Biological Data Collection – Brazos River Study Area

Final Report

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Executive Summary

The goal of this study is to update biological collection information in the middle and lower Brazos River basin, which will attempt to fill in information gaps concerning fish assemblages. Further, these collections are aimed at improving baseline data as part of scoping potential instream flow studies, supplementing information needed for understanding trends in fish assemblage dynamics, and allowing preparation of a conceptual model of fish assemblage dynamics in the study area.

This project is supported by a Research and Planning Fund Research Grant, TWDB Contract No. 2005-483-561, to the Brazos River Authority in support of Texas Instream Flow Program studies. Work was conducted in cooperation with Texas Parks and Wildlife Department, TWDB, and Texas Commission on Environmental Quality.

Concurrent to this project, Dr. Tim Bonner, Texas State University, has been preparing annotated species lists that outline historical fish species distribution and abundance within the study area (as well as in the San Antonio and Sabine rivers), temporal trends in occurrence, life history information, and linkages between life history and physical habitat, and other environmental requirements. The overall intent of that project is to develop an understanding of fish assemblage dynamics.

This project complements that work by providing current information about fish assemblages in the river and filling obvious spatial and temporal data gaps. Additional work is anticipated in evaluating sub-basin areal and historical trends in fish species occurrence and assemblage dynamics as well as preliminary efforts to evaluate habitat utilization and guilding. Historical and 2006 species occurrences will be examined for geographical trends, considering eastern and western tributaries and longitudinal trends within the main stem of the Brazos. Historic and 2006 collections will be compared to determine any discernable differences in fish assemblages over time and identify additional sampling strategies for augmenting the collection record. Habitat and fish assemblage data from 2006 will be analyzed to evaluate correlations between physical habitat variables and species occurrence. We will also give preliminary consideration to defining mesohabitat-based guilds for future testing.

Introduction

As noted by Annear et al. (2004)[1] and the National Research Council (NRC 2005)[2], a starting point in addressing natural resource questions relative to instream flow evaluations includes attempting to answer many questions about the biological systems being studied. Areas of importance include identifying the overall community composition, determining which assemblages are likely to be affected, establishing any linkages with flow components, and deciding whether certain assemblages or species should be targeted for study. Much of this information may be available through published literature, though often field sampling will be necessary to develop missing data. The results should be a thorough assessment of flora and fauna sufficient to build an understanding of community composition, connectivity, and function (Annear et al. 2004) that will enable construction of a conceptual model relating assemblage dynamics and flow components (subsistence and base flows, high flow pulses and overbank flows; NRC 2005).

A critical aspect in scoping an instream flow study is to identify existing literature and data and its geographical and temporal coverage, allowing researchers to evaluate data gaps as well as to develop a preliminary conceptual model of the system. Towards that end, Texas Water Development Board (TWDB) Research and Planning Funds were expended during FY04-05 to develop a geo-referenced database that identified literature and data in the areas of hydrology, biology, physical processes, water quality, and connectivity for the middle and lower Brazos River. Further, historical information was gathered from primary literature and museum collections housed at Texas A&M University, University of Texas and Tulane University. Historical fish collections for the mainstem Brazos River (from Waco downstream to the Gulf of Mexico) date from 1939 to 2005. These collections represent 120 sampling events containing more than 275,000 specimens representing 66 species. Western tributary collections (e.g. Little River, San Gabriel River, etc) date from 1951 to 1973. These collections represent 23 sampling events containing more than 8500 specimens representing 39 species. Eastern tributary collections (e.g. Navasota River, Little Brazos River, etc) date from 1938 to 1988. These collections represent 76 sampling events containing more than 20000 specimens representing 61 species. Evaluation of existing biological data in the Brazos River study area indicated potential spatial and temporal gaps in historical collections as well as collection sites that would facilitate long-term trends analysis in fish assemblages.

The goal of this study is to conduct new biological collections, which will attempt to fill in information gaps concerning fish assemblages. Further, these collections are aimed at improving baseline data as part of scoping potential instream flow studies, supplementing information needed for understanding trends in fish assemblage dynamics, and allowing preparation of a conceptual model of fish assemblage dynamics in the study area.

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[1] Annear, T., I. Chisholm, H. Beecher, A. Locke and 12 other authors. 2004. Instream flows for riverine resource stewardship, revised edition. Instream Flow Council, Cheyenne, Wyoming.

[2] NRC (National Research Council). 2005. The science of instream flows: a review of the Texas Instream Flow Program. National Academies Press, Washington, D.C. Available online: <http://books.nap.edu/catalog/11197.html>.

This work is supported by a Research and Planning Fund Research Grant, TWDB Contract No. 2005-483-561, to the Brazos River Authority in support of Texas Instream Flow Program studies. Work was conducted in cooperation with Texas Parks and Wildlife Department, TWDB, and Texas Commission on Environmental Quality. The scope of work is included in Appendix A.

Study Scope

Study Area Description

The Texas Instream Flow Studies: Programmatic Work Plan published in December 2002 prioritized instream flow studies based on potential water development projects, water rights permitting issues, as well as other factors. The lower and middle subbasins of the Brazos River were identified as priority studies based on the possible cumulative effect of numerous water development projects on flow regimes in the Brazos basin.

