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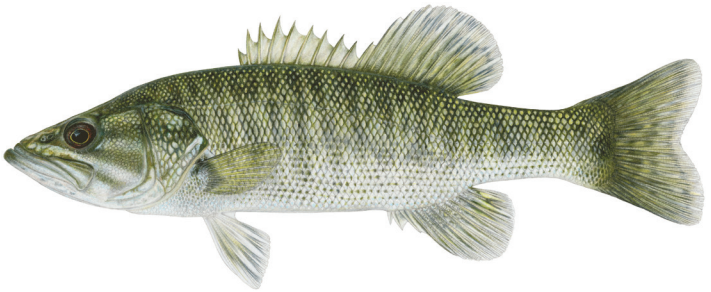
Guadalupe Bass *Micropterus treculii* (Vaillant & Bocourt, 1874)



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Taxonomic Status

Guadalupe Bass *Micropterus treculii* diverged from northeastern ancestral *Micropterus* (Conner and Suttkus1986) approximately 4.1–5.7 million years ago during the late Miocene or early Pliocene (Near et al. 2003, 2005). The species was originally described by Cope (1880) as the Texas (Johnson Fork of the Llano River) version of Florida Bass *M. floridanus*, differing slightly in some morphometric and meristic counts from its Florida counterpart. Since that time, Guadalupe Bass have undergone several redescriptions, including *Dioplites treculii* (Vaillant and Bocourt 1883), *M. nuecensis* var. *treculii* (Vaillant and Bocourt 1883), *M. salmoides* (Jordan and Gilbert 1886, Evermann and Kendall 1894), *M. pseudaplites* (Hubbs 1927), *M. punctulatus punctulatus* (Hubbs and Bailey 1940), *M. p. treculii* (Hubbs and Bailey 1942), *M. treculi* (Jurgens and Hubbs 1953; Hubbs 1954), and its current nomenclature *M. treculii* (Nelson et al. 2004). Johnson et al. (2001) determined that the sister taxa of Guadalupe Bass is Spotted Bass *M. punctulatus* based on mitochondrial DNA analyses. Near et al. (2003, 2005) also used mitochondrial DNA analyses and found historical introgression of Guadalupe Bass with Largemouth Bass *M. salmoides*.

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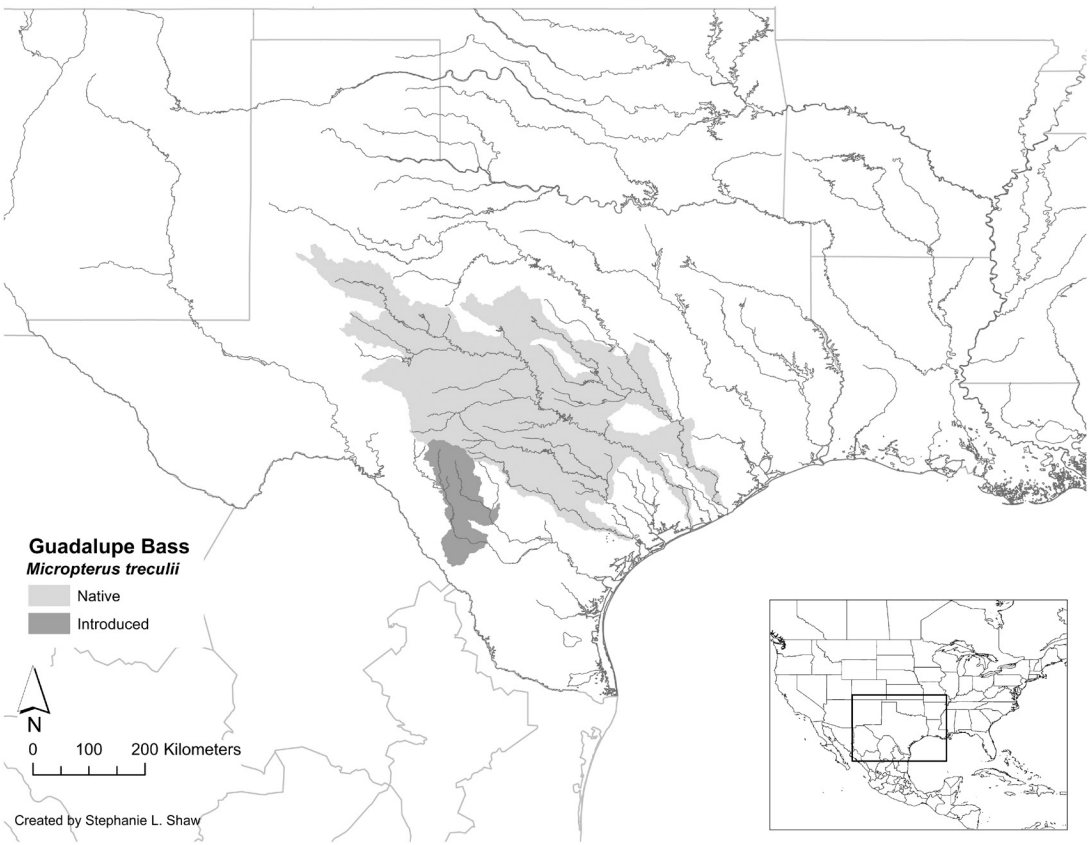

