

South Dakota Black Bass Regulation Toolbox

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Special Report

August 2023

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Preface

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Executive Summary

The Black Bass Toolbox contains a set of regulation choices designed for black bass fisheries in South Dakota. The number of regulations included in the toolbox is limited to reduce regulation complexity. The Black Bass Toolbox should serve as a starting point when looking at regulations for black bass in new and existing waters.

The number of lakes in which a toolbox regulation is used in South Dakota has declined since the 2009 Black Bass Toolbox (47 in 2009 and 3 in 2023). This reduction follows a declining trend in black bass special regulations observed across the Midwest and Canada. The primary reason that black bass regulations are not as needed is a prevailing attitude supporting catch-and-release angling for black bass. Waters not managed with a special regulation have a daily limit of five Largemouth/Smallmouth Bass (any combination and any size).

Regulations included in the toolbox include a 381-mm (15-in) minimum length limit (MLL), a 356-457 mm (14-18 in) protected slot limit (PSL) with one fish $\geq$ 457 mm (18 in), and an experimental regulation category. Choice of the appropriate black bass regulation is dependent on growth, recruitment, and mortality. The 381-mm (15-in) MLL can be used for two different management objectives. One objective would be to improve black bass abundance and/or population size structure in lower-density populations, and the second objective would be to maintain a high abundance of black bass to promote predation of panfish and/or rough fish. The 356-457 mm (14-18 in) PSL with one fish $\geq$ 457 mm (18 in) can be used to increase the average size of black bass in higher-density populations while allowing for harvest of small bass and an occasional trophy-sized bass. The experimental regulation category allows for research into potential new black bass regulations in situations where toolbox regulations are not applicable.

A 10-year evaluation plan will be required with the implementation of any regulation. All regulation changes, including citizen's petitioned regulation changes, will need to be evaluated through the collection of biological data. Black bass populations considered for a new regulation or as part of an evaluation of a regulation will be sampled by boat electrofishing to determine relative abundance, size structure, condition, to estimate growth and annual mortality, and to characterize recruitment. In many cases, human dimensions data gained either through creel surveys or broader questionnaire surveys will also be used in the evaluation. At the end of the 10-year evaluation, a report of the findings will be completed, which will include a recommendation of whether or not the regulation will continue.

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South Dakota Black Bass Toolbox

Introduction:

Black bass management across North America shifted from a time of relatively restrictive regulations prior to 1940 to more liberal regulations from 1940 to 1960 and then a return to more restrictive regulations after 1960 (Redmond 1986). The liberal regulations from 1940 to 1960 were founded on the belief that fish populations were generally underexploited. More restrictive regulations began to be used again in the 1960s after studies showed that black bass were extremely vulnerable to overfishing (Redmond 1986; Simonson 2001). While most early regulations were established to protect spawning black bass, the objectives for implementing current regulations often were to reduce fishing mortality, provide an equitable distribution of harvest, and improve size structure (Paukert et al. 2007; Allen et al. 2008). These regulations tended to be received with broad public support (Quinn 1996; Hansen et al. 2015). However, over the last two decades, there has been large-scale removal of black bass length restrictions, especially in the upper Midwest and Canada, in response to increased black bass abundances resulting in declines in black bass growth and negative effects on Walleye (Fayram et al. 2005; OMNR 2009; Hansen et al. 2015).

In 1982, South Dakota Game, Fish and Parks (GFP) repealed the spring fishing closure used for black bass and other species which had been in effect since 1947 in northeast South Dakota. Length restrictions were first applied to Largemouth Bass in South Dakota when a 305-mm (12-in) minimum length limit (MLL) was implemented for Largemouth Bass on five lakes with bass populations that were purportedly overharvested (Jacobson 1986). The conclusion of the study was that the MLL had little effect on the bass populations, and it was recommended that the MLL be removed from two of the five lakes. In 1987, an MLL of 381 mm (15 in) was

applied to Largemouth Bass in Lake Alvin, and a 305-mm (12-in) MLL was implemented on Lake Yankton, South Dakota (Lindgren 1991). An ensuing study showed an improvement in the size structure of Largemouth Bass in Lake Alvin after the implementation of the MLL (Lindgren 1991). From 1987 to the implementation of the toolbox (2009), black bass size restrictions were enforced on 47 waters (Table 1). In 2009, South Dakota black bass size restrictions were comprised of four special regulations (other than the statewide regulation) that included a 381-mm (15-in) MLL and three protected slot limits (PSL; 305-406 mm [12-16 in], 305-457 mm [12-18 in], and 356-457 mm [14-18 in]). Each PSL allowed for the harvest of only one bass above the upper threshold. The 381-mm (15-in) MLL is generally used for Largemouth Bass while PSLs are used for both Largemouth Bass and Smallmouth Bass. Waters not managed with a special regulation have a daily limit of five Largemouth/Smallmouth Bass (any combination and any size). Smallmouth Bass and Largemouth Bass were combined for regulation purposes in 2003 due to angler difficulty in distinguishing between the two species where they co-occur.

