

LOUISIANA DEPARTMENT OF WILDLIFE & FISHERIES



OFFICE OF FISHERIES INLAND FISHERIES SECTION

Evaluation of the 14 Inch Minimum Length Limit for Largemouth
Bass in the Atchafalaya Basin and surrounding waters, Louisiana

TECHNICAL REPORT SERIES



Evaluation of the 14 Inch Minimum Length Limit for Largemouth Bass in the Atchafalaya Basin and Surrounding Waters

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Summary

We evaluated the effectiveness of the 14" minimum length limit (MLL) on largemouth bass (LMB) in the Atchafalaya Basin. The MLL was implemented in 1993 for the waters of the Atchafalaya Basin and Lakes Verret and Palourde following the devastating fish kill that resulted from Hurricane Andrew. After the storm, LMB were stocked in an effort to help the fishery recover. The initial purpose of the MLL was to protect those stocked fish for at least three years until they could spawn and replenish the population naturally. The MLL became a permanent regulation in 1997 with substantial support from anglers. The regulation has received mixed reviews for a number of years. This evaluation involved the population dynamics of the LMB in the Atchafalaya Basin and catch statistics obtained from angler surveys. LMB population characteristics included relative abundance, growth rates, mortality estimates and longevity. Results indicated that LMB in the Atchafalaya Basin reached 14 inches total length (TL) in an average of 3.4 years. Results of the age analysis indicated LMB in the Atchafalaya Basin were relatively short-lived, seldom reaching five years of age.

Over a 22 year monitoring period in the Atchafalaya Basin, it became apparent that environmental factors such as water level fluctuations and the frequency of severe tropical storms have a primary role in the growth and survival rates of the LMB population. The frequency of tropical storm activity since the implementation of the 14" MLL is cause for reasonable prediction that such events will adversely impact the basin on a routine basis. We conclude that the slow growth and short expected life span of Atchafalaya Basin LMB and the frequency of catastrophic environmental events are inherent and uncontrollable factors that cannot be mitigated by the 14" MLL. As such, the 14" MLL is an ineffective regulation for the purpose of protecting LMB and increasing the abundance of larger size bass in the Atchafalaya Basin.

Introduction

When Hurricane Andrew struck the Atchafalaya Basin in 1992, fish populations were decimated. By conservative estimates, the number of fish lost in the catastrophic event approached 200 million. Efforts to address the damage to the fishery included fish stocking and a protective length limit that restricts harvest of LMB under 14" in total length (TL). The regulation was implemented in 1993 for LMB within the Atchafalaya Basin and Lakes Verret and Palourde (Figure 1). The daily creel limit of 10 bass daily was retained. Justification for the 14" MLL was that bass would be protected and allowed to spawn at least once and possibly twice before being subjected to angler harvest. The resulting spawns would replenish the local fishery. In the absence of large predators, the bass population responded with a tremendous resurgence in a short period of time. Instead of recognizing the resilience of the native bass population, many anglers credited the 14" MLL regulation. The 14" MLL gained popularity and soon began to also receive support as a tool to produce larger size bass. In time, the regulation that had originally been designed as a temporary protective measure was extended indefinitely and linked with expectations beyond original intent.