The middle and lower subbasins of the Brazos River include five primary watersheds – Central Watershed of the Brazos River, Little River Watershed, Navasota River Watershed, Yegua Creek Watershed, and the Lower Watershed of the Brazos River. The middle subbasin watersheds, Central, Little River, and Navasota River, drain approximately 7,294 square miles and include Lakes Georgetown, Granger, and Limestone. The land use is predominantly agricultural with two areas of urban influence in Williamson County in the Little River Watershed and the Bryan/College Station cities in the Navasota River Watershed.

The lower subbasin watersheds, Yegua Creek and the Lower Watershed drain approximately 3,393 square miles and include Somerville Lake and proposed Allen Creek reservoir. Predominantly land use in this region is agriculture, with 887,000 acres of agricultural land along the Braozs River below the mouth of Yegua Creek. Urban growth has been increasing in the Fort Bend and Brazoria counties over recent years.

A study area map is included in Appendix B.

Site Selection

Five sites on the Brazos River main stem, two on the Little River, and one on the Navasota River were sampled during this study. The Brazos River sites were selected to cover representative habitats from the middle and lower basin downstream of Waco, including areas with runs, pools and riffles, and a variety of substrate and instream cover types. Emphasis was also placed on areas with limited recent fish community data. From a practical standpoint, the sites were also selected for accessibility and ease of launching boats. The coastal plain was not sampled since it was sampled recently as part of the Allens Creek study. The Little River was sampled at two sites, one each in the Texas Blackland Prairies and East Central Texas Plains ecoregions. The Little River has relatively little recent fish community data, and the basin contains reservoirs managed for public water supply. The Little River data provides information on western (Edwards Plateau) fish community influences on the mainstem Brazos. The Navasota River, another large tributary of the lower Brazos, is an important source of eastern (Mississippian) fish community influences on the Brazos. Many of the historical fish collections in the basin contain little or no information on sample methods and effort, and do not contain descriptions of the habitats sampled. Biological data collected by this study in these five mainstream sites and three major tributary sites will help to fill spatial and temporal gaps with current fish species occurrences and their associated habitats.

Table 1. Site Locations and Descriptions

Site No.	Latitude	Longitude	Location Description	County 1	County 2
12020	29.99873	-96.0997	Brazos River downstream of Highway 159	Washington	Waller
12030	30.36674	-96.1519	Brazos River upstream of Highway 105	Washington	Brazos
12040	30.52797	-96.1494	Navasota River West of Piedmont	Navasota	Brazos
12060	30.83477	-97.1678	Little River between Highway 486 and Highway 1600	Milam	
12070	30.84398	-96.7086	Little River downstream of County Road 264	Milam	
12080	30.87898	-96.6896	Brazos River upstream of Highway 485	Milam	Robertson
12087	31.21497	-96.9223	Brazos River downstream of Highway 712	Falls	
12090	31.29975	-96.9788	Brazos River upstream of Highway 7	Falls	

Methodology

In general, sampling methods for fish assemblages follow those outlined in *Surface Water Quality Monitoring Procedures, Vol. 2: Methods for Collecting and Analyzing Biological Community Habitat Data* (TCEQ 2005)[3]. Though sampling protocols follow that outlined in the above reference, fish collections were segregated by identified major habitat types (e.g., riffle, run, pool). Since the goal in baseline fish sampling is to collect a representative sample of the species present in their relative abundances, all available habitats and combinations of habitats were sampled with the most effective sampling gear that could be feasibly deployed. Habitat data were collected for each sampling event.

A reach was located for each study site that measured 40 times the mean wetted width of the stream up to 1000 m. Reaches may have exceeded 1000m if the scale of the stream dictated in order to cover at least one full meander wavelength. This ensured that the reach included most of the representative habitats in the area of the study site.

Seines were used at each study site. Deep pools and runs were typically sampled with a 9.1 m x 1.8 m x 6.4 mm mesh seine, whereas riffles, runs, and small pools were usually sampled using a 4.6 m x 1.8 m x 4.8 mm or a 1.8 m x 1.8 m x 4.8 mm mesh seine. A minimum of 10 effective seine hauls were made but sampling continued until no new species were added. The number of effective seine hauls, the length of seine, and a measurement of the distance of each seine haul were recorded.

Backpack electrofishers (Smith-Root Model 12) were used in wadeable areas that could not be sampled as effectively with other methods; most sites did not require the use of backpack electrofishers. Boat-mounted electrofishers (Smith-Root GPP series) were used in non-wadeable habitats, such as deep pools or runs. All species observed but not captured were noted (along with an estimated total length). Sites were sampled (with one or both types of electrofishers) for a minimum of 900 seconds of combined actual shock time.

Fish samples were preserved for each sampling event (each seine haul or habitat type shocked) and processed independently. Fish that were too large for sample containers were positively identified, measured on a portable measuring board (total length), checked for disease or anomaly, photographed for vouchering, and released.

