

**Proposed Standard  
Length Categories  
for Guadalupe Bass**

**by  
Greg Cummings**

**Management Data Series  
No. 294  
2018**



**INLAND FISHERIES DIVISION**  
4200 Smith School Road  
Austin, Texas 78744

PROPOSED STANDARD LENGTH CATEGORIES FOR GUADALUPE BASS

By

Greg Cummings

MANAGEMENT DATA SERIES

No. 294

2018

Texas Parks and Wildlife Department  
Inland Fisheries Division  
4200 Smith School Road  
Austin TX 78744

## **ACKNOWLEDGEMENTS**

The author thanks Marcos De Jesus, Mukhtar Farooqi, Warren Schlechte, Paul Fleming, Stephan Magnelia, Preston Bean, Tim Birdsong, Spencer Dumont, Brian VanZee, Randy Myers, Lynn Wright, and Dave Terre for their input and involvement with Guadalupe Bass conservation, and Chris Cummings and Danny Lewis for assistance with interpreting and updating the Fish Monitoring File program with the new length categories. Appreciation goes to Matt Acre, Sarah Fritts, Jessica Pease, and Heather Williams from Texas Tech University for collection of Guadalupe Bass lengths from the Colorado River used in this report.

## ABSTRACT

The Guadalupe Bass (*Micropterus treculii*), a popular sport fish and species of special concern endemic to Texas, presents many challenges to fishery professionals who seek to conserve their ecological, economic, and recreational benefits. Management of Guadalupe Bass populations should be supported with science-based evaluations for characterizing them. Size structure indices are a common tool used by fisheries biologists to calculate and describe the proportion of size groups for fish species targeted by anglers. To adequately compute these indices, a length-categorization system is required to delineate each length group. Typically, these categories are based on a world record length for a particular species, however, the longest documented fish has also been used. Although several options exist for assigning length categories to Guadalupe Bass, a standard has not been proposed. A Guadalupe Bass collected in 2017, measured 18.9 inches and is the longest documented specimen to date. This presented an opportunity to establish standard length categories for the species. Minimum lengths of 4, 8, 10, 12, and 15 inches are proposed to represent “stock”, “quality”, “preferred”, “memorable”, and “trophy” categories, respectively. These proposed lengths should better represent sizes of Guadalupe Bass available to anglers and provide a more useful standard for calculating size structure indices and assessing population structure.

## INTRODUCTION

The Guadalupe Bass, an endemic, is the State Fish of Texas; and plays an important role as a top predator in central Texas river and stream ecosystems. It is also a popular and economically important sport fish species (Thomas et al. 2015). Populations have historically been distributed among streams in the Edwards Plateau region of central Texas, including sub-basins of the Brazos, Colorado, Guadalupe, and San Antonio Rivers, and have been introduced into the Nueces River system (Curtis et al. 2015). Economic impact from fishing in Hill Country streams has been estimated at over \$50 million/year, and 42% of those anglers targeted Guadalupe Bass (Thomas et al. 2015). In the lower Colorado River, directed effort for black basses (including Guadalupe Bass) has increased from 23 percent in 2001 to 37 percent in 2017 (Cummings and De Jesus 2017). This is likely due to the availability of Guadalupe Bass over 15 inches, the publicity of the Texas State Record Guadalupe Bass caught there in 2014, and the increasing popularity of kayak fishing. Paddlesports are recognized as one of the fastest growing sectors of the outdoor recreation industry in the U.S. (Outdoor Foundation 2015). At least eight reservoirs in central Texas provide fishing opportunities for Guadalupe Bass, including Lake Travis which produced the previous record Guadalupe Bass in 1983, and hosts the annual Texas Tournament Zone Guadapalooza fishing event each fall.

