	762	0	53	4	6	0	1,293
				Cladopelma sp.	0	0	0	2	0	0	0	0	0	0	2
				Cladotanytarsus sp.	0	0	16	0	0	0	249	1	18	6	290
				Cryptochironomus sp.	1	1	8	0	0	0	0	0	0	6	16
				Einfeldia natchitocheae (Sublette)	0	0	0	4	0	0	0	0	0	0	4
				Einfeldia sp.	0	0	8	0	0	0	0	0	0	0	8
				Glyptotendipes sp.	0	0	652	1	10	0	420	0	986	11	2,080
				Goeldichironomus sp.	0	0	83	4	75	0	179	3	206	45	595
				Microchironomus sp.	0	0	0	3	0	0	0	0	0	0	3
				Micropsectra/Tanytarsus sp.	0	0	0	4	0	0	0	0	0	0	4
				Parachironomus sp.	0	0	222	0	0	0	252	2	5	2	483
				Polypedilum sp.	0	0	524	102	313	69	700	63	134	106	2,011
				Polypedilum beckae (Sublette)	0	0	4	0	0	0	35	0	77	0	116
				Tanytarsini	0	0	0	2	8	0	11	0	0	0	21

Table 4. Taxonomic classification of benthic macroinvertebrates and counts of individual taxa for sites in Armand Bayou near Galveston Bay, Texas—Continued

Class	Order	Family	Subfamily	Genus or scientific name	Sampling site and habitat type										Total
					ARM01 QMH	ARM01 DTH	ARM02 QMH	ARM02 DTH	ARM03 QMH	ARM03 DTH	HRSP01 QMH	HRSP01 DTH	HRSP02 QMH	HRSP02 DTH	
Insecta—Cont.	Diptera—Cont.	Chironomidae—Cont.	Chironominae—Cont.	*Tanytarsus* sp.	2	3	60	2	0	0	32	0	2	0	101
				Zavreliella sp.	0	0	8	0	0	0	0	0	0	0	8
			Orthocladiinae	*Cricotopus bicinctus* gr.	0	0	0	0	0	0	56	6	19	0	81
				Cricotopus sp.	0	0	0	0	0	0	0	2	0	0	2
				Nanocladius sp.	0	0	4	0	0	0	21	0	0	0	25
				Orthocladiinae	0	0	4	0	0	0	18	0	0	6	28
				Parakiefferiella sp.	0	0	4	0	0	0	0	0	0	0	4
				Pseudosmittia sp.	0	0	0	0	0	0	11	0	6	0	17
			Tanypodinae	*Ablabesmyia* sp.	5	1	0	0	0	0	32	2	0	0	40
				Coelotanypodini	0	0	0	3	0	0	0	0	0	0	3
				Coelotanypus sp.	0	0	4	15	5	28	0	2	0	2	56
				Labrundinia sp.	17	1	4	0	0	0	42	0	0	0	64
				Larsia sp.	0	0	20	0	0	0	179	0	12	0	211
				Pentaneurini	0	0	0	0	0	0	32	0	6	0	38
				Procladius sp.	0	0	12	63	0	2	0	2	0	0	79
				Tanypodinae	0	0	0	0	0	0	11	0	0	0	11
				Tanypus sp.	6	3	0	0	0	2	0	2	6	0	19
	Diptera	Culicidae		*Culicidae*	0	0	0	0	0	0	11	0	0	0	11
	Diptera	Stratiomyidae		*Stratiomyidae*	0	0	16	0	0	0	32	0	18	0	66
			Stratiomyinae	*Odontomyia* sp.	0	0	8	0	0	0	42	0	0	0	50
	Ephemeroptera	Baetidae		*Acentrella* sp.	0	0	0	2	0	0	0	0	0	0	2
				Baetidae	0	0	24	0	0	0	11	0	0	0	35
				Callibaetis sp.	0	0	0	0	0	0	11	0	0	0	11
	Ephemeroptera	Caenidae		*Caenis* sp.	51	101	52	0	0	0	21	4	7	42	278
				Caenis latipennis	28	47	0	0	0	0	0	0	0	0	75
	Hemiptera	Belostomatidae		*Belostoma lutarium* (Stal)	0	0	0	0	0	0	1	0	1	0	2
				Belostoma sp.	1	0	0	0	0	0	0	0	0	0	1
				Belostomatidae	2	1	0	0	0	0	11	0	0	0	14
	Hemiptera	Corixidae		*Corixidae*	0	0	0	0	0	0	11	0	2	0	13
	Hemiptera	Gerridae		*Gerridae*	0	0	80	0	0	0	0	0	0	0	80
			Rhagodotarsinae	*Rheumatobates* sp.	0	0	8	0	14	0	0	0	0	0	22
	Hemiptera	Mesoveliidae		*Mesovelia mulsanti* (White)	0	0	0	0	5	0	11	0	0	0	16
				Mesovelia sp.	0	0	8	0	5	0	21	0	6	0	40
	Hemiptera	Nepidae	Ranatrinae	*Ranatra nigra* (Herrich-Schaeffer)	0	0	8	0	0	0	0	0	1	0	9
				Ranatra sp.	0	0	0	0	0	0	21	0	6	0	27
	Isopoda			*Isopoda*	0	0	0	0	0	4	0	0	0	0	4
	Lepidoptera			*Lepidoptera*	0	1	4	0	0	0	11	0	12	0	28
	Odonata			*Anisoptera*	0	0	24	0	0	0	0	0	0	0	24
				Aphylla sp.	0	1	0	0	0	0	0	0	0	0	1
				Argia sp.	4	0	0	0	0	0	0	0	0	0	4
	Odonata	Coenagrionidae		*Coenagrion/Enallagma* sp.	0	0	16	0	0	0	0	0	0	0	16
				Coenagrionidae	10	1	78	0	0	0	189	0	19	0	297
				Enallagma sp.	0	0	0	0	0	0	0	0	2	0	2
				Ischnura sp.	0	0	8	0	0	0	0	0	0	0	8

