Technical Study Summaries: Middle and Lower Brazos River
Biological Data

Fish Population Changes (July 2007)
By Dr. Timothy Bonner and Dennis T. Runyan

A total of 67 species were observed in 118 historical collections from the main stem Brazos River, according to the study.

Trend analysis indicated that:
- Eight species declined in population over time;
- Four species increased in population;
- Omnivores increased, while piscivores decreased (see Table 1)

This study drew from museum records, unpublished and published data, and agency reports covering the period 1939 and 2006.

Full report: http://www.twdb.state.tx.us/RWPG/rpgm_rpts/2005483033_fish.pdf

Oxbow Lake Response to Hydrologic Exchanges with the Brazos River (December 2004)
By Dr. Kirk Winemiller, Dr. Fran Gelwick, and Dr. Timothy Bonner

Oxbow lakes are formed when a wide meander from the main stem of a river is cut off from the main channel. This study found that oxbow lakes provide essential aquatic habitats that increase the overall fish diversity in the lower Brazos River. Six oxbow lakes and three sites in the Brazos River channel were surveyed between June 2003 and September 2004 including upstream and downstream of the site selected for the Allen's Creek reservoir.

Findings suggest that:
- Oxbow lakes contained high densities of white crappie, sunfishes, and shads, unlike the main river channel.
- For species common in oxbow lakes, density tended to decline following periods of peak flow, which indicates a net export of individuals from oxbows to the river channel during floods that connect these habitats.
- Species adapted to higher water velocities appeared in low to moderate numbers in oxbows during periods of peak flow, but generally did not survive more than a month or two.

The study complemented research by the Texas Water Development Board that examined the effect land and water features have on channel connectivity.

Full report:
http://www.twdb.state.tx.us/RWPG/rpgm_rpts/2003483493_2003483006_Response_Oxbow_Lake_Biota_Hydrologic_Exchanges_with_Brazos_River_Channel_with_TWDB_Work.pdf

Fish Collections Updated (2007-2008)

Brazos River Authority, Texas Parks and Wildlife, Texas Commission on Environmental Quality, and Texas Water Development Board

Fish were collected from the middle and lower Brazos River, Little River, and Navasota River to update biological information and fill information gaps about fish populations. Sampling 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.

In addition, the data are intended to provide a baseline for potential instream flow studies, identify trends in fish populations and develop a conceptual model of fish population dynamics.

Fish were collected using backpack and boat electrofishing and seining in discrete habitats. Global positioning system coordinates and photos were taken at each sample location and the habitat was measured for depth, substrate, and current velocity.

Full report:
http://www.twdb.state.tx.us/RWPG/rpgm_rpts/2005483561_BiologicalDataCollection.pdf

In May 2008, a new site on the Brazos River near College Station, referred to as Mussel Shoals, was added to the baseline instream sampling, bringing the total to six main stem and three tributary sites. The effort is expected to deepen the program's understanding of fish species and their associated habitats. TPWD staff analyzed habitat, historic and current fish assemblage data.

Pimpleback freshwater mussel found in abundance, Fawnsfoot mussel found rarely (2008)

By Alexander Y. Karatayev, and Lyubov E. Burlakova

Some 12 species - including 463 live mussels - were found at 44 sites in the lower and middle sub-basins of the Brazos River and its tributaries during this survey of freshwater mussel populations.

The smooth pimpleback freshwater mussel, native to central Texas, was found in high densities at 14 sites in the Brazos basin.

The Texas fawnsfoot mussel, also native to central Texas, was found in the lower Brazos only once as a live specimen. Dead specimens of the rare species were found at three other locations.

Full Report:
http://www.twdb.state.tx.us/RWPG/rpgm_rpts/0604830631FreshwaterMussels.pdf

Mussel survey shows Brazos River supports diversity (2008)
By Charles Randklev and James Kennedy

Sampling efforts at four sites were undertaken to survey mussel beds in the lower Brazos River drainage; measure the physical and biological characteristics of the habitats associated with any mussel beds; document the distribution and habitats of mussels; and identify four mussel beds for continued monitoring of habitat under varying flow conditions.

This survey found that:

- The lower Brazos River supports high freshwater mussel diversity, similarly to the findings of the Karatayev and Lyubov survey performed earlier in 2008.

- Densities appear to be greatest in Yegua Creek and the Navasota River.

- A large mussel die-off was discovered in the Brazos River near FM 485. The cause is unclear.

Table 1.- Historic and recent fish species collected in the middle and lower Brazos River mainstem and major tributaries.

