



North Fork Guadalupe River, from the Upstream Boundary
of the Kerr Wildlife Management Area to the Farm-to-Market 1340
Bridge Crossing at Mo-Ranch

Sarah McMillan
Stephan Magnelia
Leroy Kleinsasser
Gordon Linam
Melissa Parker

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EXECUTIVE SUMMARY

A 6.4 km reach of the North Fork Guadalupe River between the upstream boundary of the Kerr Wildlife Management Area (WMA) and the low water dam downstream of the Farm-to-Market (FM) 1340 bridge crossing at Mo-Ranch (Figure 1) was surveyed to assess instream physical habitat, water quality, fish, mussel, and macroinvertebrate assemblages, riparian area, and public access locations in April 2012. This river reach is approximately 15 km west of Hunt, Texas in Kerr County. Until this point there have been no published surveys on the habitat or aquatic communities in this portion of the Guadalupe River, although the mainstem Guadalupe River was sampled in 1983 (Twidwell 1987) and in Kendall and Comal counties in 1995 (Terre and Magnelia 1996). While the riparian corridor is protected within the Kerr WMA, there are no regulations protecting the riparian area along other areas of the North Fork Guadalupe River. No special fish harvest regulations or fisheries management practices are currently being used within this reach. Past stockings of genetically pure Guadalupe bass (*Micropterus treculii*) were made with the objective of reducing genetic introgression with smallmouth bass (*Micropterus dolomieu*).

Survey samples classified this reach as having a high to exceptional aquatic life use (TCEQ 2007) for instream physical habitat, fish, and aquatic macroinvertebrate indices of biotic integrity, which is in keeping with a previous designation of the North Fork Guadalupe River as having an exceptional aquatic life use (TCEQ 2010). High quality riparian vegetation and instream habitat promoted diverse macroinvertebrate and fish communities at this site. High water quality and habitat conditions make this a good site for conservation of native species.

Limited angling and recreational opportunities exist for the public in this reach of the river. Two sportfish species, largemouth bass (*Micropterus salmoides*) and channel catfish (*Ictalurus punctatus*), were collected in low abundance during fish surveys; however, electrofishing efficiency was likely poor due to the clear water, and actual abundances of these species may be higher than reported. Reproduction of largemouth bass and channel catfish was documented and supplemental fingerling stockings of these species would likely not increase abundance. Guadalupe bass were not collected although they had previously been experimentally stocked in the reach in an effort to reduce genetic introgression with smallmouth bass. Limited opportunity exists for habitat enhancement seeing as much of the river was shallow with bedrock substrate. Other angling opportunities are available for the six sunfish species that occurred at moderate to high abundances within the reach; however, angler access is limited to three public access areas, two of which had limited parking and bank fishing opportunities.

INTRODUCTION

Site Description

North Fork Guadalupe River: The North Fork Guadalupe River lies within the Edwards Plateau ecoregion of Texas. Fish and Wildlife Springs comprise the headwaters of this river and are located in the western portion of Kerr County, adjacent to the Kerr WMA. These springs are important to sustaining numerous fish and wildlife species, as well as, sustaining baseflows to the mainstem Guadalupe River. From the springs, the North Fork Guadalupe River flows 47 km to the city of Hunt, Texas where it joins the South Fork and becomes the Guadalupe River. The biological function of aquatic and riparian habitats associated with the river support an exceptionally diverse assemblage of macroinvertebrates, fish, reptiles, and bird's characteristic of the Edwards Plateau ecoregion (El-Hage and Moulton 2001).

Kerr Wildlife Management Area: The Kerr WMA is comprised of 2,628 hectares located in Kerr County, Texas, approximately 19.3 km west of the city of Hunt. The property has been owned and operated by the Texas Parks and Wildlife Department (TPWD) since 1950. The primary function of the Kerr WMA is as a wildlife management, research, and training facility promoting wildlife related research, but also offers public hunting and fishing opportunities. The Management Area borders the headwaters of the North Fork Guadalupe River (Figure 1) and offers a public access site for anglers and river recreationists at its upstream boundary (Figure 1). The Management Area and Mo-Ranch, downstream of the WMA, have been designated as destinations on the Heart of Texas Wildlife Trail by TPWD for their recreational opportunities and diverse plant and animal communities representative of the Texas Hill Country.

Management History

Management Strategies and Actions: There are no published fish surveys from the North Fork Guadalupe River. The only fisheries management action enacted in this river within the study area was the reintroduction of genetically pure Guadalupe bass as part of an experimental effort to reduce genetic introgression with smallmouth bass (Gary Garrett, TPWD, personal communication).

Harvest Regulation: Sportfishes in the North Fork Guadalupe River are currently managed under statewide freshwater fishing regulations.

Stocking: Non-native smallmouth bass were stocked in the Guadalupe River from 1974-1981 to provide an additional sportfish species for anglers. Specific stocking locations were not specified. Hybridization with endemic Guadalupe bass was an unanticipated consequence of the smallmouth bass stockings.

Genetically pure Guadalupe bass were stocked annually in the headwaters of the Guadalupe River in Kerr County (including the North Fork at Mo-Ranch, Site D (Figure 1)) from 2007-2010

as part of an experimental effort to reduce genetic introgression with smallmouth bass (Gary Garrett, TPWD, personal communication).