Distribution

Guadalupe Bass are historically distributed among streams originating on the Edwards Plateau in central Texas, including subbasins of the Brazos, Colorado, Guadalupe, and San Antonio rivers (Hurst et al. 1975; Conner and Suttkus 1986; Thomas et al. 2007; Hubbs et al. 2008). Several populations are introgressed with Smallmouth Bass *M. dolomieu* (Bean et al. 2013), resulting in possible extirpation from historical ranges. Pure Guadalupe Bass are extirpated from the South Concho River (Bean et al. 2013) and the Blanco River (Littrell et al. 2007) based on genetic analyses. In addition, an introduced population is established in the Nueces River basin (Hubbs et al. 2008).

Characteristics

Guadalupe Bass are elongate and slightly compressed with a body depth usually contained three to five times in their standard length (Hubbs et al. 2008). The mouth is terminal and oblique with a maxilla extending past the center of the eye. Guadalupe Bass possess a tooth patch on their tongue (glossohyal). The shortest dorsal fin spine is contained 1.1–2.5 times in the longest dorsal spine (Hubbs et al. 2008), resulting in the first and second dorsal fin broadly joined by a shallow notch (Thomas et al. 2007). Bases of the soft dorsal fin and anal fin are scaled. Similar to Smallmouth Bass and Spotted Bass, pyloric cecae are not branched (Hubbs et al. 2008).

Like other black bass species, the dorsal region of Guadalupe Bass is olive-green and the ventral region is white. The lower dorsal and lateral region scales are covered with dark pigments that form horizontal rows along their body. They have a dark mid-lateral stripe obscured by 10–12 diamond-shaped vertical bars, most notable in juveniles (Page and Burr 1991; Thomas et al. 2007). Maximum depth of the bars is contained 1.5–2 times in their maximum body depth (Hubbs et al. 2008). Guadalupe Bass have the following counts: 6–13 dor-

sal fin spines, 11–13 dorsal soft fin rays, 15–16 pectoral fin rays, 3 anal fin spines, 9–11 anal soft fin rays, 55–71 lateral line scales, 7–10 scales above lateral line, 14–20 scales below lateral line, 22–29 scales around caudal peduncle, 10–18 cheek scales, 6–7 branchiostegals, and 8 gill rakers (Edwards 1980; Thomas et al. 2007).

Habitat

Guadalupe Bass inhabit spring-fed streams of the Edwards Plateau (Hurst et al. 1975; Edwards 1980; Page and Burr 1991) and clear to moderately turbid, low-gradient tributaries and rivers east and downstream from the Edwards Plateau (Hubbs et al. 1953; Robbins and MacCrimmon 1974; Edwards 1980). Individuals are generally not associated with thermally constant headwater reaches or immediately downstream from reservoirs with hypolimnion releases (Hubbs et al. 1953; Edwards 1978, 1980).