The 2023 Black Bass Toolbox contains only two special regulations designed to encompass the variety of black bass fishing opportunities in South Dakota, but more may be added if needed. The toolbox also allows for experimental regulations to be used for research or special management situations. The two regulations in the 2023 Black Bass Toolbox are designed for fisheries with varying population dynamics and substantially different goals. The toolbox was designed to reduce regulation complexity while allowing adequate replication for effective evaluation.

2023 Black Bass Toolbox Options:

381-mm (15-in) MLL

Objectives:

- A. To improve black bass population density (electrofishing CPUE > 20/h) and/or size structure (PSD of 40-70).

Criteria for implementation:

1. Low-density population (electrofishing CPUE < 10/h; may require stocking of advanced juveniles or adults to maintain the population).
2. Moderate to fast growth [>230 mm (9 in) at age 3]
3. A population comprised primarily of smaller fish (PSD < 40, PSD-P < 10) which is attributed to high fishing mortality of quality-size and larger bass.

Rationale for removing the regulation:

1. Slowed growth [<200 mm (8 in; LMB) or <230 mm (9 in; SMB) at age 3] because of stockpiling of small fish under the regulation. Slowed growth could be a product of more consistent or exceptional recruitment and a subsequent depletion of the prey base.
 2. Inability to consistently maintain a PSD of 40-70 and/or PSD-P of at least 10.
 3. Unsuitable water quality or habitat for maintaining a quality black bass population.
 4. Angler dissatisfaction and noncompliance.
- B. To maintain a high-density population of Largemouth Bass < 381 mm (15 in) to promote predation on small panfish and/or rough fish (e.g., Quantity/Panfish Management Option).

Criteria for implementation:

1. Moderate to high Largemouth Bass abundance (electrofishing CPUE > 30/h).
2. Slow to moderate growth [<230 mm (9 in) at age 3].
4. Low probability of winterkill.
5. Anglers desire quality panfish over Largemouth Bass quality.
6. Overabundant rough fish.

Rationale for removing the regulation:

1. Change in Largemouth Bass recruitment pattern; bass density (CPUE < 30/h) insufficient to exert needed predation on panfish population.
2. Unsuitable water quality and habitat for maintaining a high-density Largemouth Bass population.
3. Angler dissatisfaction and noncompliance.

356 – 457 mm (14-18 in) PSL with one fish > 457 mm (18 in)

Objective: To increase the average size of black bass populations while allowing harvest of small bass to avoid slowing of growth.

Criteria for implementation:

1. Reasonably consistent recruitment.
2. Moderate to high black bass population abundance (electrofishing CPUE > 50/h).
3. Slowed growth [<200 mm (8 in; LMB) or <230 mm (9 in; SMB) at age 3] in young individuals.
4. A population comprised primarily of smaller fish (PSD < 40, PSD-P < 10) which is attributed to high fishing mortality of preferred-size and larger bass.
5. Anglers are willing to harvest black bass < 356 mm (14 in).

Rationale for removing the regulation:

1. Unable to meet desired objective (e.g., insufficient numbers of black bass making it to the protected slot or above the protected slot).
2. Angler harvest of black bass less than 356 mm (14 in) is not sufficient to accomplish regulation objective.
3. Angler dissatisfaction with the regulation and poor compliance.
4. Regulation has led to an unintended effect (e.g., increased competition with other species).

Experimental Regulations

Objective: To research potential new regulations (e.g., maximum size limit or mandatory catch and release).

Criteria for implementation:

1. Unique management or biological situation that cannot be adequately addressed with a statewide or toolbox regulation.
2. Desire to create unique fishing opportunity (e.g., maintain an abundance of large bass in an urban fishery).
3. Need to research the effectiveness of new regulation types.

Rationale for removing the regulation:

1. Unable to meet desired objectives.
2. Angler dissatisfaction and non-compliance.

Regulation Changes After Implementation of the Black Bass Toolbox

Black bass special regulations changed dramatically from the time of implementation of the toolbox in 2009 when 47 waters contained various size restrictions (Table 1) on harvest to the present (2023). In 2010, the 381-mm (15-in) MLL was removed from three northeastern South Dakota lakes (Farley, Faulkton, and Mina) because these waters contained few, if any, Largemouth Bass and did not support a black bass fishery (Appendix). Also in 2010, the special regulation on black bass in nine northeastern South Dakota lakes was changed from a 305-457 mm (12-18 in) PSL and a three fish daily bag with at most one fish $\geq$ 457 mm (18 in) to a 356-457 mm (14-18 in) PSL with at most one fish $>$ 457 mm (18 in). A similar change occurred that year on western South Dakota lakes when the regulation on three lakes (New Wall, Newell, and Waggoner) was changed from a 305-406 mm (12-16 in) PSL and with at most one fish $\geq$ 406 mm (16 in) to a 356-457 mm (14-18 in) PSL with at most one fish $>$ 457 mm (18 in). Reasons behind the change were to promote the harvest of bass beneath the PSL and to bring PSL regulations across the state in line with the toolbox recommended PSL that was already in place

Table 1. Geographic distribution of black bass length regulations in use in South Dakota waters in 2023 and 2009 (in parentheses) when the toolbox was first implemented.