Riparian Vegetation and Habitat: The riparian corridor of the North Fork Guadalupe River supports numerous tree species such as sycamore (*Platanus* sp.), willows (*Salix* sp.), green ash (*Fraxinus pennsylvanica*), bald cypress (*Taxodium distichum*), pecan (*Carya* sp.), hackberry (*Celtis* sp.), plateau live oak (*Quercus fusiformis*), Texas oak (*Quercus texana*), and Ashe juniper (*Juniperus ashei*). The Kerr WMA has been designated as a riparian conservation area to protect this habitat (El-Hage and Moulton 2001).

Instream Aquatic Vegetation and Habitat: No studies have been published describing instream aquatic vegetation or habitat. No management actions have been used to control aquatic vegetation or enhance instream habitats.

METHODS

Instream Physical Habitat: Six equidistant habitat transects were assessed over a 500 m reach between the angler access point at the upstream boundary of the Kerr WMA and Site B (Figure 1) according to guidelines in TCEQ (2007). At each transect instream and riparian variables were quantified, summarized using nine habitat metrics, and summed to determine a habitat quality score.

Water Quality: Water temperature, specific conductance, dissolved oxygen, and pH were recorded for a 24 hour period using a YSI multiparameter water quality sonde (data follows TCEQ QA/QC procedures, (TCEQ 2007)) at Site A (Figure 1). Means and standard deviations were calculated for each verified parameter.

Fish Assemblage: Fish were collected from four sites (Figure 1) within the study reach using a combination of boat electrofishing (Site D), backpack electrofishing (Sites A and C), and seining (Sites A, B, and C) techniques following TCEQ protocol (TCEQ 2007). For large fish, total lengths were recorded and a voucher photograph was taken before release. All other fish captured were preserved in 10% formalin and taken to the laboratory for enumeration and species identification. Once all fish were identified, a regional index of biotic integrity was calculated (Linam *et al.* 2002).

Mussel Assemblage: Mussels were surveyed using timed snorkel surveys in multiple mesohabitat types (Strayer and Smith 2003) from Site A downstream to Site C (Figure 1). Search time totaled 100 minutes.

Macroinvertebrate Assemblage: Aquatic macroinvertebrates were collected from four locations at Site A (Figure 1). Macroinvertebrates were collected using a D-frame kick net following

procedures in TCEQ (2007). A minimum of 175 macroinvertebrates were collected per location. Macroinvertebrates were preserved in 70% ethanol and transported back to the lab where they were identified to the lowest possible taxonomic group. The macroinvertebrate community was assessed using 12 metrics (TCEQ 2007). These metrics were scored and summed to determine the aquatic life use score.

Riparian Area: Aerial photography was used to get an overall perspective of the site and to determine locations for placing 50 m transects for a rapid riparian assessment within the Kerr WMA boundaries. Of the habitat available, one site was chosen for a 50 m x 10 m transect to obtain a representative sample of the vegetative composition from the water's edge up the slope, and perpendicular to the river channel. All trees and shrubs within the transect grid were identified to species, and the diameter at breast height (DBH) to the nearest 1 cm for each individual was recorded. Seedlings were classified as having a DBH less than 1 cm. Saplings were classified as having a DBH of 1 to 5 cm. Herbaceous plants were measured using a line-intercept method along the center of the 50 m transect.

Public Access: The North Fork Guadalupe River from the upstream boundary of the Kerr WMA, downstream to the low water dam on the Mo-Ranch property was assessed using aerial imagery to identify potential access points to the river. In the field, access points were visited and assessed for public accessibility, parking capacity, bank fishing potential, wheelchair accessibility, and whether access fees were charged.

RESULTS AND DISCUSSION

Instream Physical Habitat: Much of the reach (Sites A, B, and C) was dominated by shallow habitats with braided stream channels cut through limestone bedrock (Figure 2). Many of the braids were filled with senescing organic matter. Severe drought in 2011 and lack of recent scouring flows in this section of the river may have caused build-up of organic matter. The channel morphological classification (Rosgen 1996) appeared to be a C1. This channel type is slightly entrenched, has moderate to high width to depth ratio, moderate to high sinuosity, a channel slope of 2% or less and is dominated by bedrock. Aquatic vegetation was present intermittently throughout the reach, but was not identified. Site D was impacted by a low water dam located just downstream of the FM 1340 bridge crossing and was deeper than the upstream sites with a mean depth of 1.04 m (Figure 2). Mean maximum depth calculated from the six physical habitat transects between the upstream boundary of the WMA and Site B was 0.43 m. Mean stream width for the transects was 26.2 m and appeared representative of downstream widths. TCEQ habitat scores for the reach ranged from moderate to high in all habitat categories assessed with the exception of substrate stability. The primary reason for the low substrate stability score was the bedrock stream bed, which is not conducive to stability of other substrate types, but is common in streams throughout this ecoregion. This section of the

river demonstrated many positive habitat qualities including extensive riparian vegetation, highly stable banks, large pools, common riffle habitats, and common instream cover (Table 2). The overall habitat quality index score was 24 which falls into the high quality habitat availability category. While the TCEQ methodology ranked the reach as having high quality aquatic habitat there were few deeper areas for adult sportfish such as Guadalupe or largemouth bass. Perkin *et al.* (2010) indicated depth most suitable for Guadalupe bass was 1 m. Throughout most of the reach this depth was not attained.