			Mainstem		Western Tributaries		Eastern Tributaries	
Species	**Common name**	**Trend**	Historic 1939 - 2005	**Recent**	Historic 1951 - 1973	**Little River Recent**	Historic 1938 - 1988	**Navasota River Recent**
Atractosteus spatula	alligator gar		X	**X**			X	**X**
Lepisosteus oculatus	spotted gar		X	**X**			X	**X**
Lepisosteus osseus	longnose gar		X	**X**		**X**	X	**X**
Amia calva	bowfin		X				X	
Alosa chrysochloris	skipjack shad		X					
Dorosoma cepedianum	gizzard shad	↓	X	**X**	X	**X**	X	**X**
Dorosoma petenense	threadfin shad		X	**X**	X	**X**	X	
Campostoma anomalum	Central stoneroller		X	**X**	X		X	
Cyprinella lutrensis	red shiner	↑	X	**X**	X	**X**	X	**X**
Cyprinella venusta	blacktail shiner		X	**X**	X	**X**	X	**X**
*Cyprinus carpio**	common carp		X	**X**	X	**X**	X	
Hybognathis nuchalis	Mississippi silvery minnow	↓	X	**X**	X		X	**X**
Hybognathus placitus	plains minnow		X		X		X	
Hybopsis amnis	pallid shiner		X	**X**	X		X	
Lythrurus fumeus	ribbon shiner		X				X	**X**
Macrhybopsis hyostoma	shoal chub	↓	X	**X**	X	**X**		
Macrhybopsis storeriana	silver chub	↓	X		X		X	
Notemigonus crysoleucas	golden shiner		X	**X**	X		X	
Notropis atrocaudalis	blackspot shiner				X		X	
Notropis buccula	smalleye shiner	↓	X		X			
Notropis buchanani	ghost shiner	↑	X	**X**	X	**X**	X	
Notropis oxyrhynchus	sharpnose shiner	↓	X	**X**	X		X	
Notropis potteri	chub shiner	↓	X	**X**	X			
Notropis shumardi	silverband shiner		X	**X**	X	**X**	X	
Notropis volucellus	mimic shiner		X	**X**	X	**X**	X	
Opsopoeodus emiliae	pugnose minnow		X	**X**	X		X	**X**
*Pimephales promelas**	fathead minnow		X				X	
Pimephales vigilax	bullhead minnow	↑	X	**X**	X	**X**	X	**X**
Platygobio gracilis	flathead chub		X					
Carpiodes carpio	river carpsucker	↓	X	**X**	X	**X**	X	
Erimyzon oblongus	creek chubsucker						X	
Ictiobus bubalus	smallmouth buffalo		X	**X**	X		X	**X**
Ictiobus niger	black buffalo						X	
Minytrema melanops	spotted sucker						X	**X**
Moxostoma congestum	gray redhorse			**X**	X	**X**	X	
Astyanax mexicanus	Mexican tetra				X			
Ameiurus melas	black bullhead		X		X		X	
Ameiurus natalis	yellow bullhead			**X**	X	**X**	X	
Ictalurus furcatus	blue catfish		X	**X**		**X**	X	
Ictalurus punctatus	channel catfish	↓	X	**X**	X	**X**	X	**X**
Noturus gyrinus	tadpole madtom		X		X		X	**X**
Pylodictis olivaris	flathead catfish		X	**X**		**X**	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	**X**
Fundulus olivaceus	blackspotted topminnow		X	**X**	X		X	
Gambusia affinis	Western mosquitofish	↑	X	**X**	X	**X**	X	**X**
Poecilia latipinna	sailfin molly		X		X			
*Labidesthes sicculus**	brook silverside		X		X			**X**
Menidia beryllina	inland silverside		X	**X**		**X**		
*Morone chrysops**	white bass		X					
Elassoma zonatum	banded pygmy sunfish						X	
Lepomis auritus	redbreast sunfish				X			
Lepomis cyanellus	green sunfish		X	**X**	X	**X**	X	
Lepomis gulosus	warmouth	↓	X		X		X	**X**
Lepomis humilis	orangespotted sunfish		X	**X**	X		X	**X**
Lepomis macrochirus	bluegill		X	**X**	X	**X**	X	**X**
Lepomis marginatus	dollar sunfish		X				X	
Lepomis megalotis	longear sunfish		X	**X**	X	**X**	X	**X**
Lepomis microlophus	redear sunfish		X	**X**	X		X	**X**
Lepomis miniatus	spotted sunfish		X				X	
Lepomis symmetricus	bantam sunfish		X					
Micropterus punctulatus	spotted bass		X	**X**	X	**X**	X	**X**
Micropterus salmoides	largemouth bass		X	**X**	X	**X**	X	**X**
Pomoxis annularis	white crappie	↓	X	**X**			X	**X**