Guadalupe Bass are a species of special concern due to stream habitat degradation and genetic introgression with Smallmouth Bass *Micropterus dolomieu* (Garrett 1991; Hubbs et al. 2008; Curtis et al. 2015). Since the 1990s, the Texas Parks and Wildlife Department (TPWD) has focused resources into management and research of Guadalupe Bass (Garrett 1991). Most of this effort centered on reducing genetic introgression from Smallmouth Bass through supplemental stockings (Fleming et al. 2015) and habitat restoration in selected watersheds (Garrett et al. 2015). This initiative was watershed-based, focusing on habitat restoration, instream flows, and restoring and/or maintaining healthy ecosystems to support Guadalupe Bass populations. The TPWD also expanded fishing opportunities for Guadalupe Bass through the Texas Paddling Trails and the River Access and Conservation Area programs. District Fisheries Management offices have monitored Guadalupe Bass population trends in reservoir systems and the lower Colorado River. Research has evaluated Guadalupe Bass movement (Perkin et al. 2010), population genetics (Bean et al. 2013, Fleming et al. 2015), flow-ecology relationships (Grabowski 2014), and effects of urbanization (Bean et al. 2007, Pease et al. 2017). In 2017, a rangewide conservation plan was published, providing a ten-year plan to restore and preserve Guadalupe Bass in Texas (Bean 2017). The plan outlined data gaps, threat assessments, and priority populations for conservation and restoration action.

Development of size-structure indices specifically for Guadalupe Bass were outlined as a science need in the rangewide conservation plan (Bean 2017). Prior to this biologists had several options to describe Guadalupe Bass population size structure including an index designed for Spotted Bass (*Micropterus punctulatus*), one created from the current State Record Guadalupe Bass, one based on the longest documented fish, and one based on percentiles of length data. Size-structure indices define length categories for a fish species, which describe structural characteristics of a fish population (Anderson 1976). A commonly used index is proportional size distribution (PSD; Guy et al. 2007), which is a numerical interpretation of length-frequency data (Anderson and Neumann 1996).

To evaluate size structure of a fish population, a length categorization system is used to determine the proportion of fish that compose each category. Typically, the Gabelhouse (1984) method is used, which categorizes fish stocks based on percentage lengths of the all-tackle, world-record fish for that particular species. World records are determined by the International Game Fish Association (IGFA). Length ranges are computed for stock, quality, preferred, memorable, and trophy size fish, from or near which a minimum length is selected to define each category (Gabelhouse 1984). Anderson and Weithman (1978) defined stock length as 20 to 26% of the world-record length. Stock length represents fish that are long enough to have recreational value, are at or near the length of maturity, and are recruited to traditional sampling gear (Gabelhouse 1984). Anderson (1980) defined quality length as 36 to 41% of the world-record length, which is a size of fish that most anglers would like to catch. Preferred length is defined as 45 to 55% of world-record length, and refers to fish bigger than quality that anglers would prefer to catch (Gabelhouse 1984). The suggested range for memorable length is 59 to 64% of world-record length, and refers to a size of fish anglers remember catching (Gabelhouse 1984). Trophy length has a suggested range of 74 to 80% of world-record length, and described as a size worthy of acknowledgement (Gabelhouse 1984).

The Gabelhouse methodology has been used in recent years to update or develop length categories. New world-records, updated angler preferences, and new information on growth, maximal length, and life history are typically behind the reasoning (Quinn 1991; Bister et al. 2000; Dumont and Neely 2011). Suwannee Bass *Micropterus notius*, an endemic black bass species of special concern with a limited range in Florida and Georgia recently had a standard weight ( $W_s$ ) equation and length categories developed (Bonvechio et al. 2010). Guadalupe Bass in Texas provide a similar scenario to establish standard length categories. In May 2017, a Guadalupe Bass measuring 18.9 inches was collected by Texas Tech University from the lower Colorado River. Since it was unlikely to be introgressed (Bean et al. 2013; M. J. De Jesus and D. J. Lutz-Carrillo, TPWD, unpublished data) it presented an opportunity to establish new length categories for Guadalupe Bass based on the longest documented specimen.

## METHODS

An internal review was performed during the summer of 2017 within the TPWD Inland Fisheries Division to establish standard length categories for Guadalupe Bass. Each contributor had involvement with Guadalupe Bass management, conservation efforts, or research. Several options were discussed to determine standard length categories for Guadalupe Bass. The merits of each option were discussed and a consensus was reached among staff as to the most appropriate methodology.

The committee decided that using the Gabelhouse methodology for the longest documented Guadalupe Bass would be the best option. Calculated ranges for each length category (stock, quality, preferred, memorable, and trophy) were the same as those described by Gabelhouse (1984) and based on the 18.9-inch Guadalupe Bass caught from the lower Colorado River. The minimum and maximum boundary lengths for each length category were calculated by multiplying total length in inches by the lower and upper percentage. When metric values are used, separate calculations are recommended rather than conversions since small differences in index values occur between measurement units (Willis et al. 1993). After length ranges were

calculated, the representative minimum length for each category was adjusted based on the range and expert opinion.