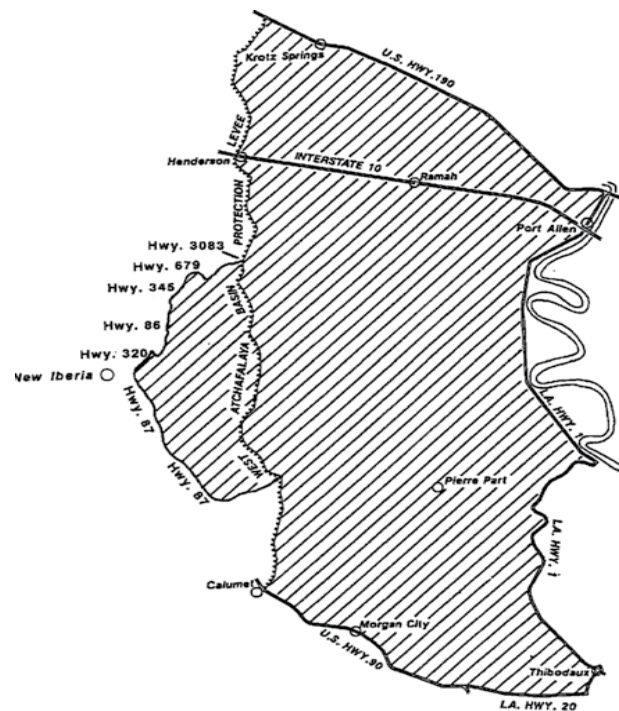


Figure 1. Geographic boundary of the 14" MLL for LMB within the Atchafalaya Basin and surrounding waters in south central Louisiana (1993-present)

LDWF had been managing black bass populations before Hurricane Andrew. Statewide regulations included a reduction in daily take from 15 to 10 bass in 1991. LDWF fisheries biologists began sampling fish populations and angler catch with standardized techniques as early as 1989. We were able to use this long term data set to support this evaluation and to describe the pattern of LMB recovery following major storm events. The results of a 3 year study specifically designed to evaluate the 14" MLL regulation for LMB were also included.

Study Area

The Atchafalaya River Basin (ARB) is the largest contiguous river-floodplain swamp in North America and is one of the most popular destinations for freshwater anglers in Louisiana. ARB carries 30% of the annual discharge of the Mississippi and Red Rivers combined. Flow is regulated by the U.S. Army Corps of Engineers (USACE) with two diversion structures (Old River Control Structures) and guide levees along the east and west portions of the basin. The structures have reduced flood magnitude and duration and have prevented the Atchafalaya River from capturing the Mississippi River main stem. Flood regime plays a pivotal role in fisheries production and fishing activity by commercial and recreational fishers (Alford and Walker 2012).

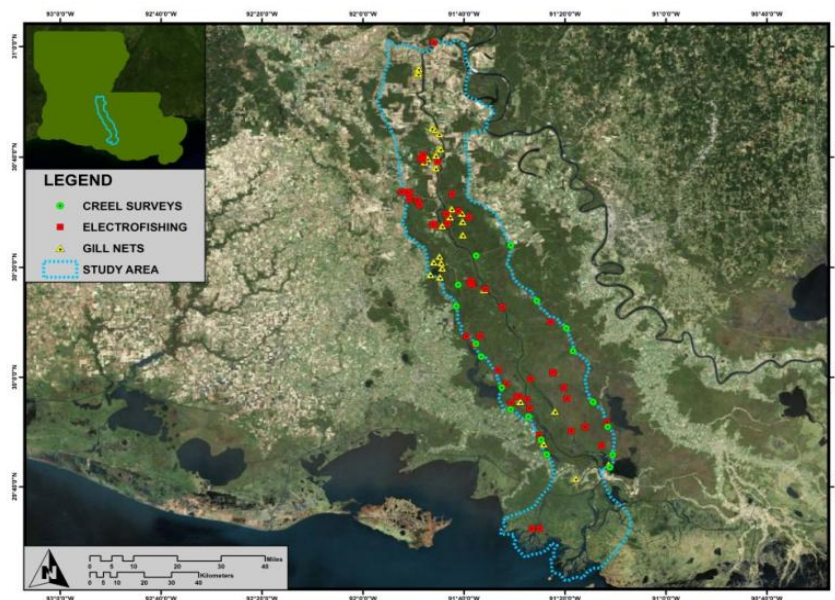


Figure 2. Map of the Atchafalaya Basin, Louisiana and surrounding waters (area of 14" MLL regulation) depicting fixed electrofishing and angler survey sampling sites.

Methods

LMB were sampled in the Atchafalaya Basin over a 22 year period from 1990–2011. Fixed stations were sampled with electrofishing during the fall when water levels were low and stable. Each station was sampled for 900 seconds of actual shocking time. All LMB in the sample were retained for subsequent analysis. We calculated catch-per-unit-effort (CPUE) as a measure of relative abundance for all age groups of LMB over this time period.