Regulation	Number of Waters			
	East River	West River	Missouri River Reservoirs	Combined
381-mm (15-in) MLL	2 (25)	0 (9)	0 (0)	2 (34)
305 – 406 mm (12-16 in) PSL with at most one fish $\geq$ 406 mm (16 in)	0 (0)	0 (3)	0 (0)	0 (3)
305 – 457 mm (12-18 in) PSL with at most one fish $\geq$ 457 mm (18 in)	0 (9)	0 (0)	0 (0)	0 (9)
356 – 457 mm (14-18 in) PSL with at most one fish $\geq$ 457 mm (18 in)	0 (0)	1 (0)	0 (1)	1 (1)
Total	2 (34)	1 (12)	0 (1)	3 (47)

on Lake Sharpe. Additionally, a 381-mm (15-in) MLL was implemented on Durkee Lake (Meade County) in 2010 and Bismarck Lake (Custer County) in 2016.

Most of the changes in black bass regulations after implementation of the 2009 toolbox involved the repeal of size restrictions. The size restrictions primarily were repealed because they were deemed unnecessary with the popularity of catch and release angling and subsequent limited harvest of black bass, concerns that a high abundance of black bass may have a negative impact on Walleye and Yellow Perch populations, and as part of an initiative to simplify fishing regulations. The PSL on Smallmouth Bass in Lake Sharpe was the first of these regulations to be repealed in 2012. The angling public's concern about the impact of abundant Smallmouth Bass on the Walleye population was a major driver behind the decision to repeal the size restriction. Additionally, Fincel et al. (2015) examined the impact of the Lake Sharpe PSL and found that any improvement in the Smallmouth Bass population during the regulation period could likely be attributed to system-wide factors rather than the regulation. Next, the 381-mm (15-in) MLL was removed from five southeastern South Dakota impoundments in 2017 as Largemouth Bass populations in these waters had declined, and GFP had discontinued monitoring and managing these populations. In 2019, black bass size restrictions were removed from all remaining special-regulation waters except Burke Lake, New Wall Lake, and Yankton Lake. Elimination of ineffective or unnecessary regulations, and an initiative to simplify regulations were the primary drivers behind this large-scale removal of black bass size restrictions.

As of January 2023, a 381-mm (15-in) MLL on black bass was removed from Burke Lake and reinstated on Lake Mitchell. The 381-mm (15-in) MLL was not removed in 2019 because Burke Lake was included in a study that was investigating Largemouth Bass size structure and abundance in relation to Largemouth Bass removal rates. Angler catch (Lake

Mitchell Bassmasters league results) and summer electrofishing catch (Game, Fish and Parks, unpublished data) of Largemouth Bass in Lake Mitchell have decreased substantially over the last 10 years. Hatchery-reared, sub-adult Largemouth Bass will be stocked in an attempt to rebuild the population, and the 15-inch MLL has been reinstated to protect these fish from harvest.

Support for Regulation Choices:

If a quality black bass population is desired, MLLs should only be applied to populations with low to moderate density and moderate to fast growth. Otherwise, growth rates will likely slow, and bass will stockpile below the MLL. To increase panfish quality, Largemouth Bass size structure must be sacrificed to increase bass abundance so predation can reduce panfish abundance and, ultimately, lead to increased panfish population size structure. An abundance of Largemouth Bass <381 mm (15 in) will exert predation on the panfish community, leading to improved panfish population size structure. Protected slot limits should be used to improve black bass size structure in high density, slow growing populations. Computer simulations of black bass dynamics have suggested that fishing regulations can shape yield, harvest, density, size structure, and biomass in productive (i.e., fast growth and low mortality) populations but can only affect the size structure in unproductive (i.e., slow growth and high mortality) populations (Beamesderfer and North 1995).

Rate Functions

Growth. Growth is one of three population rate functions (i.e., growth, mortality, and recruitment) that must be considered for proper selection of harvest regulations. Growth can be

qualitatively characterized as slow, moderate, or fast for management purposes. Growth characterizations for each species were determined by examining back-calculated lengths at age for 24 Largemouth Bass and 13 Smallmouth Bass populations from across South Dakota. Scales were used to age Largemouth Bass and Smallmouth Bass because that was the common practice in South Dakota at that time and sacrificing fish from some populations would have been deemed unacceptable. Although otoliths are recommended as the standard structure for estimating black bass ages when sacrificing fish is acceptable, scales have been shown to be a suitable surrogate for estimating ages of Largemouth Bass < 35 cm TL and Smallmouth Bass < 34 cm TL (Blackwell et al. 2019).

