Technical Study Summaries: Lower San Antonio River

Biological Data

Fish Population Changes in Three Western Gulf Slope Drainages (2008)

By Timothy Bonner and Dennis T. Runyan

Fifty-seven fish species (Table 1) have been reported in the main stem of the San Antonio River based upon 73 collections (earliest report was 1950).


One native species - the pugnose minnow – significantly declined in abundance.

Seventeen species showed stable populations and 35 showed indeterminable changes.

Only four non-native species were reported in the earliest records; whereas, now there are 17.


The San Antonio River Authority, Texas Parks and Wildlife Department, Texas Commission on Environmental Quality, and Texas Water Development Board collected baseline data for the lower San Antonio River and lower Cibolo Creek from March through October 2006 and June 2008.

The primary focus of this study was the characterization of fish populations (see Current columns in Table 1) at each sampling site (Table 2) and their association with river habitats to help understand current conditions and guide future research.


Distributional Survey and Habitat Utilization of Freshwater Mussels (2007)

By Alexander Y. Karatayev and Lyubov E. Burlakova

Only two live species were found in Cibolo Creek – threeridge and yellow sandshell.

In addition to these two species, golden orb and Tampico pearly mussel were also found in the San Antonio River.

Of these species, the golden orb is the most significant find as the American Fisheries Society considers this species of special concern because of a suspected decline in their population.

Table 1. Historical and current fish occurrences for the lower San Antonio River and lower Cibolo Creek. Status refers to native (N) or introduced (I).

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Status</th>
<th>San Antonio River</th>
<th>Cibolo Creek</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atractosteus spatula</td>
<td>alligator gar</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Lepisosteus oculatus</td>
<td>spotted gar</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Lepisosteus osseus</td>
<td>longnose gar</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Anguilla rostrata</td>
<td>American eel</td>
<td>N</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Dorosoma cepedianum</td>
<td>gizzard shad</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Dorosoma petenense</td>
<td>threadfin shad</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Campostoma anomalum</td>
<td>central stoneroller</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Cyprinella lutrensis</td>
<td>red shiner</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Cyprinella venusta</td>
<td>blacktail shiner</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Cyprinus carpio</td>
<td>common carp</td>
<td>I</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Macrhybopsis marconis</td>
<td>burrhead chub</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Notemigonus crysoleucas</td>
<td>golden shiner</td>
<td>I</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Notropis amabilis</td>
<td>Texas shiner</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Notropis buchanani</td>
<td>ghost shiner</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Notropis stramineus</td>
<td>sand shiner</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Notropis texanus</td>
<td>weed shiner</td>
<td>N</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Notropis volucellus</td>
<td>mimic shiner</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Opsopoeodus emiliae</td>
<td>pugnose minnow</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pimephales promelas</td>
<td>fathead minnow</td>
<td>I</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pimephales vigilax</td>
<td>bullhead minnow</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Carpiodes carpio</td>
<td>river carpsucker</td>
<td>N</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Ictiobus bubalus</td>
<td>smallmouth buffalo</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ictiobus niger</td>
<td>black buffalo</td>
<td>N</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Moxostoma congestum</td>
<td>gray redhorse</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Astyanax mexicanus</td>
<td>Mexican tetra</td>
<td>I</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ameiurus melas</td>
<td>black bullhead</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ameiurus natalis</td>
<td>yellow bullhead</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hypostomus plecostomus</td>
<td>suckermouth catfish</td>
<td>I</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ictalurus furcatus</td>
<td>blue catfish</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ictalurus punctatus</td>
<td>channel catfish</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Noturus gyrinus</td>
<td>tadpole madtom</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Noturus nocturnus</td>
<td>freckled madtom</td>
<td>I</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pterygophlichthys multiradiatus</td>
<td>sailfin catfish</td>
<td>I</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Pyldictis olivaris</td>
<td>flathead catfish</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Mugil cephalus</td>
<td>striped mullet</td>
<td>N</td>
<td>X</td>
<td>X</td>
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</tbody>
</table>
Table 1. Continued.