Table 4. Taxonomic classification of benthic macroinvertebrates and counts of individual taxa for sites in Armand Bayou near Galveston Bay, Texas—Continued

Class	Order	Family	Subfamily	Genus or scientific name	Sampling site and habitat type										Total
					ARM01 QMH	ARM01 DTH	ARM02 QMH	ARM02 DTH	ARM03 QMH	ARM03 DTH	HRSP01 QMH	HRSP01 DTH	HRSP02 QMH	HRSP02 DTH	
Insecta—Cont.	Odonata—Cont.	Libellulidae		*Erythemis simplicicollis* (Say)	0	0	0	0	0	0	21	0	0	0	21
				Erythemis sp.	0	0	8	0	0	0	63	0	0	0	71
				Libellulidae	6	1	0	0	0	0	32	0	0	0	39
	Trichoptera	Leptoceridae	Leptocerinae	*Oecetis* sp.	0	0	0	0	0	0	11	0	0	0	11
Malacostraca	Decapoda			*Decapoda*	0	0	0	0	0	2	11	0	0	0	13
Nematoda				*Nematoda*	0	0	81	11	1,159	33	186	70	112	108	1,760
Nemertea				*Nemertea*	0	1	0	0	0	0	7	2	5	2	17
Oligochaeta				*Oligochaeta*	13	35	0	0	0	0	0	0	0	0	48
	Enchytraeida	Enchytraeida		*Enchytraeidae*	0	0	18	0	101	0	60	0	14	0	193
	Tubificida	Naididae		*Naididae*	0	0	529	18	1,277	28	1,558	34	1,264	398	5,106
	Tubificida	Tubificidae		*Tubificidae*	0	0	153	51	66	54	140	233	95	275	1,067
Phylactolaemata				*Urnatella gracilis* (Leidy)	0	0	0	0	0	0	0	0	6	0	6
Polychaeta	Phyllodocida	Nereididae		*Laeonereis culveri* (Webster)	0	0	0	0	101	0	0	0	42	0	143
				Nereididae	0	0	11	16	17	4	0	32	0	44	124
	Spionida	Spionidae		*Spionidae*	0	0	0	0	5	92	0	0	0	0	97
	Terebellida	Ampharetidae		*Hobsonia florida* (Hartman)	0	0	46	16	112	216	0	24	0	434	848
Turbellaria				*Turbellaria*	0	0	0	0	0	0	0	0	2	0	2
Total individuals per site					2,779	493	4,557	338	4,517	569	7,893	504	3,449	1,542	26,641
Total species per site					42	34	54	25	31	20	65	26	46	24	141