## RESULTS AND DISCUSSION

The committee chose the Gabelhouse method to establish Guadalupe Bass length categories for several reasons. The method is widely accepted in North America and is used by TPWD to assess size structure for all other managed fisheries. However, the Gabelhouse method relies on one (longest) angler-caught IGFA world-record fish. An unusually large fish could be considered an outlier and skew the categories upward. This was not an issue with Guadalupe Bass as individuals near 18.9 inches have been observed. The committee agreed that consistency was important and extensive data collection required for the percentile method was not necessary.

Minimum lengths for Guadalupe Bass size categories were calculated from the longest documented specimen, measuring 18.9 inches long. This resulted in the following length categories (in inches): stock = 4, quality = 7, preferred = 10, memorable = 12, trophy = 15 (Table 1). This arrangement is similar to Yellow Perch (*Perca flavescens*), White Crappie (*Pomoxis annularis*), Black Crappie (*Pomoxis nigromaculatus*), and White Perch (*Morone americana*) which have world-record lengths comparable to Guadalupe Bass (Gabelhouse 1984). Guadalupe Bass are mature at age-1 (Garrett 1991), and minimum length at sexual maturity ranges from 3.3 inches to 6.1 inches (Curtis et al. 2015), converted to total length using Beckman (1948). Guadalupe Bass below four inches are assumed to have no recreational value to anglers. Therefore, stock length was set at 4 inches. The minimum length for a quality size Guadalupe Bass was set at 8 inches. This value was rounded up from the maximum boundary calculated for that category (7.7 inches) and seemed to be a length of Guadalupe Bass most anglers would like to catch. Preferred length was set at 10 inches, which was bigger than quality length and a size anglers would prefer to catch. Memorable length for Guadalupe Bass was set at 12 inches, which the committee believed to be a size most anglers would remember catching. Trophy length was set at 15 inches, which seemed worthy of acknowledgement in most of the Guadalupe Bass range. In many Guadalupe Bass populations, 15-inch fish are uncommon. For instance, in the upper Guadalupe River Guadalupe Bass  $\geq 14$  inches make up 1% of the population (TPWD unpublished data). However, in some areas with frequent 17- and 18-inch fish caught this value may seem low. Gabelhouse (1984) did recognize that regional differences in angler success and perception could alter what is considered a “trophy”.

## MANAGEMENT IMPLICATIONS

Defined size categories can be beneficial for the management and conservation of Guadalupe Bass. An updated and accepted length-categorization system would allow a more detailed and comparable assessment of Guadalupe Bass population size structure. Standard length categories also enable the prioritization of conservation and/or management efforts through identification of size structure deficiencies. Long-term trend analysis using these indices can illustrate population-level responses of Guadalupe Bass to biotic or anthropogenic activities. Size structure comparisons among waterbodies could also help inform anglers where populations exist that suit their preferences (e.g. – where a population has a high percentage of trophy category individuals). Length-based awards can be adjusted to official size categories

(Bonvechio et al. 2010). Weight is typically used for most TPWD fish awards but length is used for Catch and Release, Elite Angler, and Big Fish awards. Big Fish awards are based on trophy classes of each fish species. Currently, Guadalupe Bass must be 14 inches to qualify for a Big Fish award. This may need to be updated to reflect the new size categories.

More work can be done on population indices to improve the management of Guadalupe Bass. Since size categories are meant to reflect recreational value, angler opinions regarding size categories of Guadalupe Bass could be included in future creel surveys or online polling. The development of a  $W_s$  equation for Guadalupe Bass would allow calculations of relative weight ( $W_r$ ) as an index of fish condition. This would be a logical next step, and has been referenced as a science need in the rangewide conservation plan for Guadalupe Bass (Bean 2017). Relative weight can be used as a partial predictor of forage conditions, seasonal loss of fat content, fecundity, and mortality (Anderson and Neumann 1996). Environmental conditions (Liao et al. 1995) and stocking rates (Mitzner 1990) can be assessed in part by relative weight indices. With the development of these indices, fisheries statistics will be available for Guadalupe Bass at the same level as other fish species managed by TPWD.