A mean of back-calculated mean lengths for each age was determined. Slow growth was defined as one standard deviation (SD) below the mean, and fast growth was one SD above the mean (Allen et al. 2002). Von Bertalanffy growth models were fit to the mean of mean back-calculated length-at-age values and to the mean length-at-age values one SD above and below the mean of means to estimate lengths at age for slow, moderate, and fast growth. Estimated back-calculated lengths at age from the von Bertalanffy growth models for slow, moderate, and fast growth for Smallmouth Bass are provided in Table 2, and those for Largemouth Bass are in Table 3.

Several studies have demonstrated a negative relationship between Largemouth Bass growth and their abundance, especially in smaller waters (Hill and Willis 1993; Paukert and Willis 2004; Gaeta et al. 2011). Population size structure or density can increase with implementation of a size restriction (Terre and Zerr 1994; Wilde 1997), and slow growth often is an impediment to achieving regulation objectives. A significant increase in Largemouth Bass density across Wisconsin from 1990-2011 coincided with a concurrent decrease in Largemouth

Bass growth (Hansen et al. 2015). Restrictive harvest policies provided one plausible explanation for these trends; however, the authors conceded that other factors such as increased voluntary release and potentially favorable environmental conditions, presented other reasonable causes. At Lake Cochrane, South Dakota, under a 381-mm (15 in) MLL from 1999 through 2004, Largemouth Bass growth slowed as bass abundance increased because of a change in the recruitment pattern. Although Largemouth Bass populations in eastern South Dakota glacial lakes and large impoundments are generally recruitment-limited and exhibit low abundance (McKibbin 2002), growth rates should still be monitored under restrictive length regulations because of the potential for slowing growth to negate any benefits from the regulation.

Mortality. Mortality combined with recruitment results in population abundance for a waterbody. Total mortality includes the death of fish due to natural causes and fish that are lost to angling. Separating total mortality into the portion caused naturally and that induced by

Table 2. Predicted back-calculated length at age for slow-, moderate-, and fast-growing Smallmouth Bass populations in South Dakota waters.

	Predicted back-calculated lengths at age (mm)		
Age	Slow	Moderate	Fast
1	78 (3.1 in)	88 (3.5 in)	98 (3.9 in)
2	167 (6.6 in)	186 (7.3 in)	206 (8.1 in)
3	233 (9.2 in)	259 (10.2 in)	286 (11.3 in)
4	282 (11.1 in)	314 (12.4 in)	346 (13.6 in)
5	319 (12.6 in)	355 (14.0 in)	391 (15.4 in)
6	346 (13.6 in)	385 (15.2 in)	425 (16.7 in)
7	366 (14.4 in)	408 (16.1 in)	450 (17.7 in)
8	381 (15.0 in)	425 (16.7 in)	469 (18.5 in)

Table 3. Predicted back-calculated length at age for slow-, moderate-, and fast-growing Largemouth Bass populations in South Dakota waters.

	Predicted back-calculated lengths at age (mm)		
Age	Slow	Moderate	Fast
1	75 (2.9 in)	95 (3.7 in)	114 (4.5 in)
2	140 (5.5 in)	174 (6.9 in)	209 (8.2 in)
3	197 (7.7 in)	238 (9.4 in)	282 (11.1 in)
4	244 (9.6 in)	290 (11.4 in)	338 (13.3 in)
5	285 (11.2 in)	333 (13.1 in)	381 (15.0 in)
6	319 (12.6 in)	367 (14.4 in)	414 (16.3 in)
7	348 (13.7 in)	394 (15.5 in)	439 (17.3 in)
8	373 (14.7 in)	416 (16.4 in)	459 (18.1 in)
9	395 (15.5 in)	434 (17.1 in)	474 (18.6 in)
10	412 (16.2 in)	449 (17.7 in)	485 (19.1 in)
11	428 (16.8 in)	461 (18.1 in)	494 (19.4 in)
12	441 (17.4 in)	470 (18.5 in)	501 (19.7 in)

anglers can be difficult. Total mortality is generally estimated using a catch curve (Ricker 1975).

Published estimators have been shown to provide reasonably accurate estimates of natural mortality in Largemouth Bass and Smallmouth Bass (Maceina and Sammons 2016) and can provide general guidance on mortality components when angler exploitation data are lacking. Angler-caused mortality includes fish that are harvested and those that perish due to hooking and/or handling.