A global positioning system receiver was used to take a location at the mid-point of each habitat type sampled (datum=WGS84; units=decimal degrees; reception=3D) and was tied to a photograph of habitat sampled. Average habitat depth, dominant substrate type, instream cover type and density, and current velocity was measured and recorded for each sampling event. Typically a Marsh-McBirney electronic flow meter was used to collect current velocity and depth was measured using a top-setting wading rod. In some cases, an Acoustic Doppler Current Profiler was used to collected representative depth

[3] TCEQ (Texas Commission on Environmental Quality). 2005. Surface water quality monitoring procedures. Volume 2: methods for collecting and analyzing biological community and habitat data. RG-416. TCEQ, Austin, TX.
http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/mtr/swqm_procedures.html

and velocity measurements. Habitat type and lateral location (e.g., bank, mid-channel) were recorded for each sampling event. Substrate was classified using the modified Wentworth scale and instream cover was classified using quartiles and codes. A sampling protocol and field guide were developed and used to ensure consistency in reach layout, habitat measurements, and fish sampling.

Sample Variance

One planned site, Brazos River at Mussel Shoals near College Station, was eliminated due to accessibility problems. The site was replaced with site 12087 upstream. Sampling was completed successfully at the final eight sites, and no modifications were made to the collection methods.

Results

Table 2. Historic occurrence of fish species for the Lower Brazos River mainstem and sampled mainstem tributaries.

Species	Common Name	Lower Brazos River Mainstem Period of Record 1939 - 2005	Western Tributaries Period of Record 1951 - 1973	Eastern Tributaries Period of Record 1938 - 1988
Lepisosteus oculatus	Spotted gar	x		x
Lepisosteus osseus	Longnose gar	x		x
Lepisosteus spatula	Alligator gar	x		x
Amia calva	Bowfin	x		x
Alosa chrysochloris	Skipjack shad	x		
Dorosoma cepedianum	Gizzard shad	x	x	x
Dorosoma petenense	Thradfin shad	x	x	x
Campostoma anomalum	Central stoneroller	x	x	x
Cyprinella lutrensis	Red shiner	x	x	x
Cyprinella venusta	Blacktail shiner	x	x	x
Cyprinus carpio	Common carp	x	x	x
Hybognathis nuchalis	Mississippi silvery minnow	x		x
Hybognathus placitus	Plains minnow	x		x
Lythrurus fumeus	Ribbon shiner	x		x
Macrhybopsis hyostoma	Shoal chub	x		
Macrhybopsis storeriana	Silver chub	x		x
Notemigonus crysoleucas	Golden shiner	x	x	x
Notropis amnis	Pallid shiner	x		x
Notropis atrocaudalis	Blackspot shiner			x
Notropis buccula	Smalleye shiner	x		
Notropis buchanani	Ghost shiner	x	x	x
Notropis oxyrhynchus	Sharpnose shiner	x		x
Notropis potteri	Chub shiner	x		x
Notropis shumardi	Silverband shiner	x		x
Notropis volucellus	Mimic shiner	x	x	x
Opsopoeodus emiliae	Pugnose minnow	x	x	x
Pimephales promelas	Fathead minnow	x		x
Pimephales vigilax	Bullhead minnow	x	x	x
Platygobio gracilis	Flathead chub	x		
Carpiodes carpio	River carpsucker	x	x	x
Erimyzon oblongus	Creek chubsucker			x
Ictiobus bubalus	Smallmouth buffalo	x		x
Ictiobus niger	Black buffalo			x
Minytrema melanops	Spotted sucker			x
Moxostoma congestum	Gray redhorse		x	x
Astyanax mexicanus	Mexican tetra		x	
Ameiurus melas	Black bullhead	x	x	x

Table 2. Historic occurrence of fish species for the Lower Brazos River mainstem and sampled mainstem tributaries.

Species	Common Name	Lower Brazos River Mainstem Period of Record 1939 - 2005	Western Tributaries Period of Record 1951 - 1973	Eastern Tributaries Period of Record 1938 - 1988
Ameiurus natalis	Yellow bullhead		x	x
Ictalurus furcatus	Blue catfish	x		x
Ictalurus punctatus	Channel catfish	x	x	x
Noturus gyrinus	Tadpole madtom	x	x	x
Pylodictis olivaris	Flathead catfish	x		x
Esox americanus	Chain pickerel			x
Aphredoderus sayanus	Pirate perch	x		x
Strongylura marina	Atlantic needlefish	x		
Cyprinodon variegatus	Sheepshead minnow	x	x	
Fundulus dispar	Starhead topminnow			x
Fundulus notatus	Blackstripe topminnow	x	x	x
Fundulus olivaceus	Blackspotted topminnow	x	x	x
Gambusia affinis	Western mosquitofish	x	x	x
Poecilia latipinna	Sailfin molly	x	x	
Labidesthes sicculus	Brook silverside	x	x	
Menidia beryllina	Inland silverside	x		
Morone chrysops	White bass	x		
Elassoma zonatum	Banded pygmy sunfish			x
Lepomis auritus	Redbreast sunfish		x	
Lepomis cyanellus	Green sunfish	x	x	x
Lepomis gulosus	Warmouth	x	x	x
Lepomis humilis	Orangespotted sunfish	x	x	x
Lepomis macrochirus	Bluegill	x	x	x
Lepomis marginatus	Dollar sunfish	x		x
Lepomis megalotis	Longear sunfish	x	x	x
Lepomis microlophus	Redear sunfish	x	x	x
Lepomis punctatus	Spotted sunfish	x		x
Lepomis symmetricus	Bantam sunfish	x		
Micropterus punctulatus	Spotted bass	x	x	x
Micropterus salmoides	Largemouth bass	x	x	x
Pomoxis annularis	White crappie	x		x
Pomoxis nigromaculatus	Black crappie	x	x	x
Etheostoma chlorosomum	Bluntnose darter	x		x
Etheostoma gracile	Slough darter	x	x	x
Etheostoma parvipinne	Goldstripe darter			x
Etheostoma spectabile	Orangethroat darter		x	
Percina caprodes	Logperch	x	x	
Percina macrolepida	Bigscale logperch		x	
Percina sciera	Dusky darter	x	x	x

Table 2. Historic occurrence of fish species for the Lower Brazos River mainstem and sampled mainstem tributaries.