Table 5. Taxonomic classification of benthic macroinvertebrates and counts of individual taxa for sites in Dickinson Bayou near Galveston Bay, Texas

[Number of individuals per taxon shown for each site and habitat type. QMH, qualitative multi-habitat; DTH, depositional targeted habitat]

Class	Order	Family	Subfamily	Genus or scientific name	Sampling site and habitat type										Total
					DCK01 QMH	DCK01 DTH	DCK02 QMH	DCK02 DTH	DCK03 QMH	DCK03 DTH	DCK04 QMH	DCK04 DTH	DCK05 QMH	DCK05 DTH	
Arachnoidea	Acari			*Acari*	33	4	0	0	3	0	0	0	28	0	68
Bivalvia				*Bivalvia*	0	4	54	0	0	24	8	0	0	0	90
		Mytilidae		*Ischadium recurvum* (Rafinesque)	0	0	0	0	0	0	0	0	0	4	4
	Veneroida	Dreissenidae		*Mytilopsis leucophaeata* (Conrad)	8	1	71	0	0	18	0	0	0	0	98
	Veneroida	Mactridae		*Rangia cuneata* (Sowerby)	0	0	0	0	0	1	2	0	0	5	8
	Veneroida	Solecurtidae		*Tagelus plebeius* (Lightfoot)	0	0	0	0	0	0	0	0	0	1	1
Crustacea (Malacostraca)	Amphipoda			*Amphipoda*	2	0	6	0	2	30	0	0	19	0	59
	Amphipoda	Aoridae		*Grandidierella bonnieroides* (Stephensen)	0	0	6	0	0	12	0	2	0	35	55
	Amphipoda	Corophiidae		*Apocorophium* sp.	0	0	0	0	2	0	0	5	0	35	42
				Apocorophium lacustre (Vanhoffen)	0	0	0	0	0	72	0	0	0	0	72
				Apocorophium louisianum (Shoemaker)	0	0	0	0	0	0	0	0	14	0	14
	Amphipoda	Gammaridae		*Gammarus* sp.	0	0	0	0	0	0	0	0	28	0	28
	Amphipoda	Hyalellidae		*Hyalella azteca* (Saussure)	47	0	18	0	0	0	0	0	0	0	65
	Decapoda			*Decapoda*	3	0	0	0	0	0	2	0	19	0	24
	Decapoda	Cambaridae		*Cambaridae*	4	0	0	0	0	0	0	0	0	0	4
	Decapoda	Palaemonidae		*Palaemonetes kadiakensis* (Rathbun)	19	0	0	0	0	0	0	0	0	0	19
				Palaemonetes paludosus (Gibbes)	0	0	0	0	0	0	0	0	1	0	1
				Palaemonetes pugio (Holthuis)	0	0	0	0	0	1	0	0	723	0	724
	Decapoda	Penaeidae		*Penaeus setiferus* (Linnaeus)	0	0	0	0	0	0	0	0	15	0	15
	Decapoda	Portunidae		*Callinectes sapidus* (Rathbun)	0	0	0	0	0	0	0	0	22	1	23
	Isopoda	Idoteidae		*Edotea triloba* (Say)	0	0	0	0	0	0	0	0	5	0	5
	Isopoda	Munnidae		*Uromunna reynoldsi* (Frankenberg and Menzies)	3	0	24	0	0	6	0	0	0	0	33
	Isopoda	Sphaeromatidae		*Cassidinidea ovalis* (Say)	0	0	0	0	0	0	0	0	9	0	9
	Mysida	Mysidae		*Taphromysis louisianae* (Banner)	146	11	3	0	0	0	6	0	0	2	168
	Tanaidacea	Paratanaidae		*Hargeria rapax* (Harger)	0	0	0	0	0	0	0	0	275	44	319
Gastropoda				*Gastropoda*	7	0	39	0	0	24	0	0	0	0	70
	Basommatophora	Ancylidae		*Ancylidae*	2	0	0	0	0	0	0	0	0	0	2
	Basommatophora	Lymnaeidae		*Lymnaeidae*	5	0	2	0	1	0	0	0	3	0	11
		Lymnaeidae	Lymnaeinae	*Fossaria* sp.	9	0	3	0	0	0	0	0	0	0	12
	Basommatophora	Physidae	Physinae	*Physella* sp.	265	4	74	0	2	0	3	0	0	0	348
	Basommatophora	Planorbidae		*Micromenetus* sp.	9	0	0	0	0	0	0	0	0	0	9
	Mesogastropoda	Hydrobiidae		*Hydrobiidae*	7	0	324	0	0	174	5	1	19	16	546
	Neogastropoda	Pyramidellidae		*Sayella* sp.	9	0	0	0	0	0	0	0	0	0	9
Insecta	Coleoptera	Curculionidae		*Curculionidae*	0	0	2	0	0	0	0	0	5	0	7
	Coleoptera	Dytiscidae	Hydroporinae		2	0	0	0	0	0	0	0	0	0	2