## LITERATURE CITED

- Anderson, R. O. 1976. Management of small warm water impoundments. *Fisheries*, Bethesda, Maryland, 1(6):5-7, 26-28.
- Anderson, R. O. 1980. Proportional stock density (PSD) and relative weight ( $W_r$ ): interpretive indices for fish populations and communities. Pages 27-33 in S. Gloss and B. Shupp, editors. *Practical fisheries management: more with less in the 1980's*. Workshop proceedings, New York chapter, American Fisheries Society, Ithaca, New York, USA.
- Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 in B. R. Murphy and D. W. Willis, editors. *Fisheries techniques*, 2<sup>nd</sup> edition. American Fisheries Society, Bethesda, Maryland, USA.
- Anderson, R. O., and A. S. Weithman. 1978. The concept of balance for coolwater fish populations. Pages 371-381 in R. L. Kendall, editor. *Selected coolwater fishes of North America*. Special Publication 11, American Fisheries Society, Bethesda, Maryland, USA.
- Bean, P. T. 2017. Conservation of the Guadalupe Bass: a ten-year plan for restoring and preserving the state fish of Texas 2017-2026. Texas Parks and Wildlife Department, Austin.
- Bean, P. T., D. J. Lutz-Carrillo, and T. H. Bonner. 2013. Rangewide survey of the introgressive status of Guadalupe Bass: implications for conservation and management. *Transactions of the American Fisheries Society* 142:681-689.
- Bean, P. T., T. H. Bonner, and B. M. Littrell. 2007. Spatial and temporal patterns in the fish assemblage of the Blanco River, Texas. *Texas Journal of Science* 59:179-200.
- Beckman, W. C. 1948. The length-weight relationship, factors for conversions between standard and total lengths, and coefficients of condition for seven Michigan fishes. *Transactions of the American Fisheries Society* 75:237-256.
- Bister, T. J., D. W. Willis, M. L. Brown, S. M. Jordan, R. M. Neumann, M. C. Quist, and C. S. Guy. 2000. Proposed standard weight ( $W_s$ ) equations and standard length categories for 18 warmwater nongame and riverine fish species. *North American Journal of Fisheries Management* 20:570-574.
- Bonvechio, T. F., K. I. Bonvechio, and R. L. Cailteux. 2010. Proposed standard weight ( $W_s$ ) equation and standard length categories for Suwannee Bass. *North American Journal of Fisheries Management* 30:983-988.
- Cummings, G. C., and M. J. De Jesus. 2017. Statewide freshwater fisheries monitoring and management program survey report for the Colorado River, 2016. Texas Parks and Wildlife Department, Federal Aid Report F-221-M-2, Austin.

- Curtis, S. G., J. S. Perkin, P. T. Bean, M. L. Sullivan, T. H. Bonner. 2015. Guadalupe Bass *Micropterus treculii*. Pages 55-60 in M. D. Tringali, J. M. Long, T. M. Birdsong, and M. J. Allen, editors. Black bass diversity: multidisciplinary science for conservation. American Fisheries Society, Symposium 82, Bethesda, Maryland.
- Dumont, S. C., and B. C. Neely. 2011. A proposed change to Palmetto Bass proportional size distribution length categories. North American Journal of Fisheries Management 31:722-725.
- Edwards, R. J. 1997. Ecological profiles for selected stream-dwelling Texas freshwater fishes. Final Report, Texas Water Development Board, Austin.
- Fleming, B. P., G. P. Garrett, and N. G. Smith. 2015. Reducing hybridization and introgression in wild populations of Guadalupe Bass through supplemental stockings. Pages 537-548 in M. D. Tringali, J. M. Long, T. M. Birdsong, and M. J. Allen, editors. Black bass diversity: multidisciplinary science for conservation. American Fisheries Society, Symposium 82, Bethesda, Maryland.
- Gabelhouse, D. W., Jr. 1984. A length-categorization system to assess fish stocks. North American Journal of Fisheries Management 4:273-285.
- Garrett, G. P. 1991. Guidelines for the management of Guadalupe Bass. Texas Parks and Wildlife Department, Special Publication N3200-367, Austin.
- Garret, G. P., T. W. Birdsong, M. G. Bean, and R. McGillicuddy. 2015. Guadalupe Bass restoration initiative. Pages 379-385 in M. D. Tringali, J. M. Long, T. W. Birdsong, and M. J. Allen, editors. Black bass diversity: multidisciplinary science for conservation. American Fisheries Society, Symposium 82, Bethesda, Maryland.
- Grabowski, T. B. 2014. Guadalupe Bass (*Micropterus treculli*). Pages 42-48 in M. M. Davis and S. Brewer, editors. Gulf Coast Prairie Landscape Conservation Cooperative regional hypothesis of ecological responses to flow alteration. Wildlife Management Institute Grant Number GCP LCC 2012-003.
- Guy, C. S., R. M. Neumann, D. W. Willis, and R. O. Anderson. 2007. Proportional size distribution (PSD): a further refinement of population size structure index terminology. Fisheries 32:348.
- Hubbs, C., R. J. Edwards, and G. P. Garrett. 2008. An annotated checklist of the freshwater fishes of Texas, with keys to identification of species, 3<sup>rd</sup> edition. Available: <http://texasacademyofscience.org>. (April 2018).
- Liao, H., C. L. Pierce, D. H. Wahl, J. B. Rasmussen, and W. C. Leggett. 1995. Relative weight