Species	Common Name	Lower Brazos River Mainstem Period of Record 1939 - 2005	Western Tributaries Period of Record 1951 - 1973	Eastern Tributaries Period of Record 1938 - 1988
Aplodinotus grunniens	Freshwater drum	x		x
Tilapia aureus	Blue tilapia	x		
Agonostomus monticola	Mountain mullet	x		
Mugil cephalus	Striped mullet	x		
Mugil curema	White mullet	x		

The remaining data results are presented by site location in table format. Photographs and additional information are available on CD in Appendix C.

Table 3. Summary of depth, velocity, and dominant substrate types by site, sample collection method (siene "S", boat electrofishing "BE", backpack electrofishing "BP"), and habitat. See Table 1 for site descriptions.

Site_id	Method	Habitat	Number of samples	Depth (ft)			Velocity (ft/s)			Number of samples			
				Min	Mean	Max	Min	Mean	Max	Silt/ Clay	Sand	Gravel	Rubble/ Cobble
12020	BE	pool	3	5.2	6.4	7.1	0.24	0.76	1.13	3			
12020	BE	run	8	1.7	3.8	6.5	0.09	0.66	1.13	3	5		
12020	S	run	10	0.9	1.9	3.5	-0.12	0.54	0.93	4	6		
12030	BE	backwater	1	5.6	5.6	5.6	0.57	0.57	0.57	1			
12030	BE	run	6	1.7	2.3	3.5	0.35	1.15	1.83	2	4		
12030	S	backwater	1	0.9	0.9	0.9	1.19	1.19	1.19		1		
12030	S	run	9	1.4	2.0	3.4	0.74	1.36	1.79		9		
12040	BE	pool	3	0.9	2.1	3.2	0.05	0.21	0.47	3			
12040	BE	run	4	1.7	3.3	5.1	-0.03	0.10	0.17	4			
12040	BP	backwater	1	2.0	2.0	2.0	-0.06	-0.06	-0.06	1			
12040	BP	run	4	1.2	1.7	2.4	0.12	0.71	1.36	2	2		
12040	S	backwater	1	0.5	0.5	0.5	-0.04	-0.04	-0.04	1			
12040	S	pool	4	1.9	2.7	3.3	-0.05	0.13	0.28	4			
12040	S	run	5	0.7	1.8	2.1	0.12	0.87	1.36	5			
12060	BE	backwater	1	3.0	3.0	3.0	0.05	0.05	0.05	1			
12060	BE	pool	1	4.2	4.2	4.2	0.72	0.72	0.72			1	
12060	BE	run	5	1.7	2.4	3.3	0.21	0.56	1.27	5			
12060	S	pool	1	1.8	1.8	1.8	0.05	0.05	0.05	1			
12060	S	riffle	4	0.2	0.5	0.9	1.18	1.36	1.72			4	
12060	S	run	7	0.9	1.6	2.5	-0.13	0.60	1.93	2	1	4	
12070	BE	backwater	2	2.4	2.7	3.0	-0.28	-0.19	-0.11	2			
12070	BE	chute	1	3.2	3.2	3.2	1.47	1.47	1.47		1		
12070	BE	pool	1	5.5	5.5	5.5	0.11	0.11	0.11	1			
12070	BE	run	5	1.3	4.4	7.5	0.20	0.46	0.83	2	3		
12070	BP	backwater	1	2.1	2.1	2.1	-0.76	-0.76	-0.76			1	
12070	BP	riffle	3*	0.3	0.7	1.3	1.01	2.01	3.16		1	1	
12070	BP	run	4	1.4	2.0	3.0	0.53	1.41	2.66		1	3	
12070	S	backwater	2	1.0	1.4	1.7	-0.14	0.38	0.90			2	
12070	S	riffle	5	0.3	0.5	1.0	1.38	2.36	3.25	1		3	1
12070	S	run	3	1.3	1.5	1.8	1.50	1.76	1.90		1	1	1
12080	BE	backwater	2	2.0	5.0	8.0	-0.06	-0.05	-0.04	2			
12080	BE	run	6	0.7	3.5	6.0	0.01	0.11	0.25	6			
12080	BP	backwater	2	1.5	1.9	2.3	-0.04	-0.04	-0.03	1	1		
12080	BP	chute	3	0.7	1.4	1.9	2.81	3.19	3.66		2		1
12080	BP	riffle	1	0.8	0.8	0.8	2.12	2.12	2.12		1		

Table 3 (Continued). Summary of depth, velocity, and dominant substrate types by site, sample collection method (siene "S", boat electrofishing "BE", backpack electrofishing "BP"), and habitat. See Table 1 for site descriptions.