Table 5. Taxonomic classification of benthic macroinvertebrates and counts of individual taxa for sites in Dickinson Bayou near Galveston Bay, Texas—Continued

Class	Order	Family	Subfamily	Genus or scientific name	Sampling site and habitat type										Total
					DCK01 QMH	DCK01 DTH	DCK02 QMH	DCK02 DTH	DCK03 QMH	DCK03 DTH	DCK04 QMH	DCK04 DTH	DCK05 QMH	DCK05 DTH	
Insecta—Cont.	Coleoptera—Cont.	Elmidae		*Heterelmis* sp.	2	0	0	0	0	0	0	0	0	0	2
				Stenelmis sp.	0	0	0	0	0	0	0	0	33	0	33
				Stenelmis crenata (Say)	0	0	0	0	0	0	0	0	5	0	5
	Coleoptera	Gyrinidae		*Gyretes sinuatus* (LeConte)	3	0	0	0	0	0	0	0	0	0	3
	Coleoptera	Haliplidae		*Peltodytes* sp.	8	0	0	0	0	0	0	0	0	0	8
	Coleoptera	Hydrophilidae		*Paracymus* sp.	0	0	2	0	0	0	0	0	0	0	2
	Coleoptera	Noteridae		*Hydrocanthus* sp.	0	0	2	0	1	0	0	0	0	0	3
	Coleoptera	Scirtidae		*Scirtidae*	2	0	10	0	0	0	4	0	0	0	16
	Coleoptera	Staphylinidae		*Staphylinidae*	0	0	2	0	0	0	0	0	0	0	2
	Collembola			*Collembola*	15	2	10	0	3	0	201	0	387	0	618
	Diptera	Ceratopogonidae		*Ceratopogonidae*	18	2	20	0	1	0	6	0	6	2	55
				Probezzia sp.	0	3	0	0	0	0	0	0	0	0	3
	Diptera	Ceratopogonidae	Ceratopogoninae	*Bezzia/Palpomyia* sp.	3	0	0	0	0	0	0	0	0	0	3
				Ceratopogon sp.	0	4	0	0	0	0	0	0	0	0	4
			Dasyheleinae	*Dasyhelea* sp.	10	0	2	0	1	2	1	0	0	0	16
	Diptera	Chironomidae		*Chironomidae*	0	0	0	0	0	0	2	1	5	0	8
	Diptera	Chironomidae	Chironominae	*Chironominae*	0	2	12	0	0	12	0	0	0	0	26
				Chironomini	5	8	0	0	0	0	0	0	0	0	13
				Chironomus sp.	0	22	6	5	0	6	0	7	0	7	53
				Cladotanytarsus sp.	0	10	78	0	0	0	0	2	0	0	90
				Cryptochironomus sp.	0	2	6	0	0	2	0	0	0	0	10
				Cryptotendipes sp.	0	16	0	0	0	0	0	0	0	0	16
				Dicrotendipes sp.	13	0	554	0	0	276	6	0	28	0	877
				Einfeldia sp.	56	0	6	0	0	0	0	0	0	0	62
				Fissimentum sp.	2	30	0	0	0	0	0	0	0	0	32
				Goeldichironomus sp.	3	0	2	0	0	0	0	0	0	0	5
				Harnischia sp.	0	33	0	0	0	0	0	0	0	0	33
				Microchironomus sp.	0	0	0	0	0	2	0	0	0	0	2
				Micropsectra/Tanytarsus sp.	5	20	0	1	0	0	0	1	0	0	27
				Microtendipes sp.	0	0	0	0	0	0	0	0	5	0	5
				Parachironomus sp.	0	0	0	0	0	6	0	0	0	0	6
				Paralauterborniella nigrohalterale (Malloch)	0	100	0	0	0	0	0	0	0	0	100
				Phaenopsectra/Tribelos sp.	3	0	0	0	0	0	0	0	0	0	3
				Polypedilum sp.	126	122	669	0	30	378	165	3	37	13	1,543
				Polypedilum beckae (Sublette)	0	0	2	0	0	0	0	0	0	0	2
				Rheotanytarsus sp.	0	0	0	0	0	0	0	0	5	0	5
				Stempellina sp.	0	10	0	0	0	0	0	0	0	0	10
				Stenochironomus sp.	3	0	0	0	0	0	0	0	0	0	3
				Tanytarsini	0	0	2	0	0	0	0	0	0	0	2
				Tanytarsus sp.	20	84	0	0	0	2	0	0	0	0	106
				Tribelos sp.	35	0	0	0	0	0	0	0	0	0	35
	Diptera	Chironomidae	Orthocladiinae	*Antillocladius* sp.	2	0	0	0	0	0	0	0	0	0	2
				Corynoneura sp.	85	0	15	0	0	0	4	0	0	0	104