Water Quality: Water clarity was good throughout the reach and was estimated at 2 m. Water temperature varied less than 1°C during the 24 hour sampling period (Table 3). The fairly uniform water temperature was most likely an artifact of the mild April temperatures and the close proximity to spring outflows. Specific conductance varied approximately 200 µs/cm and peaked in the early morning on April 13, 2012. pH was consistent during the study period. Dissolved oxygen data did not pass the quality assurance check and was therefore omitted from this report.

Fish Assemblage: A total of 2,103 fish, representing 18 species were collected at the four sites (Table 4). One non-native species was collected, redbreast sunfish (*Lepomis auritus*), making up a relatively small percentage of the total catch (2.5%) (Table 5). Less than 1% of individuals had a body deformity or anomaly. The largest trophic guild was invertivores at more than 90% of the total catch. Total catch per-unit-effort was 900.0 individuals per hour of backpack electrofishing, 511.7 individuals per hour of boat electrofishing, and 75.3 individuals per seine haul. Based on abundance and species present, catch per-unit-effort, and anomalies an index of biotic integrity score was calculated as 52. This score falls into the exceptional aquatic life use category.

Largemouth bass and channel catfish were the only sportfish collected (Figure 3). While present, these individuals made up less than 1% of the total catch. Largemouth bass up to 13 inches in length (Figure 3) were collected and provide a sportfishing opportunity; however, channel catfish collected were small, only measuring up to 8 inches in length. Larger channel catfish were observed, but not captured. Surprisingly no Guadalupe bass were collected despite past stockings in this area. This species has been documented as abundant in the mainstem Guadalupe River (Terre and Magnelia 1996). The aforementioned lack of suitable depth habitat in most of the reach may have been responsible for our inability to collect this species. In addition, high water clarity likely limited electrofishing effectiveness for adult sportfish. Length frequency data for sportfish species may have been supplemented through a hook-and-line angling survey. Six species of sunfish were collected throughout the reach, including redbreast sunfish, warmouth (*Lepomis gulosus*), and bluegill (*Lepomis machrochirus*), which provide additional angling opportunity. No threatened, endangered, or species of concern were collected.

Macroinvertebrates: A total of 770 macroinvertebrates, representing 17 orders and 26 families were collected and identified from four locations within Site A (Table 6). Dominant macroinvertebrates present were amphipods (Order: Amphipoda), water mites (Order: Trombidiformes), and mayflies (Order: Ephemeroptera) making up 22.5%, 19.0%, and 17.5% of

the total catch respectively. The aquatic life use score as calculated from the rapid bioassessment protocol for benthic macroinvertebrates was 35, placing this site in the high aquatic life use category (Table 7).

Mussels: No live mussels were collected during this study, nor was any shell material from native mussels observed during shoreline searches. Three long dead Asian clam (*Corbicula* sp.) valves were found. Given that no shell material from native mussels was observed, it is likely that the site did not historically support a population of native mussels. The predominantly bedrock substrate in the reach does not favor native mussel colonization. Another potential contributing factor to the absence of mussels is the spring run conditions, and thus a lack of primary productivity (i.e. phytoplankton).

Riparian Area: The riparian species documented within the transect (Figures 4 and 5, Table 8) were consistent with the riparian types identified in the Texas Ecological Systems Classification Project database, which records the following riparian vegetative community types on the Kerr WMA: Edwards Plateau: Riparian Ashe Juniper Forest; Edwards Plateau: Riparian Ashe Juniper Shrubland; Edwards Plateau: Riparian Deciduous Shrubland; Edwards Plateau: Riparian Hardwood Forest; Edwards Plateau: Floodplain Hardwood/Ashe Juniper Forest; and Edwards Plateau: Floodplain Live Oak Forest. The transect data, coupled with visual observation of other important riparian species not represented in the transect such as switchgrass (*Panicum virgatum*), eastern gammagrass (*Tripsacum dactyloides*), white-top sedge (*Rhynchospora colorata*), buttonbush (*Cephalanthus occidentalis*), baccharis (*Baccharis neglecta*), watercress (*Rorippa nasturtium-aquaticum*), and frogfruit (*Phyla nodiflora*), showed the riparian area to be very diverse, with recruitment of riparian species actively occurring. In addition to the diverse riparian vegetation, the substrate was confined by bedrock, making it vertically stable. Large woody debris was present to help reduce current velocities during flood events and trap sediment for additional riparian plant recruitment.

Public Access: Four sites were evaluated for public angler access. Three of these sites were deemed available for public access (Table 1). The bridge at the Stowers Ranch Road was evaluated as a potential public access site based on aerial imagery; however, private property signs were posted in the area so it was determined to be unsuitable as an access site. Two of the sites deemed appropriate for public angling access offered bank fishing opportunities, one of which had wheelchair accessible accommodations (Table 1). The Mo-Ranch conference center allows day use access by reservation for fishing and canoeing for a per person fee. This site is located just upstream of a low water dam that has created deep, pool-like habitats, more suitable for sportfish and sunfish than the two upstream access points.