Site_id	Method	Habitat	Number of samples	Depth (ft) Min	Depth (ft) Mean	Depth (ft) Max	Velocity (ft/s) Min	Velocity (ft/s) Mean	Velocity (ft/s) Max	Number of samples Silt/ Clay	Sand	Gravel	Rubble/ Cobble
12080	BP	run	1	1.9	1.9	1.9	1.57	1.57	1.57		1		
12080	S	backwater	1	0.7	0.7	0.7	0.14	0.14	0.14	1			
12080	S	pool	4	0.7	0.9	1.0	-0.05	0.02	0.07	4			
12080	S	riffle	1	0.6	0.6	0.6	0.56	0.56	0.56		1		
12080	S	run	4	0.4	1.5	3.7	-0.08	0.70	1.45	1	2	1	
12087	BE	backwater	3	3.0	4.9	6.5	0.03	0.09	0.21	3			
12087	BE	run	3	1.2	2.1	3.0	0.17	0.74	1.65	1	2		
12087	S	backwater	1	1.5	1.5	1.5	0.00	0.00	0.00		1		
12087	S	pool	1	2.7	2.7	2.7	0.03	0.03	0.03		1		
12087	S	riffle	3	0.3	0.5	0.6	2.04	2.47	3.01			3	
12087	S	run	5	1.2	1.7	2.8	0.10	1.64	2.51	1		4	
12090	BE	backwater	2	4.0	4.1	4.2	0.15	0.29	0.42	2			
12090	BE	run	5	1.2	2.3	4.0	0.09	0.42	1.35	4	1		
12090	S	backwater	3	0.5	0.9	1.6	-0.02	0.12	0.20		3		
12090	S	riffle	3	0.1	0.2	0.3	1.04	1.55	2.35			3	
12090	S	run	6	0.9	1.5	2.4	0.16	1.26	2.52		2	4	

* No substrate type recorded for one of the samples.

Table 4. Occurrences of fish species by Brazos basin sample site collected during summer 2006. See Table 1 for site descriptions.

Species	Common name	Sample sites 12020	12030	12040	12060	12070	12080	12087	12090
Ameiurus natalis	yellow bullhead				X	X			
Aplodinotus grunniens	freshwater drum								X
Atractosteus spatula	alligator gar			X					
Campostoma anomalum	central stoneroller								X
Carpiodes carpio	river carpsucker	X	X		X	X	X	X	X
Cyprinella lutrensis	red shiner	X	X	X	X	X	X	X	X
Cyprinella venusta	blacktail shiner	X	X	X	X	X	X	X	X
Cyprinus carpio	common carp				X				X
Dorosoma cepedianum	gizzard shad	X	X	X		X	X	X	X
Dorosoma petenense	threadfin shad	X	X			X	X	X	X
Etheostoma chlorosoma	bluntnose darter			X					
Etheostoma gracile	slough darter			X					
Fundulus notatus	blackstripe topminnow			X					
Gambusia affinis	western mosquitofish	X	X	X	X	X	X	X	X
Hybognathus nuchalis	Mississippi silvery minnow	X	X	X					
Hybopsis amnis	pallid shiner	X							
Ictalurus furcatus	blue catfish	X				X		X	X
Ictalurus punctatus	channel catfish	X	X	X	X	X	X	X	X
Ictiobus bubalus	smallmouth buffalo			X				X	
Labidesthes sicculus	brook silverside			X					
Lepisosteus oculatus	spotted gar	X	X	X			X		
Lepisosteus osseus	longnose gar	X	X	X	X	X	X	X	X
Lepomis cyanellus	green sunfish		X			X			X
Lepomis gulosus	warmouth			X					
Lepomis humilis	orangespotted sunfish		X	X				X	
Lepomis macrochirus	bluegill			X	X			X	X
Lepomis megalotis	longear sunfish	X	X	X	X	X	X	X	X
Lepomis microlophus	redear sunfish			X					X
Lepomis sp.(unknown)	hybrid sunfish	X							
Lepomis sp.(unknown)	sunfish sp. 1						X		
Lythrurus fumeus	ribbon shiner			X					
Macrhybopsis hyostoma	shoal chub	X	X			X	X	X	
Menidia beryllina	inland silverside		X			X	X		X

Table 4 (continued). Occurrences of fish species by Brazos basin sample site collected during summer 2006. See Table 1 for site descriptions.

Table 4 (continued). Occurrences of fish species by Brazos basin sample site collected during summer 2006. See Table 1 for site descriptions.

Species	Common name	Sample sites 12020	12030	12040	12060	12070	12080	12087	12090
Micropterus punctulatus	spotted bass	X		X	X			X	X
Micropterus salmoides	largemouth bass	X		X	X	X		X	X
Minytrema melanops	spotted sucker			X					
Moxostoma congestum	gray redhorse				X				X
Mugil cephalus	striped mullet	X	X						
Notropis buchanani	ghost shiner	X	X		X	X	X	X	X
Notropis oxyrhynchus	sharpnose shiner		X						
Notropis potteri	chub shiner	X	X						
Notropis shumardi	silverband shiner	X	X			X	X	X	X
Notropis volucellus	mimic shiner				X			X	X
Noturus gyrinus	tadpole madtom			X					
Opsopoeodus emiliae	pugnose minnow			X				X	
Percina sciera	dusky darter			X	X	X	X	X	
Pimephales vigilax	bullhead minnow	X	X	X	X	X	X	X	X
Pomoxis annularis	white crappie		X	X					
Pomoxis nigromaculatus	black crappie			X					
Pylodictis olivaris	flathead catfish	X	X	X	X	X	X	X	X

Conclusions

Concurrent to this project, Dr. Tim Bonner, Texas State University, has been preparing annotated species lists that outline historical fish species distribution and abundance within the study area (as well as in the San Antonio and Sabine rivers), temporal trends in occurrence, life history information, and linkages between life history and physical habitat, and other environmental requirements. The overall intent of that project is to develop an understanding of fish assemblage dynamics.