Table 5. Taxonomic classification of benthic macroinvertebrates and counts of individual taxa for sites in Dickinson Bayou near Galveston Bay, Texas—Continued

Class	Order	Family	Subfamily	Genus or scientific name	Sampling site and habitat type										Total
					DCK01 QMH	DCK01 DTH	DCK02 QMH	DCK02 DTH	DCK03 QMH	DCK03 DTH	DCK04 QMH	DCK04 DTH	DCK05 QMH	DCK05 DTH	
Insecta—Cont.	Diptera—Cont.	Chironomidae—Cont.	Orthocladiinae—Cont.	*Cricotopus bicinctus* gr.	18	0	10	0	0	0	3	0	0	0	31
				Cricotopus/Orthocladius sp.	0	0	0	0	0	0	0	0	6	0	6
				Cricotopus trifascia gr.	0	0	0	0	0	0	0	0	0	2	2
				Gymnometriocnemus sp.	2	0	0	0	0	0	0	0	0	0	2
				Nanocladius sp.	4	0	0	0	0	0	0	0	0	0	4
				Orthocladiinae	0	0	0	0	0	0	0	0	9	0	9
				Parakiefferiella sp.	0	4	0	0	0	0	0	0	0	0	4
				Pseudosmittia sp.	8	0	0	0	0	0	0	0	0	0	8
				Thienemanniella sp.	18	0	0	0	0	0	0	0	0	0	18
				Tvetenia sp.	0	0	0	0	0	0	0	0	9	0	9
	Diptera	Chironomidae	Tanypodinae	*Ablabesmyia* sp.	11	8	0	0	0	0	0	0	0	0	19
				Clinotanypus sp.	2	2	0	0	0	0	0	0	0	0	4
				Labrundinia sp.	7	0	2	0	0	0	0	0	0	0	9
				Larsia sp.	2	0	0	0	0	0	0	0	0	0	2
				Tanypus sp.	0	2	50	2	0	2	0	0	65	7	128
	Diptera	Sciomyzidae		*Sciomyzidae*	0	0	2	0	0	0	0	0	0	0	2
	Diptera	Simuliidae		*Simuliidae*	0	2	0	0	0	0	0	0	0	0	2
Insecta	Ephemeroptera			*Ephemeroptera*	3	0	0	0	0	0	0	0	5	0	8
	Ephemeroptera	Baetidae		*Acentrella turbida* (McDunnough)	0	0	0	0	0	0	0	0	0	4	4
				Baetidae	32	0	12	0	0	0	0	0	0	0	44
				Baetis sp.	0	0	0	0	0	0	0	0	5	0	5
				Callibaetis sp.	3	0	0	0	2	0	0	0	0	0	5
				Centroptilum/Procloeon sp.	3	0	0	0	0	0	0	0	0	0	3
				Fallceon quilleri (Dodds)	5	0	0	0	0	0	0	0	0	0	5
				Pseudocloeon dardanum (McDunnough)	5	0	0	0	0	0	0	0	0	0	5
	Ephemeroptera	Caenidae		*Caenis* sp.	24	0	0	0	0	0	0	2	0	0	26
	Ephemeroptera	Ephemeridae		*Hexagenia* sp.	0	23	0	0	0	0	0	0	0	0	23
				Hexagenia limbata (Serville)	0	6	0	0	0	0	0	0	0	0	6
	Hemiptera	Corixidae		*Corixidae*	9	0	0	0	0	0	0	1	0	0	10
	Hemiptera	Corixidae	Corixinae	*Trichocorixa* sp.	4	0	10	0	0	0	1	0	0	0	15
	Hemiptera	Gerridae	Rhagodotarsinae	*Rheumatobates* sp.	45	0	6	0	0	30	0	0	0	0	81