SUMMARY AND RECOMMENDATIONS

This reach was classified as having a high to exceptional aquatic life use rating for instream physical habitat, fish, and aquatic macroinvertebrate indices of biotic integrity. These scores coupled with high water quality and an extensive riparian zone support the exceptional aquatic life use designation assigned to this reach by TCEQ (2010). Overall this reach provides suitable physical habitat to sustain diverse fish and macroinvertebrate assemblages; although, the lack of deeper pools likely limits the abundance of adult sportfish and the predominantly bedrock substrate coupled with close proximity to springs does not favor mussel colonization. Monitoring and maintenance of water quality and the riparian area will aid in preserving the high to excellent aquatic life use ratings for fish and macroinvertebrate populations.

The addition of instream cover structures (Rosgen 1996) in this reach would provide additional habitat for sportfishes such as largemouth and Guadalupe bass. Availability and suitability of instream cover strongly influences the distribution and abundance of Guadalupe bass (Perkin *et al.* 2010). Sportfish habitat improvement structures rated as excellent for a C1 channel type include: bank placed boulders, bank cover, half log cover, floating log cover, submerged shelters located on meanders and straight reaches, and bank placed root wads (Rosgen 1996); however, the lack of depth would likely limit the effectiveness of these structures in much of the reach. Structures might be installed in selected locations, but may not withstand the frequent flash flood events that are characteristic of Central Texas streams.

Supplemental stocking of fingerling sportfish species such as largemouth bass, Guadalupe bass, and channel catfish would likely not increase abundance of these species in the reach. While supplemental stocking can be used to improve populations when reproduction is insufficient, the presence of juvenile largemouth bass and channel catfish in the fish population survey indicate these species are successfully reproducing. Rivers and streams of the Edwards Plateau ecoregion are generally characterized as nutrient poor (Ground and Groeger 1994) and growth of sportfish to adult size is typically slow compared to other ecoregions (Prentice 1987). Slow growth, angler harvest, and habitat restrictions likely have more of an effect on abundance of sportfish than lack of reproductive success.

Signage encouraging anglers to voluntarily catch-and-release should be placed at the Kerr WMA angler access area as sportfish abundance appears to be low. In addition a volunteer creel survey box (De Jesus *et al.* 2009) could be installed to help document angler exploitation. Exploitation, growth, and additional length frequency information is needed to determine if more restrictive length and bag limits would be practical and/or effective for increasing abundance of sportfish species in this reach. Future fish population surveys should include a hook-and-line angling survey to gather supplemental length frequency, presence/absence, and catch rate data for sportfish species. While one invasive fish species did occur in this reach, it was present in relatively low proportions and its benefit as an angling opportunity most likely outweigh negative impacts on the fish community. However this species should be periodically monitored and if its populations begin to negatively affect the native fish assemblage, eradication efforts should be considered.

The diversity and active recruitment of riparian plant species is an indicator of good wildlife and livestock management practices on the Kerr WMA and surrounding private ranches. These private ranches have been working with Kerr WMA staff for many years. This relationship and resulting good management practices are key factors in the diversity and long term health of the riparian zone, as recruitment of riparian species is essential to maintaining healthy riparian areas in perpetuity. The close proximity of FM 1340 to the river has the ability to greatly impact river morphology and associated riparian habitat; however, while the footprint of the road cannot be altered, by leaving vegetation intact between the road and the water's edge, the WMA has managed to minimize effects of the road. It is recommended that the practice of leaving vegetation intact continue in order to assist in maintaining riparian health. Regular monitoring of the riparian area for the presence of nuisance plant species should be established. Should nuisance species such as giant reed (*Arundo donax*), salt cedar (*Tamarix spp.*), or elephant ear (*Colocasia esculenta*) appear, they should be eliminated as quickly as possible to avoid becoming established and displacing native riparian species.

An unauthorized walking trail going downstream from the Kerr WMA angler access area is evident, which could be the result of anglers fishing along the bank. This trail is inconsistent with the recommendation to maintain a riparian buffer along the river banks. Individuals using this site should be encouraged to use a single defined access point to the river. Fishing by wading, or by canoe or kayak should be encouraged to minimize effects of angling on riparian vegetation. Expanded free public access downstream from the Kerr WMA angler access area would make it easier for the public to float and wade fish this portion of the river. While much of the river is shallow, some pools are deep enough to harbor sportfish and the river is aesthetically pleasing. While one water crossing provides some access, parking is extremely limited. Providing signage at the Kerr WMA angler access area giving information on downstream take-out points might encourage greater utilization of the reach by anglers and paddlers.