This project complements that work by providing current information about fish assemblages in the river and filling obvious spatial and temporal data gaps. Additional work is anticipated in evaluating sub-basin areal and historical trends in fish species occurrence and assemblage dynamics as well as preliminary efforts to evaluate habitat utilization and guilding. Historical and 2006 species occurrences will be examined for geographical trends, considering eastern and western tributaries and longitudinal trends within the main stem of the Brazos. Historic and 2006 collections will be compared to determine any discernable differences in fish assemblages over time and identify additional sampling strategies for augmenting the collection record. Habitat and fish assemblage data from 2006 will be analyzed to evaluate correlations between physical habitat variables and species occurrence. We will also give preliminary consideration to defining mesohabitat-based guilds for future testing.

Recommendations for Additional Work

Since this study was conducted during the summer months, it would be helpful to revisit some of the sites during the winter using the same fish collection and habitat assessment methods. This would provide an opportunity to pick up additional species which may have been missed during the summer, and provide information on winter habitat utilization. When cooler winter temperatures are combined with low flows, water clarity can be superior, allowing more effective netting while electrofishing. Sample collection during spring spawning season would also provide useful data. Also, since larger species may have been missed in deeper waters, an additional sampling method such as hoop net deployment might prove effective in augmenting fish collections.

If possible, sampling additional tributary sites would be helpful. A few sites could be selected from the following list and would provide useful data on species assemblages and habitat utilization.

Yegua Cr downstream of Lake Somerville
Leon River at FM 1829 near Gatesville
San Gabriel R near FM 486
Lampasas R immediately downstream of Stillhouse Hollow Reservoir
Lampasas R upstream of Stillhouse Hollow
Leon R downstream of Belton Reservoir, at FM 436
Leon R near Hamilton, perhaps at SH 22
San Gabriel R between Georgetown and Granger Reservoirs
North Bosque R upstream of Lake Waco

References

Annear, T., I. Chisholm, H. Beecher, A. Locke and 12 other authors. 2004. Instream flows for riverine resource stewardship, revised edition. Instream Flow Council, Cheyenne, Wyoming.

NRC (National Research Council). 2005. The science of instream flows: a review of the Texas Instream Flow Program. National Academies Press, Washington, D.C. Available online: <http://books.nap.edu/catalog/11197.html>.

TCEQ (Texas Commission on Environmental Quality). 2005. Surface water quality monitoring procedures. Volume 2: methods for collecting and analyzing biological community and habitat data. RG-416. TCEQ, Austin, TX. http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/wqm/mtr/swqm_procedures.html

APPENDIX A
SCOPE OF WORK

Scope of Work

SUPPLEMENT EXISTING BIOLOGICAL DATA IN THE BRAZOS RIVER STUDY AREA

Background: A preliminary evaluation of existing biological data in the lower San Antonio, middle and lower Brazos, and lower Sabine sub-basins indicate potential gaps in historical collections that should be supplemented to allow a thorough understanding of the systems and their biology. The goal of this proposal would be to conduct new biological collections, which would facilitate a better understanding of the fish assemblage dynamics within those sub-basins. These collections are aimed at improving baseline data as part of scoping potential instream flow studies in these basins and allowing preparation of a conceptual model of fish assemblage dynamics in the study areas.

Task 1: Collect fish assemblage and associated data

Through coordination between the river authorities, Texas Parks and Wildlife Department (TPWD), Texas Water Development Board, and Texas Commission on Environmental Quality (TCEQ), eight (8) appropriate sampling locations will be developed to fill baseline data needs within the middle and/or lower Brazos river study areas. Among the considerations for selecting sampling sites are:

- Geographic gaps in data identified from river authority databases;
- A lack of recent collections (e.g., post 1990);
- Overall geographic coverage, especially as it relates to areas where focused instream flow study efforts are anticipated.

In general, sampling methods for fish assemblages will follow those outlined in *Surface Water Quality Monitoring Procedures, Vol. 2: Methods for Collecting and Analyzing Biological Community Habitat Data* (TCEQ 2005). Collections will include boat and backpack electrofishing as well as seining.