From 2009-2011, we sampled 446 LMB for age, growth, and mortality analyses. Sagittal otoliths were removed from ten bass per inch group per year for age analysis. Otolith sections were read by independent readers. Annuli counts were assigned. Biological ages were then estimated by assigning an April 1st birth date. Ages were assigned to fish collected during the 2009-2011 sampling period with age-length-keys (Ricker 1975). Ages were assigned to fish collected from earlier years (1990-2008) strictly as an inverse of the von Bertalanffy growth model. Growth was estimated by fitting the von Bertalanffy model (1938) to the 2009-2011 data. Total instantaneous mortality (Z) was calculated using the descending slope of catch curves (Ricker 1975). Only those age classes with ≥ 5 individuals were used in estimation of Z. Assumptions critical to accurate estimation of Z using catch curves includes constant recruitment and mortality in the population. Given the impact of Hurricane Gustav in 2008, and to reduce the impact of the constant mortality assumption, catch curves were only used to estimate Z with the 2011 sample.

Angler catch and harvest rates from 11 angler surveys (1989-1991, 1993-1996, 2003-2004, and 2008-2009) conducted in the basin over a 20 period were analyzed and used to determine angler influence

Results

Electrofishing catch per unit effort (CPUE) was found to be extremely variable over the most recent 20 year period. Figure 3 represents LMB CPUE by age group from

fall electrofishing sampling. Environmental disturbances are designated for reference. For the duration of the monitoring period, influential events including hurricanes, droughts, and floods occurred at intervals of less than four years.

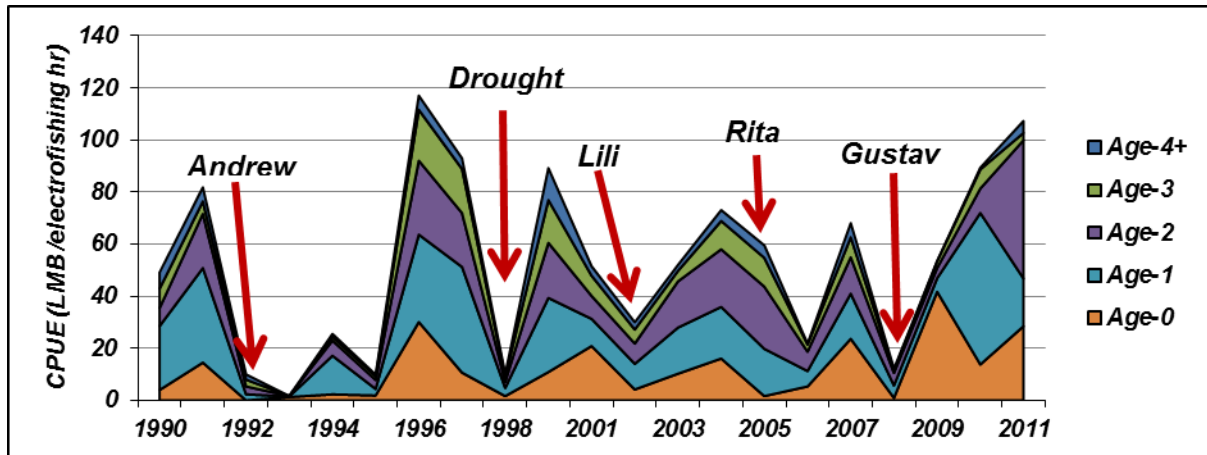


Figure 3. Catch per unit effort for LMB by age group from the Atchafalaya Basin for the time period 1990 – 2011.

Data compiled in this study indicate an average of 3.4 years is required for Atchafalaya Basin LMB to reach 14 inches TL (Figure 4). A recent LDWF study to determine mortality (and expected life span) for Atchafalaya Basin LMB was disrupted by fish kills associated with Hurricane Gustav. However, the results of less current sampling describe Atchafalaya Basin LMB as rather short-lived, seldom reaching five years of age (Figure 5). The annual mortality rate and survival rate calculated for the 2011 LMB age data is 73% ($Z = -1.29$) and 27%, respectively.