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Species	**Common name**	**Trend**	Historic 1939 - 2005	**Recent**	Historic 1951 - 1973	**Little River Recent**	Historic 1938 - 1988	**Navasota River Recent**
Pomoxis nigromaculatus	black crappie		X		X		X	**X**
Etheostoma chlorosomum	bluntnose darter		X	**X**			X	**X**
Etheostoma gracile	slough darter		X	**X**	X		X	**X**
Etheostoma parvipinne	goldstripe darter						X	
Etheostoma spectabile	orangethroat darter			**X**	X	**X**		
Percina carbonaria	logperch		X		X			
Percina macrolepida	bigscale logperch				X			
Percina sciera	dusky darter		X	**X**	X	**X**	X	**X**
Aplodinotus grunniens	freshwater drum	↓	X	**X**			X	
*Tilapia aureus**	blue tilapia		X					
Agonostomus monticola	mountain mullet		X					
Mugil cephalus	striped mullet		X	**X**				
Mugil curema	white mullet		X					
Total number of species			**67**	**44**	**50**	**26**	**60**	**30**

**Introduced species*

Potential Biological Indicators: Middle and Lower Brazos River

Biological Objectives

Identify and manage flow regimes for the benefit of the native ecosystem (i.e. habitat, flora, and fauna)

Maintain a diverse aquatic community and prevent the extinction of native species

Preserve/protect and restore/improve key habitat features for native species in river and riparian zones

Biological Indicators

Category	Indicator	Explanation
Instream Biological Communities	Native Richness	Richness, or the number of species or taxa, is a measure of community health, can be applied at a variety of scales (reach to basin to statewide), and can be related to modifications in flow. May also use proportions such as the proportion of native to non-native species.
	Relative Abundance	The number of organisms of a particular species as a percentage of the total community
	Fish	Fish are useful indicators because: • they occupy a range of habitats and have a variety of life histories that are generally known; • their position at various levels of the aquatic food chain provides an integrative view of the watershed; • they are useful for examining both direct toxicity and stressful conditions by looking at indicators such as missing species or depressed growth and reproduction; • they are valued by the public. There are many species of fish in the river and all of them cannot be studied individually. Those that may warrant study include: • Flow sensitive species • Sport fishes • Prey species • Imperiled species • Intolerant species
	Other Aquatic Organisms	Benthic invertebrates, mussels, river and riparian plants, and other vertebrates may be appropriate as indicators.

Instream Habitat	Habitat Quality and Quantity for Key Species	Involves relating suitable habitat (microhabitat) and flow for key species. Habitat attributes may include current velocity, depth, substrate and cover; other attributes may be important for some species.
	Mesohabitat Area and Diversity	This indicator stems from the knowledge that diverse habitats support diverse communities. Mesohabitat analysis provides a quantifiable relationship between larger scale habitat (e.g. riffles, runs, pools) area and flow; habitat diversity can be derived from same data. Uses biological data for all species in a community (e.g., fish species) to define the attributes of each mesohabitat.
Riparian Habitat	<u>Vegetation</u> • Age class distribution of riparian plant species • Riparian species richness and diversity • Density • % Canopy cover <u>Soils</u> • Riparian soil types <u>Hydrology</u> • Gradient of inundation, base flow levels	These are key components in assessing the diversity, health, and functionality of riparian habitat and ensuring that adequate riparian species are present for recruitment and maintenance of the ecosystem. Riparian plants typically must maintain contact with the water table, so their presence and diversity is an important indicator of soil moisture (water table) characteristics. The listed vegetation parameters can be correlated with important riparian functions, such as streambank stabilization, temperature dynamics, and nutrient cycling. In the absence of riparian vegetative indicators, soil characteristics identified by the soil survey database can be used to determine past or present hydrologic influence and hence historical riparian area extent. Periodic occurrence of flood (overbanking) flows, associated channel dynamics, and the preservation of base flows capable of sustaining high floodplain water tables are essential to maintaining the health of riparian ecosystems. Ground water depths can be sampled at each study reach and coupled with surface water data to produce a probability of inundation curve. Overbanking flow requirements can be modeled.