Largemouth Bass and Smallmouth Bass can be vulnerable to angling. At 16.6-ha Murdo Lake, South Dakota, 11% of the Largemouth Bass population was caught by 12 anglers fishing for 2 days, and at 1.3-ha Knox Pond, South Dakota, four anglers were able to catch 33% of the Largemouth Bass in one afternoon of fishing (Lindgren and Willis 1990a). Allen et al. (1998), in

a review of Largemouth Bass mortality, found that total mortality appeared to increase with increasing angler exploitation, indicating that annual mortality and exploitation were additive or possibly only partially compensatory. Although there are no estimated exploitation rates for Smallmouth Bass in South Dakota, it is known that South Dakota anglers will harvest Smallmouth Bass, and often the harvest is directed at larger (>356 mm; >14 in) fish. At Lake Sharpe, South Dakota, prior to establishment of the Smallmouth Bass PSL in 2003, anglers annually kept between 22% and 42% of the Smallmouth Bass they caught (John Lott, South Dakota Game, Fish and Parks, personal communication). Between 2003 and 2007 when a stringent (i.e., 305-457 mm; 12-18 in) PSL was in place on Lake Sharpe, the proportion of captured Smallmouth Bass that were harvested dropped to an average of ~7%. The proportion increased slightly to ~10% following the relaxation of the PSL to the 356-457 mm PSL toolbox regulation and substantially increased to an average of ~25% (range 20%-36%) in the 5 years immediately following the removal of the PSL in 2012 (South Dakota Game, Fish and Parks, unpublished data). At Enemy Swim Lake, South Dakota, anglers harvested between 10 and 16% of the Smallmouth Bass they caught prior to establishment of Smallmouth Bass harvest regulations (Blackwell 2005).

Recent research has shown that fishing mortality is becoming less of a concern with maintaining quality black bass populations. Allen et al. (2008) found that fishing mortality rates for Largemouth Bass populations ($n = 32$) had declined by about one-half since 1990 and that the decline in fishing mortality had produced a decline in total mortality. The decline in fishing mortality was primarily a result of voluntary release by anglers rather than a decrease in overall effort. Angler release rates of Largemouth Bass have been increasing across much of the United States, with higher release rates documented in Texas and Florida (Myers et al. 2008), Wisconsin

(Gaeta et al. 2013), and Minnesota (Isermann et al. 2013). Miranda et al. (2017) indicated that Largemouth Bass harvest regulations may no longer be relevant in many waters because of the prevailing catch-and-release attitude exhibited by anglers. In the southern region of Minnesota, mean ranked release rates increased significantly from 1984-1989 (76%) to 1995-1999 (92%, Isermann et al. 2013). Median release rates also increased in the northern region of the state, but rates never exceeded 85% and were not significantly different among time periods. Surprisingly, release rates of Largemouth Bass in Minnesota were not different between anglers specifically targeting black bass and those not targeting black bass across geographic regions and among various time periods (Isermann et al. 2013). Voluntary release was identified as the most-likely driver of increases in relative abundances in Largemouth Bass in Wisconsin from 1992-2011 (Hansen et al. 2015). Higher rates of voluntary catch and release make it less likely that harvest regulations will be effective in improving Largemouth Bass fisheries (Allen et al. 2008). However, Carlson and Isermann (2010) maintained that despite increases in voluntary catch and release of Largemouth Bass, angler exploitation may still be an important factor regulating size structure in northern Minnesota lakes and that more intensive harvest regulations can improve size structure in some populations. Largemouth Bass in northerly latitudes tend to grow slower, and thus, size structure may be more sensitive to angler harvest (Beamesderfer and North 1995).

Recruitment. In South Dakota, black bass typically are considered recruited to the population if they survive their first winter. McKibbin (2002) characterized Largemouth Bass populations in eastern South Dakota glacial lakes as having inconsistent recruitment, with many populations being dominated by a few large fish. Glacial lakes having submerged vegetation generally have higher Largemouth Bass recruitment (Brian Blackwell, South Dakota Game, Fish

and Parks, personal communication). Similarly, Largemouth Bass density in small South Dakota impoundments was found to be positively correlated to aquatic vegetation coverage and water transparency (Guy and Willis 1991).

Smallmouth Bass recruitment tends to be consistent in northeastern South Dakota lakes having established populations. Kaufman et al. (2008) indicated that age-1 Smallmouth Bass typically comprise a high percentage of the fall Smallmouth Bass electrofishing samples. Saunders et al. (2002) believed that a good understanding of limnological, habitat, and biological features of each lake is necessary to understand how habitat quality affects Smallmouth Bass recruitment dynamics. Smallmouth Bass year-class strength in eastern Lake Ontario was related to summer water temperature, and it was believed that a 1°C increase caused by global warming could increase Smallmouth Bass year-class strength by 2.5 times (Casselman et al. 2002).