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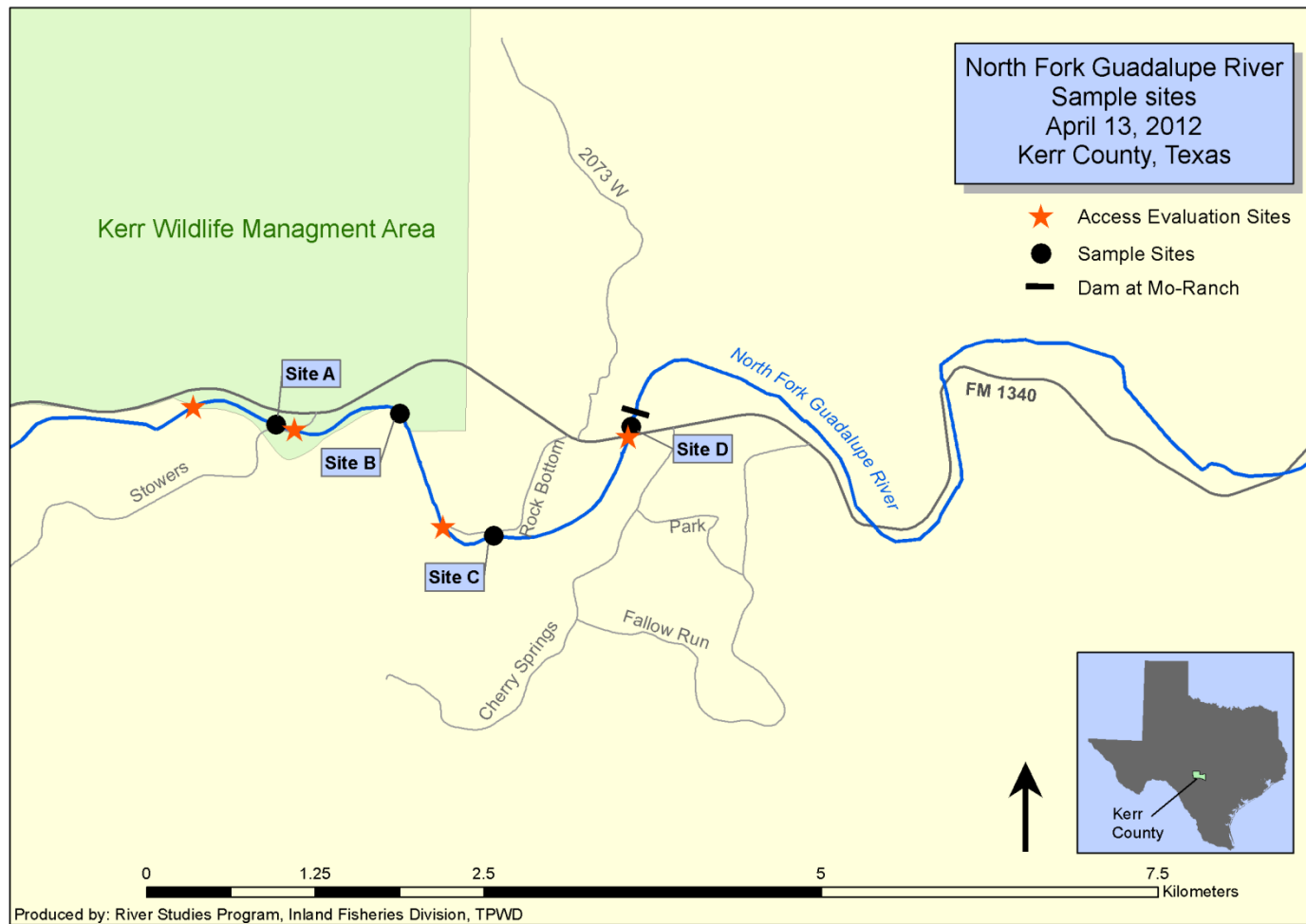


Figure 1. Map of aquatic survey sample and access evaluation sites on the North Fork Guadalupe River, Kerr County, Texas, April 2012.



Figure 2. Photographs of typical habitat on the North Fork Guadalupe River at Sites A, B, and C (upper photograph) and site D (lower photograph), April 2012. Sites A, B, and C were dominated by shallow pool habitat with braided bedrock veins. A deeper pool was located at Site D.