- ( $W_r$ ) as a field assessment tool: relationships with growth, prey biomass, and environmental conditions. *Transactions of the American Fisheries Society* 124:387-400.
- Mitzner, L. 1990. Assessment of maintenance stocked channel catfish in Iowa lakes. Iowa Department of Natural Resources, Federal Aid in Fish Restoration, Reservoir Investigations Project F-94-R 6, Final Report, Des Moines.
- Outdoor Foundation. 2015. 2015 special report on paddlesports. The Outdoor Foundation, Washington, DC. Available: [www.outdoorfoundation.org](http://www.outdoorfoundation.org). (April 2018).
- Pease, J. E., T. B. Grabowski, and A. A. Pease. 2017. Variation and plasticity and their interaction with urbanization in Guadalupe Bass populations on and off the Edwards Plateau. U.S. Department of Interior, Fish and Wildlife Service, Cooperator Science Series FWS/CSS-125-2017, Washington, D.C.
- Perkin, J. S., Z. R. Shattuck, P. T. Bean, T. H. Bonner, E. Saraeva, and T. B. Hardy. 2010. Movement and microhabitat associations of Guadalupe Bass in two Texas rivers. *North American Journal of Fisheries Management*, 30:33-46.
- Quinn, S. P. 1991. Evaluation of a length-categorization system for Flathead Catfish. *Proceedings of the Annual Conference Southeastern Association of Fish and Wildlife Agencies* 43(1989):146-152.
- Thomas, Z. A., T. L. Arsuffi, S. J. Magnelia. 2015. Fishing warmwater streams with limited public access: angling behavior, economic impact, and the role of Guadalupe Bass in a twenty-four-county region of Texas. *American Fisheries Society Symposium* 82:123-137.
- Willis, D. W., B. R. Murphy, and C. S. Guy. 1993. Stock density indices: development, use, and limitations. *Reviews in Fisheries Science* 1:203-222.

Table 1. Suggested range and minimum length for each category based on longest documented Guadalupe Bass (18.9 inches, 480 mm).

Category	Suggested range	Range (Inches)	Minimum length	
			Inches	Centimeters
Stock	20 - 26%	3.8 - 4.9	4	10
Quality	36 - 41%	6.8 - 7.7	8	20
Preferred	45 - 55%	8.5 - 10.4	10	25
Memorable	59 - 64%	11.2 - 12.1	12	30
Trophy	74 - 80%	14.0 - 15.1	15	38

Texas Parks and Wildlife Department  
4200 Smith School Road, Austin, Texas 78744

© 2018 TPWD. PWD RP T3200-2723 (4/18)

In accordance with Texas Depository Law, this publication is available at the  
Texas State Publications Clearinghouse and/or Texas Depository Libraries.

TPWD receives funds from the USFWS. TPWD prohibits discrimination on the basis of race, color, religion, national origin, disability, age, and gender, pursuant to state and federal law. To request an accommodation or obtain information in an alternative format, please contact TPWD on a Text Telephone (TDD) at (512) 389-8915 or by Relay Texas at 7-1-1 or (800) 735-2989. If you believe you have been discriminated against by TPWD, please contact TPWD or the U.S. Fish and Wildlife Service, Office for Diversity and Workforce Management, 5275 Leesburg Pike, Falls Church, VA 22041.