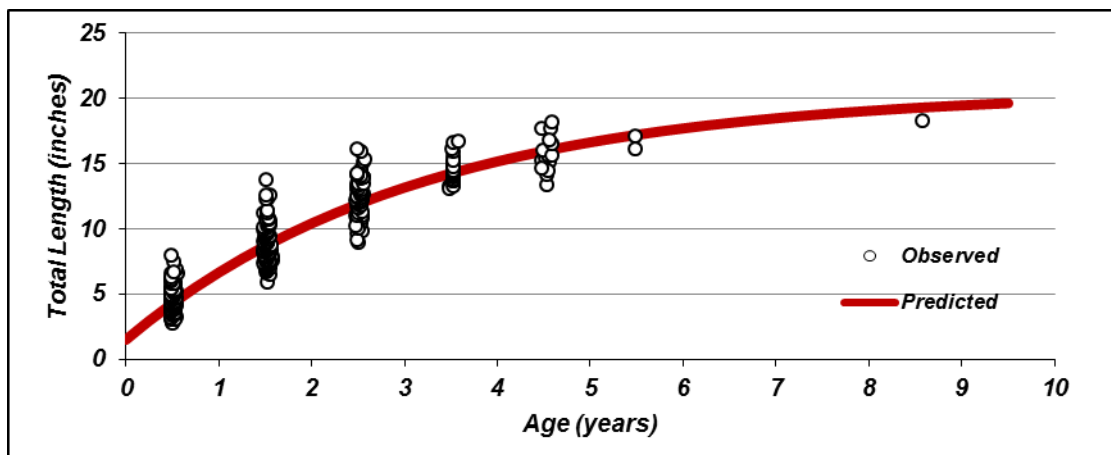


Figure 4. Growth rate of LMB from the Atchafalaya Basin, Louisiana for the period 2009 – 2011. It takes 3.4 years for LMB to grow to 14" TL (n = 446).

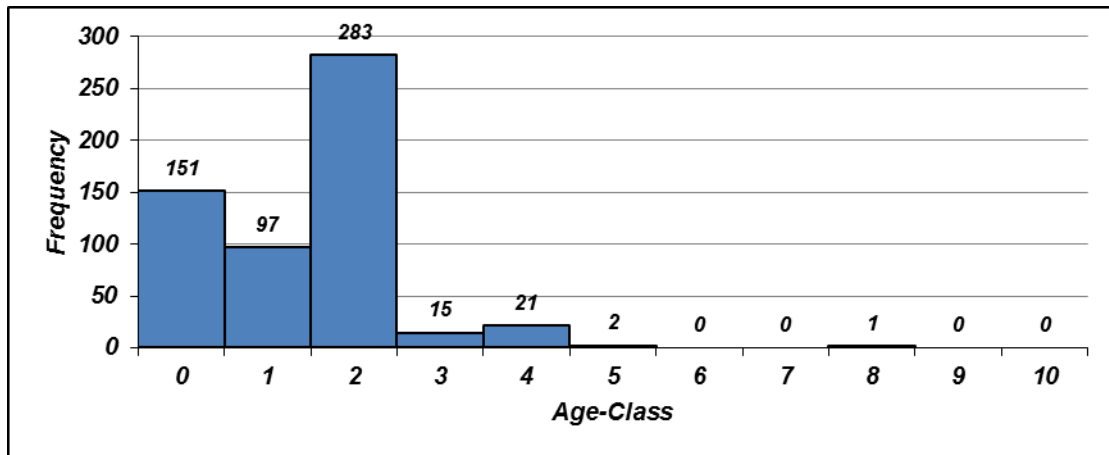


Figure 5. Age class structure of LMB collected from the Atchafalaya Basin, Louisiana for 2011 (n = 570). Few bass older than four years of age were observed in the sample.

Table 1 lists annual catch rates by bass anglers in the Atchafalaya Basin. With the exception of hurricane affected years, angler catch has been consistently higher as a result of the minimum length limit. Release rates have also been higher, as should be expected with the minimum length limit. Accordingly, harvest rates have been lower since anglers are legally required to release bass under the minimum length limit of 14 inches. The average weights for bass legally harvested have also been higher since the length limit was imposed.