				Rheumatobates hungerfordi (Wiley)	3	0	0	0	0	0	0	0	0	0	3
	Hemiptera	Gerridae	Trepobatinae	*Trepobates* sp.	0	0	6	0	0	0	0	0	0	0	6
	Hemiptera	Mesoveliidae		*Mesovelia* sp.	5	0	0	0	0	0	0	0	0	0	5
				Mesovelia cryptophila (Hungerford)	2	0	0	0	0	0	1	0	0	0	3
	Hemiptera	Veliidae	Microveliinae	*Microvelia* sp.	3	0	0	0	0	0	0	0	0	0	3
	Lepidoptera			*Lepidoptera*	0	0	0	0	0	0	12	0	2	0	14
	Odonata			*Zygoptera*	3	0	0	0	0	0	0	0	0	0	3
	Odonata	Ceonagrionidae		*Coenagrionidae*	2	0	6	0	0	0	0	0	0	0	8
				Enallagma sp.	2	0	0	0	0	0	0	0	0	0	2
	Trichoptera	Hydroptilidae		*Hydroptilidae*	0	0	0	0	0	0	0	0	5	0	5
	Trichoptera	Hydroptilidae	Hydroptilinae	*Neotrichia canixa* gr.	0	2	0	0	0	0	0	0	0	0	2
	Trichoptera	Polycentropodidae	Polycentropodinae	*Polycentropus* sp.	0	2	0	0	0	0	0	0	0	0	2

Table 5. Taxonomic classification of benthic macroinvertebrates and counts of individual taxa for sites in Dickinson Bayou near Galveston Bay, Texas—Continued

Class	Order	Family	Subfamily	Genus or scientific name	Sampling site and habitat type										Total
					DCK01 QMH	DCK01 DTH	DCK02 QMH	DCK02 DTH	DCK03 QMH	DCK03 DTH	DCK04 QMH	DCK04 DTH	DCK05 QMH	DCK05 DTH	
Nematoda				*Nematoda*	72	16	2	1	0	17	0	19	65	40	232
Nemertea				*Nemertea*	0	0	0	0	0	0	2	0	0	22	24
Oligochaeta	Enchytraeida	Enchytraeidae		*Enchytraeidae*	50	4	10	0	3	0	25	0	6	0	98
Oligochaeta	Tubificida	Naididae		*Naididae*	219	58	74	0	5	0	7	0	0	20	383
Oligochaeta	Tubificida	Tubificidae		*Tubificidae*	123	115	324	0	0	818	357	8	28	117	1,890
Polychaeta	Capitellida	Capitellidae		*Mediomastus ambiseta* (Hartman)	0	0	0	0	0	0	24	1	0	66	91
Polychaeta	Phyllodocida	Nereididae		*Nereididae*	3	0	0	0	0	0	0	0	28	0	31
Polychaeta	Spionida	Spionidae		*Spionidae*	0	0	0	0	0	17	8	4	33	121	183
Polychaeta	Terebellida	Ampharetidae		*Hobsonia florida* (Hartman)	18	0	18	0	0	5	0	4	5	4	54
Turbellaria				*Turbellaria*	0	0	0	0	0	0	0	0	9	0	9
Total number of individuals					1,709	738	2,558	9	56	1,937	855	61	1,976	568	10,467
Total number of species					71	35	45	4	13	25	24	15	39	22	131