381-mm (15-in) MLL

McKibbin (2002) found Largemouth Bass populations in eastern South Dakota glacial lakes and large impoundments to generally exhibit low abundance, high size structure and condition, and fast growth making them good candidates for MLLs.

In 2004, the rationale for use of the 381-mm (15-in) MLL in South Dakota was as follows:

Region 1 – high angling pressure and harvest, low recruitment, and predator maintenance to improve panfish populations

Region 2 – used in association with juvenile/adult stocking to restore populations

Region 3 – low recruitment and good growth, use with adult stockings for population maintenance and panfish management

Region 4 – erratic recruitment, high harvest potential, moderate to fast growth

Although the rationale was different among the regions, the common theme for all four regions was low Largemouth Bass density as a result of limited recruitment. This regulation can be implemented on black bass populations having low abundance and moderate to fast growth if a quality bass population is desired.

Largemouth Bass growth rates were monitored in several eastern South Dakota impoundments managed under the 381-mm (15-inch) MLL and showed no visible decline post-regulation (South Dakota Game, Fish and Parks, unpublished data). This was not surprising as relative abundance of Largemouth Bass in nighttime electrofishing samples often remained below management objectives and proportional size distribution indices (i.e., PSD and PSD-P) were either within or above the optimal range. Largemouth Bass recruitment continued to be inconsistent, most likely due to a lack of submerged aquatic vegetation in the impoundments. A 381-mm (15-in) MLL at Lake Alvin, South Dakota was effective at improving the size structure of the low-density fast-growing Largemouth Bass population that had been subjected to high angler harvest in the 1980s (Lindgren and Willis 1990b). However, angler catch rates of Largemouth Bass in Lake Alvin during the summers of 1995-2002 were extremely low (<0.02 fish/h) in 5 of 7 years creel-surveyed and <0.08 in the two other years (Lucchesi et al. 2015), suggesting that sporadic recruitment and low abundance were still a problem under the regulation.

One notable exception to limited Largemouth Bass recruitment was Lake Cochrane, South Dakota where a 381-mm (15-in) MLL was in place from 1999 through 2004. Largemouth Bass growth slowed after recruitment increased leading to an increase in bass abundance under 381 mm (15 in). The mean back-calculated length at age 4 declined from 345 mm (13.6 in) in 1994 to 287 mm (11.3 in) in 1999 and 264 mm (10.4 in) in 2004.

In 2005, the 381-mm (15-in) MLL was rescinded, and a 305-457 mm (12-18 in) PSL with one fish ≥ 457 mm (18 in) went into effect. In 2008, Largemouth Bass growth continued to show a decline; the mean back-calculated length at age 4 was 228 mm (9.0 in). Gabelhouse (1987) indicated that it may be difficult to attain sufficient Largemouth Bass harvest if angling effort is low or anglers are unwilling to harvest small bass (<300 mm; <12 in). Largemouth Bass relative density (100 stock-length bass per electrofishing hour) has remained high even since the PSL was removed in 2010. Growth has somewhat improved, with back-calculated lengths at age-4 exceeding 300 mm for cohorts produced during 2011-2013, but length at age-4 remains below 315 mm (South Dakota Game, Fish and Parks, unpublished data).

The 381-mm (15-in) MLL can also be implemented in moderate to high density Largemouth Bass populations if catching large panfish is desired (i.e., panfish option). A high density of small Largemouth Bass can be effective at controlling panfish abundance (Otis et al. 1998). If Largemouth Bass recruitment becomes erratic, resulting in low bass abundance, the regulation will need to be removed, since the bass density will no longer be able to control the panfish reproductive output. The panfish option is not recommended with Smallmouth Bass as the only predator species as they typically cannot control the reproductive effort of panfish species.

The 381-mm (15-in) MLL has not been used in South Dakota where Smallmouth Bass are the primary black bass species present. The main reason is that Smallmouth Bass recruitment tends to be consistent in most lakes where they are present (Kaufman et al. 2008). However, in populations that exhibit low abundance and fast growth, a 381-mm (15-in) MLL may be applicable. A 356-mm (14-in) MLL for Smallmouth Bass appeared to improve the quality of the Smallmouth Bass in the Shoals Reach of the Tennessee River, Alabama (Slipke et al. 1998). The

improvement in the Smallmouth Bass population may also be related to the high occurrence of catch-and-release angling that occurs in the Shoals Reach. At Palette Lake, Wisconsin, the number of anglers fishing for Smallmouth Bass increased after implementation of a 406-mm (16-in) MLL as anglers became more interested in catching quality-size fish versus harvesting bass (Newman and Hoff 2000). Following enactment of the 406-mm (16-in) MLL, Smallmouth Bass growth rates did not change and the number of bass >300 mm (12 in) increased.