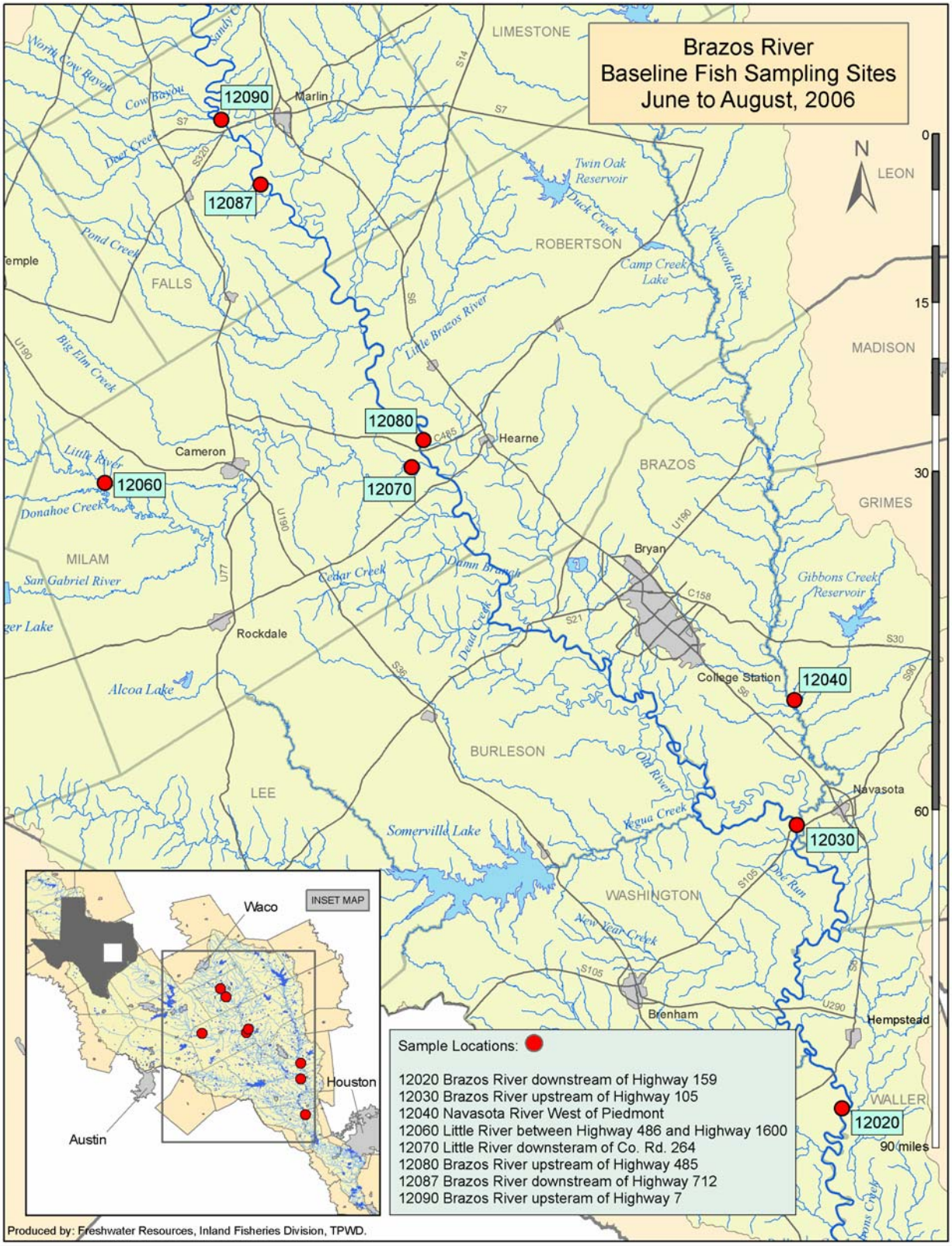
Though sampling duration will follow that outlined in the above reference, collections will be segregated by identified major habitat types (e.g., riffle, run, pool). A global position system receiver will be used to take a location at the mid-point of each habitat type (datum=WGS84; units=decimal degrees; reception=3D) and will be tied to an upstream, downstream, left bank, and right bank photograph (left and right banks as facing downstream). A measurement will be made of average habitat depth, dominant substrate, and current velocity.