Table 6. Physical-habitat data for stream reaches at sites in Armand and Dickinson Bayous near Galveston Bay, Texas

[m, meters; --, no data; m/s, meters per second; RCE, riparian, channel, and environmental index; mg/L, milligrams per liter; µS, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius]

Data collected	Sampling site									
	ARM01	ARM02	ARM03	HRSP01	HRSP02	DCK01	DCK02	DCK03	DCK04	DCK05
Downstream reach boundary coordinates										
Latitude	(1)	29°36'38.21"	29°35'18.52"	29°34'48.62"	29°34'50.98"	29°25'28.97"	29°26'25.87"	29°27'18.47"	29°27'22.55"	29°27'34.76"
Longitude	(1)	95°05'49.28"	95°04'58.97"	95°06'04.85"	95°05'27.56"	95°07'37.06"	95°04'47.41"	95°03'43.64"	95°02'50.16"	95°00'13.46"
Linear reach length (m)	66.1	317	427	202	196	92.4	294	295	457	942
Curvilinear reach length (m)	67.7	530	615	207	276	104	305	308	488	1,320
Sinuosity	1.02	1.67	1.44	1.02	1.41	1.13	1.04	1.04	1.07	1.40
Reach slope	9.1^{-6}	3.1^{-4}	1.4^{-3}	1.1^{-4}	7.2^{-4}	1.5^{-3}	3.5^{-4}	3.3^{-4}	1.2^{-4}	3.0^{-5}
Number of snags	0	0	0	0	0	1	4	0	0	0
Number of other obstructions	0	0	0	0	0	2	3	9	1	0
Number of stumps	1	0	24	0	0	0	3	2	0	0
Structure index	.005	0	.115	0	0	.009	.010	.011	.001	0
Number of undercut banks	0	0	0	0	0	0	0	0	0	0
Number of bars	0	0	0	0	0	0	0	0	0	0
Mean right bank slope	.283	.180	.044	.113	.211	.250	.244	.186	.069	.044
Mean left bank slope	.468	.156	.022	.101	.375	.257	.231	.184	.152	.045
Mean bank slope	.376	.168	.033	.107	.293	.254	.238	.185	.111	.045
Mean channel width (m)	24.3	39.0	190	52.4	27.9	20.9	46.6	63.4	57.9	198
Mean right bank height (m)	3.87	3.53	2.33	3.14	4.30	2.96	6.10	6.22	4.97	4.42
Mean left bank height (m)	3.53	3.63	1.98	4.45	3.81	3.20	5.64	6.34	4.97	4.11
Mean bank height/channel width ratio	.152	.092	.011	.072	.145	.147	.126	.099	.086	.022
Mean wetted channel width (m)	3.35	31.7	3.35	32.3	20.5	180	11.9	32.9	54.6	54.3
Mean depth (m)	.30	.79	.20	--	--	--	1.3	1.2	1.2	.85
Mean velocity (m/s)	.109	0	--	0	0	--	.005	.113	--	--
Dissolved oxygen (mg/L)	--	8.4	11.6	9.7	10.0	.9	7.5	4.0	5.2	4.0
pH (standard units)	--	7.7	8.8	7.4	7.5	7.1	7.5	7.4	7.3	7.8
Conductance (µS)	--	488	8,600	897	889	23,900	616	12,300	702	3,460
Temperature (°C)	--	16.1	24.0	17.5	19.0	29.8	13.3	22.3	15.5	17.4

[1] Global positioning system coordinates could not be obtained to determine latitude and longitude because of dense ground cover.