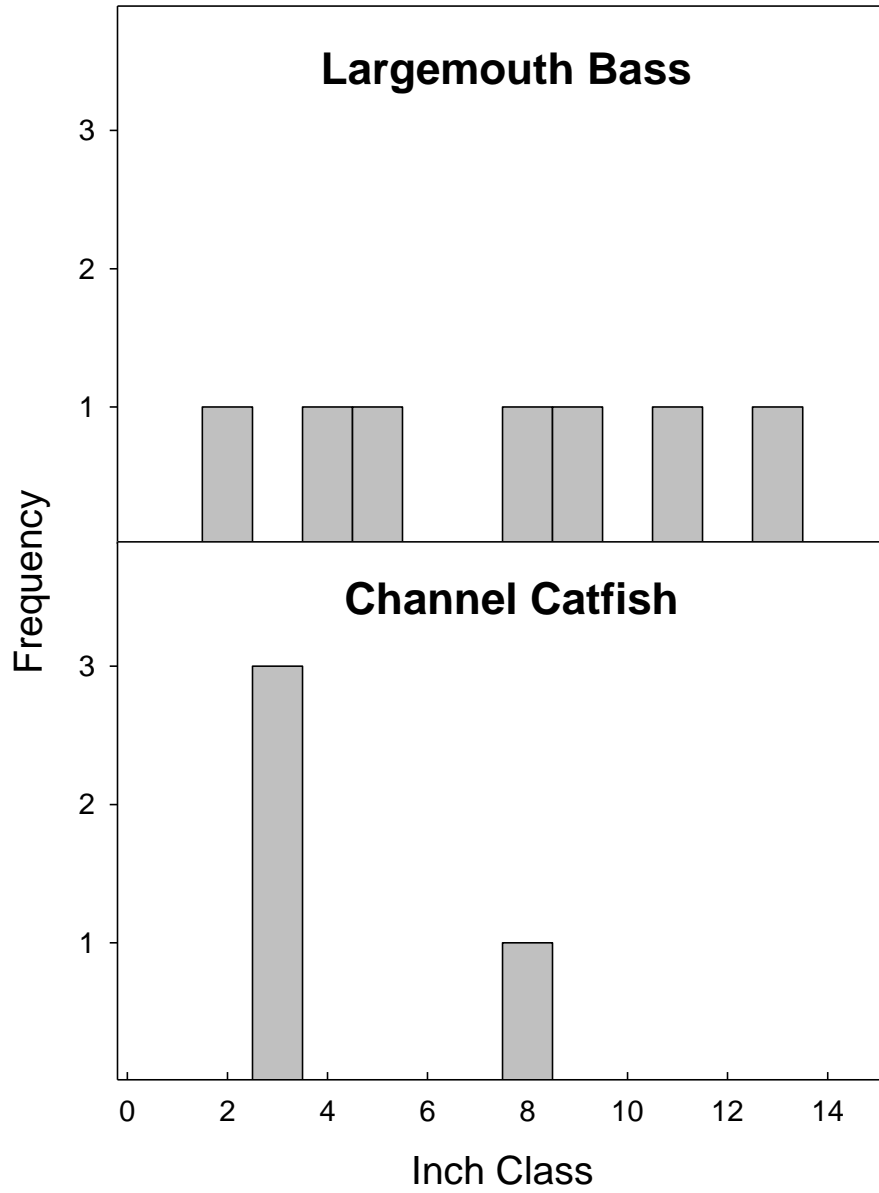


Figure 3. Number of largemouth bass and channel catfish caught by inch class using all gear types at Sites A-D on the North Fork Guadalupe River, April 2012.

Tree & Shrub Species Composition

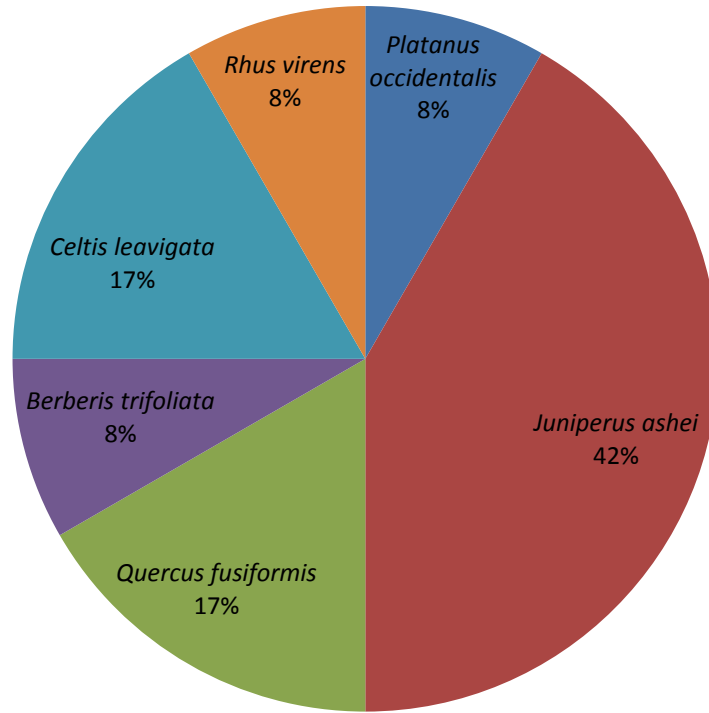


Figure 4. Tree and shrub species composition for a representative 50 m x 10 m riparian transect in the Kerr Wildlife Management Area, April 2012.

Seedling Species Composition

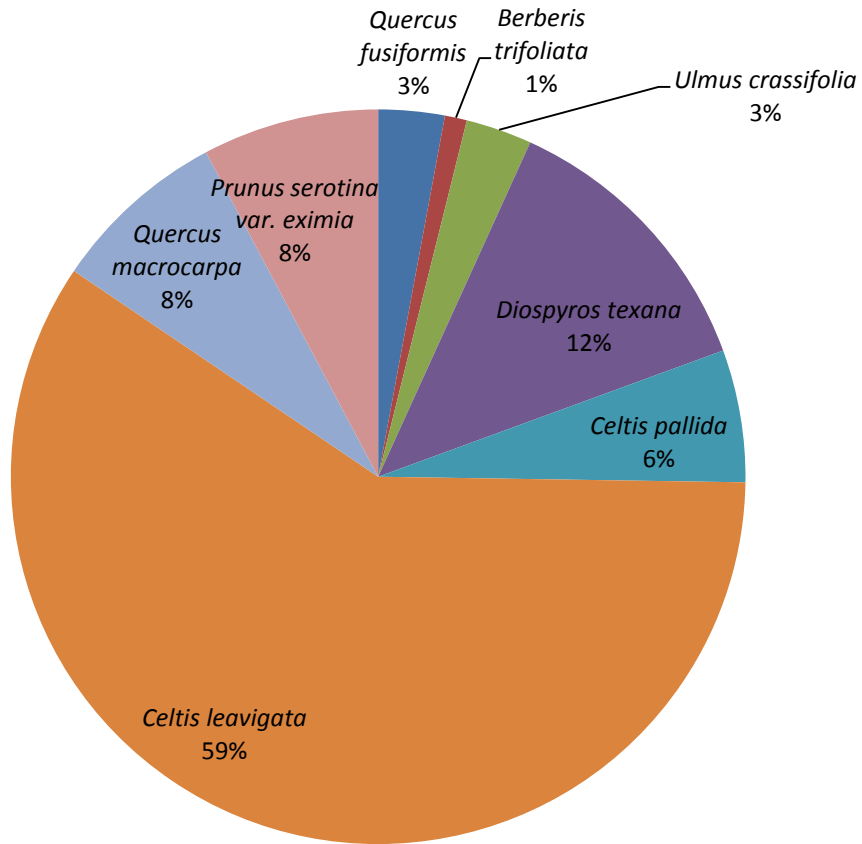


Figure 5. Seedling tree species composition for a representative 50 m x 10 m riparian transect in the Kerr Wildlife Management Area, April 2012.