356-457 mm (14-18 in) PSL with one fish ≥ 457 mm (18 in)

The second regulation in the black bass toolbox is a 356-457 mm (14-18 in) PSL, with at most one fish ≥ 457 mm (18 in). This regulation can be implemented on populations having high black bass abundance and moderate to slow growth. The goal of this regulation is to improve the quality of black bass caught by anglers while allowing for the harvest of small bass and a limited number of trophy bass. In a review of published and unpublished studies that evaluated Largemouth Bass responses to MLL and PSL, Wilde (1997) found that PSL were successful at restructuring Largemouth Bass populations by increasing population size and the proportion of larger fish.

It is believed that in most situations where a PSL is needed that harvest of black bass <300 mm (12 in) is minimal; thus, increasing the minimum to 356 mm (14 in) may encourage anglers to harvest a portion of the small bass they catch. For example, in Lake Sharpe, anglers harvested few Smallmouth Bass less than 305 mm (12 in) when a 305-457 mm (12-18 in) PSL was in place during 2003-2007 (John Lott, South Dakota Game, Fish and Parks, personal communication). In 2008, the minimum threshold was increased from 305 mm (12 in) to 356 mm (14 in) as a result of anglers wanting the ability to harvest a portion of their catch. The

proportion of the catch harvested increased slightly from 7% to ~10% following the relaxation of the PSL regulation. On northeastern South Dakota lakes that were managed with a 305-457 mm (12-18 in) PSL with at one fish ≥ 457 mm (18 in), harvest of black bass < 300 mm (12 in) was minimal. In 2006, anglers harvested an estimated 331 of the 13,737 Smallmouth Bass that were caught from Enemy Swim Lake (Blackwell et al. 2007a) and 431 of 8,323 Smallmouth Bass caught were harvested from Pickerel Lake during the 2006 summer (Blackwell et al. 2007b).

At Lake Sharpe, the percentage of Smallmouth Bass between 356 mm (14 in) and 457 mm (18 in) in spring nighttime electrofishing increased each year from enactment of the PSL in 2003 to 2009, when the toolbox was first developed. However, Fincel et al. (2015) found similar trends in Lake Oahe and Lake Francis Case, suggesting the observed increase was system-wide rather than a regulation-driven increase. In the glacial lakes region sampling Smallmouth Bass has proven difficult, but anecdotal evidence (i.e., angler catch) indicates that the size structure of Smallmouth Bass populations improved following enactment of a 305-457 mm (12-18 in) PSL with one fish ≥ 457 mm (18 in) in lakes Enemy Swim, Pickerel, Roy and Clear.

The number of anglers targeting black bass species appears to have increased since enactment of the PSL on lakes Enemy Swim, Pickerel, Clear and Roy in northeast South Dakota. The percent of summer anglers indicating that they were targeting either Smallmouth Bass or Largemouth Bass as their primary target species was 20% in 2007 and 16% in 2008 at Enemy Swim Lake (South Dakota Department of Game, Fish and Parks, unpublished data). When special regulations were first implemented for Smallmouth Bass in 2002, 4.5% of Enemy Swim Lake summertime anglers indicated they were targeting a black bass species. Following repeal of the Smallmouth Bass PSL regulation at Enemy Swim Lake in 2010, the proportion of anglers targeting black bass during the summer has fluctuated annually from 6.4% to 30.9% (South

Dakota Game, Fish and Parks, unpublished data). At Lake Sharpe, there was no increase in the percentage of anglers targeting Smallmouth Bass with the enactment or subsequent modification of the PSL. Following repeal of the Smallmouth Bass PSL on Lake Sharpe in 2012, the proportion of anglers targeting black bass during the summer has remained low and fairly consistent (South Dakota Game, Fish and Parks, unpublished data).

At Murdo Lake, South Dakota, a 305-380 mm (12-15 in) PSL resulted in an increase in Largemouth Bass size structure in a population that was previously characterized as having moderate abundance and slow growth (Neumann et al. 1994). Incremental growth and condition of Largemouth Bass increased while the abundance of stock-length bass decreased. Similar results were found at Knox Pond, South Dakota, where a PSL was simulated by manually removing 200-300 mm (8-12 in) Largemouth Bass (Neumann et al. 1994). The size structure of the Largemouth Bass population increased from a PSD of 0 at the beginning of the regulation to 47 three years after removal efforts started. Both growth and condition of Largemouth Bass increased while abundance decreased.

Experimental Regulations

After the repeal of the spring fishing closure on black bass in 1982, South Dakota black bass fishing regulations have consisted entirely of various MLL and PSL. Experimental regulations that are highly restrictive such as mandatory catch and release (MCR), a maximum length limit or a trophy MLL have never been implemented or evaluated with black bass in South Dakota. A 28-inch MLL on walleyes was considered successful at establishing and maintaining a quality Walleye fishery on Reetz Lake (Blackwell et al. 2020) and Twin Lake, South Dakota (Lucchesi et al. 2015), and providing a unique angling opportunity of good fishing

for large Walleyes in both lakes. An additional benefit is that the high abundance of large Walleye appears to have led to a stock-recruitment relationship where Walleye recruitment has been sufficient to eliminate or reduce the need for supplemental stocking.