Larger individuals (>200 mm) are typically associated with moderate depths (1.0 m) and slow current velocities (<0.05 m/s) over silt, sand, and bedrock substrates downstream from riffles and with instream cover (i.e., log complexes, boulders, undercut banks, and rootwads; Edwards 1980; Perkin et al. 2010). Smaller individuals tend to utilize swifter current velocities (>0.15 m/s) and shallower depths (<1.0 m) in riffle, run, and pool habitats with instream cover and vegetation (Edwards 1980; Curtis 2012). In streams where Spotted Bass and Guadalupe Bass are present, both species generally occupy flowing water while Spotted Bass seem to prefer larger streams and Guadalupe Bass tend to occur in smaller streams. Guadalupe Bass overlap in habitat associations with Smallmouth Bass, when present, and typically segregate from Largemouth Bass, with Largemouth Bass usually found in more lentic habitats (Robbins and MacCrimmon 1974; Hurst et al. 1975).

Adults are generally sedentary, moving from 0.1 to 3.0 m/d during nonreproductive season (late summer through winter) and from 3.0 to 9.0 m/d during reproductive season (spring and summer; Perkin et al. 2010). During an 8-month period of observation, individuals moved a maximum distance of 1.5 km upstream and 3.4 km downstream from the capture site. Diel movements are attributed to feeding in open water during the night and returning to cover during the day. Movement increased during high-flow pulses, with fish seeking velocity refugia downstream of boulders and bedrock ledges (Perkin et al. 2010). Initially, juveniles tend to seek swift habitats progressively transitioning to deeper depths and moderately flowing eddies towards the end of their first year. Overwintering for both juveniles and adults usually occurs in deeper pools (Edwards 1980).

Reproduction

Guadalupe Bass likely spawn from early spring to late summer (Hurst et al. 1975; Boyer et al. 1977), possibly extending into autumn (Edwards 1980). Edwards (1980) collected Guadalupe Bass less than 30 mm standard length (SL) from May to August, indicating a slightly longer reproductive season with secondary spawning periods occurring in late summer and early fall. Guadalupe Bass are polyphilic or lithophilic nest spawners that construct oval-shaped nests (surface area: 0.5 × 0.4 m; depth: 0.1 m) near shore in moderate current velocities (up to 0.3 m/s) and depths (1 m) within run and pool mesohabitats (Boyer et al. 1977; Edwards 1980, 1997). Nests are lined with cobble and detritus with eggs primarily adhered to sticks and leaf litter and guarded by one of the parents (Boyer et al. 1977). Females produce 400–9,300 eggs per clutch with an average diameter of 1.5–2.3 mm (Boyer et al. 1977; Edwards 1980). The minimum length of sexual maturity ranges from 70 mm SL (Hurst et al. 1975) to 128 mm SL for females and 81 mm SL for males (Edwards 1980).

Diet

Guadalupe Bass experience an ontogenetic shift from aquatic invertebrates to fish at 210 mm TL (Farquhar 1995). Invertebrates compose a large proportion of the diet, especially for juveniles that tend to consume greater proportions of aquatic ephemeropterans and dipterans and terrestrial hymenopterans and hemipterans (Edwards 1980). Adults feed mainly on megalopterans, crayfish, and fish (Edwards 1980; Farquhar 1995). Piscine prey items include cyprinids and percids in streams (Edwards 1980) and clupeids and centrarchids in reservoirs (Day 1981).

Pathogens/Parasites

Several types of parasites are reported in Guadalupe Bass. *Acolpenteron ureteroecetes* is a monogenetic trematode residing in the urinary bladder and ureter that usually causes little to no damage to the fish and is limited to streams with rocky substrate (Bunkley-Williams and Williams 1994). Edwards (1980) detected black grub *Uvulifer ambloplites*, an ectoparasitic larval trematode, in 23% of individuals collected throughout their range. *Contracaecum*, endoparasitic nematodes that encyst upon the liver, spleen, and mesentery, usually having little effect on health, were found in 95% of Guadalupe Bass sampled in Lake Bastrop and in 35% of individuals collected throughout their range (Edwards 1980; Day 1981). *Lernia* sp., a parasitic copepod, occurs in low frequency (Edwards 1980).