Table 1. Information and locations for angler access evaluation sites located from upstream to downstream on the North Fork Guadalupe River, Kerr County, Texas, April 2012. GPS coordinates are reported in degree decimals.

Location Name	GPS Coordinates	Fee Charged	Parking Capacity	Wheel Chair Access	Bank Fishing	Comments
Kerr WMA upstream boundary	Lat: 30.060607 Long: -99.503581	N	4	N	Y	
Stowers Ranch Road Crossing	Lat: 30.058749 Long: -99.496112	N/A	N/A	N/A	N/A	Private Property
Rock Bottom Road Crossing	Lat: 30.052672 Long: -99.422294	N	6-7	N	N	Parking along roadside
Mo-Ranch Conference Center	Lat: 30.058420 Long: -99.470206	Y	50+	Y	Y	Day use reservations made through moranch.com

Table 2. Physical habitat quality index scores for the North Fork Guadalupe River within the Kerr Wildlife Management Area, April 2012. Categories are scored from low quality to high quality on a scale of 1-4 for the first four metrics and 0-3 for the remaining metrics.

Habitat Quality Category	Index Score
Available instream cover	3
Bottom substrate stability	1
Number of riffles	3
Dimensions of largest pool	4
Channel flow status	3
Bank stability	3
Channel sinuosity	2
Riparian buffer vegetation	3
Aesthetics of reach	2
Total score	24
Habitat Quality Category	High

Table 3. Water quality summary from the North Fork Guadalupe River at Site A, April 2012.

	Temperature Celsius	Specific Cond. Us/cm	Dissolved Oxygen Mg/L	pH
Mean	20.75	905	*	7.30
Minimum	20.32	706	*	7.26
Maximum	20.95	991	*	7.60
Standard dev.	0.14	89	*	0.07

*data failed QA

Table 4. Fish species, separated by collection type, with their associated abundances and trophic guilds collected from Sites A-D on the North Fork Guadalupe River, April 2012. Trophic abbreviations are as follows: Invertivore (IF), Omnivore (O), Herbivore (H), and Piscivore (P).

Scientific name	Common name	Trophic guild	Backpack Electrofisher	Boat Electrofisher	Seine	Total
<i>Ameiurus natalis</i>	Yellow bullhead	O	6		1	7
<i>Astyanax mexicanus</i>	Mexican tetra	IF	2		67	69
<i>Campostoma anomalum</i>	Central stoneroller	H	27		2	29
<i>Cyprinella lutrensis</i>	Red shiner	IF	19		244	263
<i>Dionda nigrotaeniata</i>	Guadalupe roundnose minnow	O		71	12	83
<i>Etheostoma lepidum</i>	Greenthroat darter	IF	16	2	60	78
<i>Etheostoma spectabile</i>	Orangethroat darter	IF	41	6	39	86
<i>Gambusia affinis</i>	Western mosquitofish	IF	61		281	342
<i>Ictalurus punctatus</i>	Channel catfish	O	3	1		4
<i>Lepomis auritus</i>	Redbreast sunfish	IF	27	21	5	53
<i>Lepomis cyanellus</i>	Green sunfish	P	2	5		7
<i>Lepomis gulosus</i>	Warmouth	P		10		10
<i>Lepomis macrochirus</i>	Bluegill	IF		23		23
<i>Lepomis megalotis</i>	Longear sunfish	IF	67	75	160	302
<i>Lepomis miniatus</i>	Redspotted sunfish	IF	3	5		8
<i>Lepomis sp.(juvenile)</i>	Sunfish species	IF			191	191
<i>Micropterus salmoides</i>	Largemouth bass	P	1	6		7
<i>Notropis amabilis</i>	Texas shiner	IF	2	1	176	179
<i>Notropis stramineus</i>	Sand shiner	IF	18		344	362
Total			295	226	1,582	2,103

Table 5. Fish assemblage data and metric scores for fish collected from Sites A-D on the North Fork Guadalupe River, April 2012. IBI scores range from low to high on a scale of 1-5.