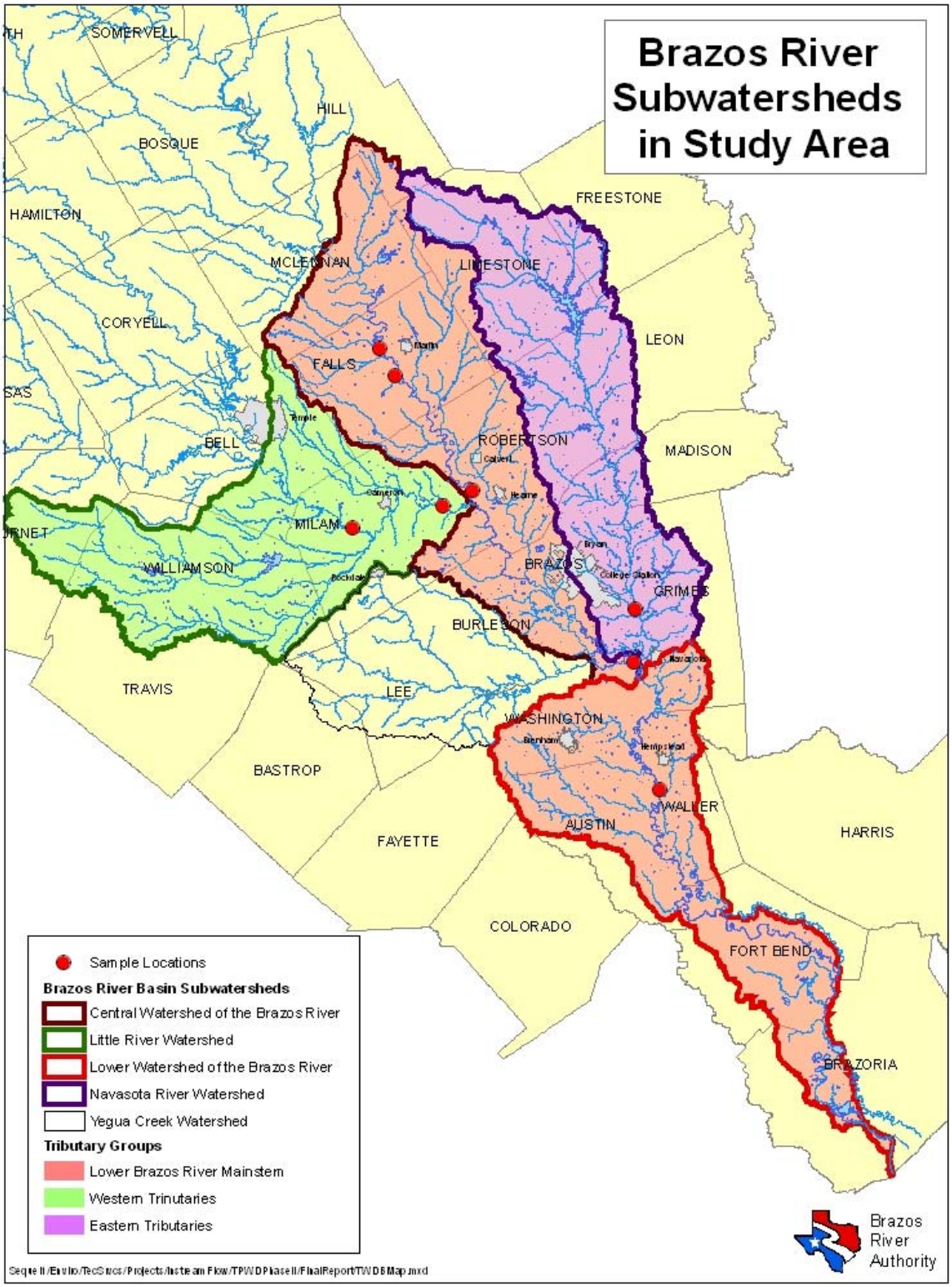
Sampling will be conducted in consultation with TWDB, TPWD, and TCEQ and a representative from each agency will be notified prior to field sampling events to allow their participation if desired. TPWD will provide technical assistance in field sampling, technical consultation as needed, and quality assurance for identification of biological specimens.

Task 2: Identify fishes, prepare species lists, and report data

Fishes collected in the field will be identified following the requirements for identification, retention, and vouchering outlined in the TCEQ manual cited above. Fish assemblage, location, and habitat information will be reported in Microsoft Excel format. Photographs will be submitted in a suitable electronic format and georeferenced.

APPENDIX B
Study Area Maps


Brazos River
Baseline Fish Sampling Sites
June to August, 2006
LIMESTONE
LEON
ROBERTSON
FALLS
MADISON
BRAZOS
GRIMES
MILAM
LEE
BURLESON
WASHINGTON
WALLER
12090
12087
12080
12070
12060
12040
12030
12020
Marlin
Cameron
Hearne
Bryan
College Station
Rockdale
Navasota
Brenham
Hempstead
Twin Oak Reservoir
Camp Creek Lake
Gibbons Creek Reservoir
Somerville Lake
Alcoa Lake
Little Brazos River
Navasota River
Old River
Dead Creek
Cedar Creek
Donahoe Creek
Little River
San Gabriel River
Big Elm Creek
Pond Creek
Duck Creek
Dime Run
New Year Creek
Regua Creek
INSET MAP
Waco
Houston
Austin
Sample Locations:
12020 Brazos River downstream of Highway 159
12030 Brazos River upstream of Highway 105
12040 Navasota River West of Piedmont
12060 Little River between Highway 486 and Highway 1600
12070 Little River downsteram of Co. Rd. 264
12080 Brazos River upstream of Highway 485
12087 Brazos River downstream of Highway 712
12090 Brazos River upsteram of Highway 7
0
15
30
60
90 miles
Produced by: Freshwater Resources, Inland Fisheries Division, TPWD.


Brazos River Subwatersheds in Study Area
SOMERVELL
HILL
BOSQUE
HAMILTON
FREESTONE
MCLENNAN
LIMESTONE
CORYELL
LEON
FALLS
ROBERTSON
BELL
MADISON
MILAM
WILLIAMSON
BRAZOS
GRIMES
BURLESON
TRAVIS
LEE
WASHINGTON
BASTROP
WALLER
AUSTIN
HARRIS
FAYETTE
COLORADO
FORT BEND
BRAZORIA
Sample Locations
Brazos River Basin Subwatersheds
Central Watershed of the Brazos River
Little River Watershed
Lower Watershed of the Brazos River
Navasota River Watershed
Yegua Creek Watershed
Tributary Groups
Lower Brazos River Mainstem
Western Trinutaries
Eastern Tributaries
Brazos River Authority

APPENDIX C
Electronic Data CD
(Attached)