Population Dynamics

Guadalupe Bass relative abundances compose up to 9.2% among fish communities in the Brazos River and Colorado River basins (Labay 2010; Shattuck 2010; Curtis 2012). Populations consist of up to six age-groups (Edwards 1980). Standard lengths by age range from 65 to 84 mm for age 1, 121–154 mm for age 2, 136–189 mm for age 3, 189–198 for age 4, 230–250 for age 5, and 256–272 for age 6 in the Guadalupe, Colorado, and Brazos River basins. Length–weight relationship of Guadalupe Bass is similar to Largemouth Bass and Spotted Bass (Edwards 1980). The optimal temperature for Guadalupe Bass growth is estimated to be 27–28°C, and decreases in length, mass, and liver index were observed at 30°C (Sullivan et al. 2013).

Sport Fisheries

Guadalupe Bass are highly sought-after sport fish in streams of the Edwards Plateau, where fly fishing has become a popular sport within the central Texas region and has increased interest in landing the official state fish of Texas (Hubbs et al. 2008). The Texas Parks and Wildlife Department has set the current regulation of a daily bag limit at five fish with no minimum length. Individuals greater than 310 mm are considered trophy fish (Boyer et al. 1977). The world record is 438 mm (1,683 g), taken from the Colorado River in 2014.

Conservation Status

Guadalupe Bass are considered a species of special concern (Hubbs et al. 2008) primarily due to introgression with introduced Smallmouth Bass (Edwards 1979; Whitmore and Butler 1982; Whitmore 1983; Garrett 1991; Morizot et al. 1991; Koppelman and Garrett 2002; Bean et al. 2013). In the 1950s, the Texas Parks and Wildlife Department began stocking Smallmouth Bass in streams and rivers of the Edwards Plateau in an effort to increase fishing opportunities for anglers of central Texas (Dietz and Lowman 1958). Smallmouth Bass took very well but began hybridizing with Guadalupe Bass. Bean et al. (2013) conducted a range-wide survey of the introgressive status of Guadalupe Bass in 12 subbasins in the Brazos, Colorado, Guadalupe/San Antonio, and Nueces drainages in Texas. Introgressive hybridization between Guadalupe Bass and Smallmouth Bass was detected in four subbasins, including the San Saba, Llano, Guadalupe, and Medina rivers. Pure Smallmouth Bass or Guadalupe Bass × Smallmouth Bass hybrids were not detected in four subbasins within the Guadalupe Bass' native range and three subbasins where Guadalupe Bass have been introduced. The Texas Parks and Wildlife Department produces Guadalupe Bass in hatcheries for supplemental stocking within their native range (Carmichael and Williamson 1986). Additionally, effects of dam construction and subsequent hypolimnetic discharge are associated with extirpation of Guadalupe Bass in portions of the Guadalupe River downstream of Canyon Lake Reservoir (Edwards 1978).

Research Needs

Future research on Guadalupe Bass should focus on developing, refining and validating techniques to eliminate Smallmouth Bass and introgressed populations of Guadalupe Bass with supplemental stocking of genetically pure Guadalupe Bass. An improved understanding of the reproductive ecology (i.e., timing, habitat

associations, and factors influencing egg, larval, and juvenile success) of Guadalupe Bass in Edwards Plateau and low-gradient streams and rivers can assist in these efforts.

Another focus should be on the protection of water quantity and quality by validating and refining existing instream flow recommendations within the range of Guadalupe Bass. Understanding the response and life history needs of this species to all flow tiers will aid in proper management and use of water resources under varied environmental conditions. In addition, instream flow recommendations should be developed in stream reaches without existing recommendations.

Due to increasing popularity of angling in clear water streams of the Edwards Plateau, it is important that the sustainability of angling pressure and harvest be assessed on a regular basis. On a broad scale, the effects of land-use conversion and stream fragmentation on instream habitats of the Guadalupe Bass should continue to be quantified and monitored into the future.

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