Collector: TPWD				April-12		Ecoregion 30	
Metric Category	Intermediate Totals for Metrics		Metric Name		Raw Value	IBI Score	
	Drainage Basin Size (km ²)	297.8					
Species Richness and Composition	Number of Fish Species	18	Number of Fish Species	18	5		
	Number of Native Cyprinid Species	5	Number of Native Cyprinid Species	5	5		
	Number of Benthic Invertivore Species	2	Number of Benthic Invertivore Species	2	5		
	Number of Sunfish Species	6	Number of Sunfish Species	6	5		
	Number of Intolerant Species	2	Number of Intolerant Species	2	5		
	Number of Individuals as Tolerants ^a	307	% of Individuals as Tolerant Species ^a	14.6	5		
Trophic Composition	Number of Individuals as Omnivores	94	% of Individuals as Omnivores	4.5	5		
	Number of Individuals as Invertivores	1,956	% of Individuals as Invertivores	93.0	5		
	Number of Individuals as Piscivores	24	% of Individuals as Piscivores	1.1	1		
Fish Abundance and Condition	Number of Individuals (Seine)	1,582	Number of Individuals in Sample	2103	5		
	Number of Individuals (Shock)	521	Number of Individuals/seine haul	75.3	5		
	Number of Individuals in Sample	2,103	Number of Individuals/min electrofishing	11.28	5		
	# of Individuals as Non-native species	53	% of Individuals as Non-native Species	2.5	3		
	# of Individuals With Disease/Anomaly	13	% of Individuals With Disease/Anomaly	0.6	3		
				Index of Biotic Integrity Numeric Score:		52	
				Aquatic Life Use:		Exceptional	
This data should be incorporated with water quality, habitat, and other available biological data to assign an overall stream score.							

^a Excluding western mosquitofish

Table 6. Macroinvertebrates with their associated abundances and trophic guilds collected from Site A on the North Fork Guadalupe River, April 2012. Trophic guilds are abbreviated as follows: collector gatherer (CG), filtering collector (FC), predator (P), scraper (SCR), and shredder (SHR).

Order	Family	Genus	Abundance	Trophic Guild
<u>Amphipoda</u>	Taltridae	<i>Hyalella</i>	173	CG/SHR
<u>Architaenioglossa</u>	Ampullariidae		8	SCR
<u>Bassomatophora</u>	Physidae	<i>Physella</i>	15	SCR
	Physidae		1	SCR
	Planorbidae	<i>Planorbula</i>	11	P
<u>Cladocera</u>	Daphniidae	<i>Daphnia</i>	1	FC
<u>Coleoptera</u>	Halplidae	<i>Peltodytes</i>	2	SHR/P
<u>Decapoda</u>	Cambaridae		2	CG
<u>Diptera</u>	Ceratopogonidae	<i>Ceratopogonidae</i>	2	P/CG
	Chironomidae	<i>Chironomidae</i>	54	P/CG/FC
	Culicidae		1	FC/CG
	Simuliidae	<i>Helodon</i>	33	FC
<u>Ephemeroptera</u>	Baetidae		44	SCR/CG
	Baetidae	<i>Callibaetis</i>	4	CG
	Ephemerellidae		1	CG
	Tricorythidae	<i>Tricorythodes</i>	86	CG
<u>Hemiptera</u>	Naucoridae	<i>Ambrysus</i>	56	P
<u>Hirudinea*</u>			4	P
<u>Mesogastropoda</u>	Pleuroceridae	<i>Elimia</i>	94	SCR
<u>Odonata</u>	Coenagrionidae		1	P
	Coenagrionidae	<i>Telebasis</i>	1	P
	Macromiidae	<i>Didymops</i>	2	P
<u>Oligochaeta*</u>			8	CG
<u>Rotifer*</u>			1	
<u>Trichoptera</u>	Helicopsychidae	<i>Helicopsyche</i>	6	SCR
	Hydroptilidae	<i>Hydroptila</i>	9	SCR
	Leptoceridae	<i>Nectopsyche</i>	1	SHR/CG/P
<u>Tricladida</u>	Planariidae	<i>Planaria</i>	3	
<u>Trombidiformes</u>	Hydracarina		146	P

*Lowest taxonomic identification available if order was not determined

Table 7. Metrics and scoring criteria for kick samples collected using the rapid bioassessment protocol for benthic macroinvertebrates at Site A in the North Fork Guadalupe River, April 2012. Metrics are scored from low to high quality on a scale of 1-4.

Metric	Total	Score
Taxa richness (Genus)	29.00	4
EPT taxa abundance	7.00	3
Biotic index (HBI)	5.91	1
% Chironomidae	7.01	3
% Dominant taxon	22.47	3
% Dominant FFG	31.63	4
% Predators	31.63	2
Intolerant: tolerant taxa	3.22	3
% Trichoptera as Hydropsychidae	0.00	4
# of non-insect taxa	13.00	4
% collector gatherers	29.79	3
% Elmidae	0.00	1
Total Score		35
Aquatic Life Use		High

Table 8. Herbaceous plant species identified in the line-intercept run along the center of the 50 m riparian transect on the Kerr Wildlife Management Area, April 2012.

Scientific name	Common name	# Line Intercepts	Relative Abundance
<i>Eleocharis</i> spp.	Spikerush	7	14%
<i>Solidago altissima</i>	Canada goldenrod	2	4%
<i>Andropogon glomeratus</i>	Bushy bluestem	3	6%
<i>Cladium mariscus</i>	Sawgrass	8	16%
<i>Boehmeria cylindrica</i>	Smallspike false nettle	2	4%
<i>Mentha spicata</i>	Spearmint	2	4%
<i>Helianthus maximiliani</i>	Maximilian sunflower	1	2%
<i>Nassella leucotrica</i>	Texas wintergrass	3	6%
<i>Celtis laevigata</i>	Sugarberry	1	2%
<i>Smilax</i> spp.	Greenbrier	2	4%
Sedge spp.	Sedge	1	2%
unknown 1		2	4%
unknown 2		1	2%



4200 Smith School Road ▪ Austin, Texas 78744
www.tpwd.texas.gov

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