Table 1. Creel survey statistics for anglers targeting bass in the Atchafalaya Basin, Louisiana. Shaded years are years before the MLL

BASS ANGLERS (89-91 - no length limit) (14 inch minimum since 1993)				
Year	LMB caught per trip/per hr.	LMB released per trip/per hr.	LMB harvested per trip/per hr.	LMB Average weight
1989	1.78/0.32	0.98/0.18	0.80/0.14	1.72
1990	4.83/0.86	3.49/0.59	1.35/0.27	1.13
1991	4.93/0.88	3.54/0.65	1.39/0.23	1.15
1993	2.35/0.48	2.15/0.44	0.20/0.04	2.09
1994	8.95/1.73	8.68/1.68	0.28/0.05	2.14
1995	6.84/1.36	6.32/1.25	0.52/0.11	1.95
1996	5.38/0.96	4.51/0.81	0.86/0.15	1.96
2003	5.82/0.92	5.39/0.86	0.43/0.06	2.12
2004	4.95/0.86	4.57/0.79	0.38/0.07	2.18
2008	8.18/1.56	7.40/1.41	0.78/0.16	2.11

Discussion and Conclusions

Minimum length limits are a commonly used management tool for regulating recreational fisheries. Anderson (1974) stated that the purpose of size limits is to help rebuild depleted stocks of bass by reducing total annual mortality on certain size fish. Implemented to protect and enhance fisheries stocks, MLL's can increase angler expectation of improved catch rates. However, MLL's can have negative impacts to fish stocks if the regulation does not "fit" the particular species biology and/or the environment it inhabits. Novinger (1984) listed the qualitative criteria for minimum length limits as waters exhibiting the following conditions: 1) high

fishing mortality, 2) low recruitment, 3) fast growth, and 4) low natural mortality. Below, each of these criteria are compared with the results determined in this evaluation:

1. Angler surveys allow direct measurement of fishing pressure, harvest, and angler success. All three are necessary in assessing the impacts of any harvest restriction on the bass population and on the angling public. Angler survey statistics indicate that annual harvest rates decreased by an average of 50% after implementation of the MLL, while rates of release for bass smaller than the limit doubled in most years. Fishing mortality is indicated to be low.
2. Recruitment is defined as the number of bass surviving through their first year of life. Recruitment is an important factor in determining the success of harvest restrictions. Recruits are the base from which harvestable size bass will grow. The numbers of Age 1+ (bass from the previous spawn) LMB in fall electrofishing samples indicates annual production and survival are adequate to sustain the basin LMB population.
3. Growth is the change in fish size over time. It takes Atchafalaya Basin bass on average 3.4 years to reach 14 inches TL. This time requirement is approximately 1.4 years more than the statewide average for LMB.
4. Mortality can be separated into two types: fishing mortality (angler harvest or post-release mortality) and natural mortality (natural causes - starvation, predation, disease, old age). The calculated annual mortality rate for Atchafalaya Basin bass from the 2011 sample was 73%. This is considered to be a high total mortality rate and is attributed to environmental influences that include severe tropical storms and droughts. Each influence is documented as having been responsible for sharp declines in LMB abundance during the study period. Low oxygen conditions often accompany the passage of tropical systems. A reduction in fingerling production is associated with prolonged droughts.

Based upon the results from this study, the Atchafalaya Basin LMB population does not exhibit any criteria for which a 14" MLL would be appropriate. Wilde (1997) compiled information on published and unpublished studies that evaluated LMB fishery responses to length limits. He reviewed 49 evaluations of MLL's. The most commonly evaluated regulations were for 12- ($n = 13$) and 14-inch ($n = 14$) MLL's. He found that while MLL's failed to increase the proportion of larger fish and the number of fish harvested by anglers, they did increase angler catch rates. Our evaluation of the 14" MLL in the Atchafalaya Basin is similar to Wilde (1997). Angler catch of larger fish has not increased. Catch rates for smaller bass have increased, but the majority of those fish are below the 14" MLL and not legally available for harvest.

Aldo Leopold (1987) determined that wildlife populations cannot be stockpiled or maintained in overabundance without risk of dire consequences to the population. Natural catastrophes and other natural mortality factors such as disease and predation serve to keep populations in balance with nature. We conclude that the inherent characteristics of Atchafalaya Basin LMB (slow growth, short life span) and the frequency of environmental events are factors that cannot be mitigated by the 14" MLL. LMB and the existing habitat in surrounding waters including Lakes Verret and Palourde, and Fausse Pointe share similar characteristics. Therefore, is it our conclusion that the 14" MLL is not effective to produce increased abundance of larger size bass.

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