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Status</th>
<th>San Antonio River</th>
<th>Cibolo Creek</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Historical</td>
<td>Current</td>
</tr>
<tr>
<td><em>Menidia beryllina</em></td>
<td>inland silverside</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Gambusia affinis</em></td>
<td>western mosquitofish</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Poecilia formosa</em></td>
<td>Amazon molly</td>
<td>I</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Poecilia latipinna</em></td>
<td>sailfin molly</td>
<td>I</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Xiphophorus helleri</em></td>
<td>green swordtail</td>
<td>I</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><em>Fundulus notatus</em></td>
<td>blackstripe</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Morone chrysops</em></td>
<td>white bass</td>
<td>I</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><em>Lepomis auritus</em></td>
<td>redbreast sunfish</td>
<td>I</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Lepomis cyanellus</em></td>
<td>green sunfish</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Lepomis gulosus</em></td>
<td>warmouth</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Lepomis humilis</em></td>
<td>orangespotted</td>
<td>I</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Lepomis macrochirus</em></td>
<td>bluegill</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Lepomis marginatus</em></td>
<td>dollar sunfish</td>
<td>I</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><em>Lepomis megalotis</em></td>
<td>longear sunfish</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Lepomis microlophus</em></td>
<td>reedear sunfish</td>
<td>N</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><em>Lepomis miniatus</em></td>
<td>redspotted sunfish</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Micropterus dolomieu</em></td>
<td>smallmouth bass</td>
<td>I</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><em>Micropterus punctulatus</em></td>
<td>spotted bass</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Micropterus salmoides</em></td>
<td>largemouth bass</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Micropterus treculi</em></td>
<td>Guadalupe bass</td>
<td>N</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><em>Pomoxis annularis</em></td>
<td>white crappie</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Etheostoma spectabile</em></td>
<td>orangethroat darter</td>
<td>N</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><em>Percina carbonaria</em></td>
<td>Texas logperch</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Percina shumardi</em></td>
<td>river darter</td>
<td>N</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Aplodinotus grunniens</em></td>
<td>freshwater drum</td>
<td>N</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><em>Cichlasoma cyanoguttatum</em></td>
<td>Rio Grande cichlid</td>
<td>I</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Oreochromis aureus</em></td>
<td>blue tilapia</td>
<td>I</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Oreochromis mossambica</em></td>
<td>Mozambique tilapia</td>
<td>I</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><em>Tilapia zilli</em></td>
<td>redbelly tilapia</td>
<td>I</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><em>Trinectes maculatus</em></td>
<td>hogchoker</td>
<td>N</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Current baseline instream flow sampling location sites and location descriptions.

<table>
<thead>
<tr>
<th>Site No.</th>
<th>Location Description</th>
<th>County</th>
</tr>
</thead>
<tbody>
<tr>
<td>19110</td>
<td>San Antonio River at Loop 1604</td>
<td>Bexar</td>
</tr>
<tr>
<td>19100</td>
<td>San Antonio River at Floresville City Park</td>
<td>Wilson</td>
</tr>
<tr>
<td>19090</td>
<td>San Antonio River at Conquista Crossing downstream of FM 791</td>
<td>Karnes</td>
</tr>
<tr>
<td>19080</td>
<td>Cibolo Creek at FM 539</td>
<td>Wilson</td>
</tr>
<tr>
<td>19070</td>
<td>Cibolo Creek at FM 537</td>
<td>Wilson</td>
</tr>
<tr>
<td>19060</td>
<td>Cibolo Creek at FM 389</td>
<td>Karnes</td>
</tr>
<tr>
<td>19050</td>
<td>San Antonio River at SH 72</td>
<td>Karnes</td>
</tr>
<tr>
<td>19040</td>
<td>San Antonio River at Riverdale Crossing</td>
<td>Goliad</td>
</tr>
<tr>
<td>19030</td>
<td>San Antonio River eight miles downstream of Goliad State Park</td>
<td>Goliad</td>
</tr>
<tr>
<td>19020</td>
<td>San Antonio River at Hwy 77</td>
<td>Refugio</td>
</tr>
<tr>
<td>19010</td>
<td>San Antonio River at confluence with Guadalupe River</td>
<td>Refugio</td>
</tr>
</tbody>
</table>
Potential Biological Indicators: Lower San Antonio River

**Biological Objectives**

Determine and maintain flows necessary to support:
- native species and biological communities known to occur in the river and riparian zones
- key aquatic habitats

<table>
<thead>
<tr>
<th>Category</th>
<th>Indicator</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Instream Biological Communities</em></td>
<td>Native Richness</td>
<td>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.</td>
</tr>
<tr>
<td>Relative Abundance</td>
<td></td>
<td>The number of organisms of a particular species as a percentage of the total community</td>
</tr>
<tr>
<td>Fish</td>
<td></td>
<td>Fish are useful indicators because:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• they occupy a range of habitats and have a variety of life histories that are generally known;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• their position at various levels of the aquatic food chain provides an integrative view of the watershed;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• they are useful for examining both direct toxicity and stressful conditions by looking at indicators such as missing species or depressed growth and reproduction;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• they are valued by the public.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>There are many species of fish in the river and all of them cannot be studied individually. Those that may warrant study include:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Flow sensitive species</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Sport fishes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Prey species</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Imperiled species</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Intolerant species</td>
</tr>
<tr>
<td>Other Aquatic Organisms</td>
<td>Benthic invertebrates, river prawn*, mussels, river and riparian plants, other vertebrates may be appropriate as indicators.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* identified in second meeting</td>
</tr>
<tr>
<td>Category</td>
<td>Indicator</td>
<td>Explanation</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Instream Habitat</strong></td>
<td>Habitat Quality and Quantity for Key Species</td>
<td>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.</td>
</tr>
<tr>
<td>Mesohabitat Area and Diversity</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Riparian Habitat</strong></td>
<td>Vegetation</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Age class distribution of riparian plant species</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Riparian species richness and diversity</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Density</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>% Canopy cover</td>
<td></td>
</tr>
<tr>
<td>Soils</td>
<td>Riparian soil types</td>
<td></td>
</tr>
<tr>
<td>Hydrology</td>
<td>Gradient of inundation, base flow levels</td>
<td></td>
</tr>
</tbody>
</table>