Carlson and Isermann (2010) found that despite recent increases in voluntary catch and release of Largemouth Bass, angler exploitation was still an important factor regulating size structure in some Minnesota lakes, and more intensive harvest regulations did improve size structure in some populations. Largemouth Bass growth is inversely related to latitude (Modde and Scalet 1985; Beamesderfer and North 1995) so fish in more northerly latitudes often take longer to reach larger sizes desired by many anglers. Largemouth bass size structure in northern populations may also be more sensitive to angler harvest (Beamesderfer and North 1995) with research suggesting the need for low exploitation to maintain smallmouth bass size structure and abundance in northern waters (Newman and Hoff 2000).

Carlson and Isermann (2010) found that MCR and maximum length limits may improve largemouth bass size structure in some fisheries where exploitation is an important factor influencing size structure. They suggest that these regulations could offer useful alternatives to our Black Bass Toolbox length-based regulations (i.e., minimum length limits and slot length limits), specifically in cases where harvest of smaller largemouth bass is deemed necessary to improve size structure (e.g., Eder 1984; Martin 1995).

Protocol for Recommending and Implementing Black Bass Regulations:

Regulation Process

Proposed regulations are developed by Aquatics staff within each Fisheries Management Area before being brought forward and identified as a possible new regulation. Regulation ideas need to be supported by biological data and be socially acceptable. New regulation ideas will

follow the Aquatics GFP Commission Rules Development (CRD) Process. New black bass regulations or changes will be included in the list of ideas during an all-Department meeting for brainstorming regulation ideas held in February. Submitted ideas are discussed in a second meeting to determine which ideas will move forward and any staff assignments. Further discussion on potential regulation changes will occur at the summer Fisheries Management Team meeting and the summer Fisheries Meeting. Aquatics supervisory staff will meet with the Department Secretary and Wildlife Division Director to finalize recommendations to move forward to the Commission. Regulation recommendations are presented to the Commission in July, and the Commission can propose the regulation change, modify the regulation change prior to proposal, or deny a recommended regulation change. Rule changes must be open for public comment for a minimum 30 days before being finalized, modified, or denied by the Commission at the September meeting. New regulations finalized by the Commission generally take effect on January 1 of the upcoming year.

Petition Process

The public can petition the GFP Commission concerning black bass regulation changes at any time. When a petition is received, the GFP Commission must act (initiate the process or deny) within 30 days. At this point, the GFP Commission can consult with Aquatics staff to determine how a black bass petitioned regulation change fits into the black bass toolbox. Data that have been collected or can be collected will be used to guide the Department's recommendation of action by the Commission. If the GFP Commission proposes a petitioned black bass regulation change, the proposed change will be open for public comment for 30 days and finalized, modified, or denied at the next GFP Commission Meeting.

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Appendix. List of waters having black bass size restrictions as of 2009 (or later if indicated). The year that the size restriction was changed or removed is in parentheses.

381-mm (15-in) MLL as of 2009

Lake Alvin (2019)
 Lake Campbell (Campbell Co, 2019)
 Burke Lake (2023)
 Carthage Lake (2017)
 Corsica Lake (2019)
 Cresbard Lake (2010)
 Curlew Lake (2019)
 Dimock Lake (2017)
 East Lemmon Lake (2019)
 East Vermillion Lake (2017)
 Farley Lake (2010)
 Faulkton Lake (2010)
 Hanson Lake (2017)
 Henry Lake (2019)
 Hiddenwood Lake (2019)
 Jones Lake (2019)
 Marindahl Lake (2019)
 McCook Lake (2019)
 Menno Lake (2019)
 Mina Lake (2010)
 Murdo City Lake (2019)
 Murdo Railroad Dam Lake (2019)
 Mitchell Lake (2019, reinstated 2023)
 New Underwood Lake (2019)
 Richland Dam (2019)
 Richmond Lake (2019)
 Rosehill Lake (2019)
 Sheridan Lake (2019)
 Simon Lake (2019)
 Staum Dam (2017)
 Stockade Lake (2019)
 Tripp Lake (2019)
 Wilmarth Lake (2019)
 Yankton Lake

381-mm (15-in) MLL implemented after 2009

Durkee Lake (2010, removed 2019)
 Bismarck Lake (2016, removed 2019)

305-457 mm (12-18 in) PSL, 3 fish daily bag with at most one fish $\geq$ 457 mm (18 in)

Campbell Slough (Day Co, 2010)
 Clear Lake (Marshall Co, 2010)
 Lake Cochrane (2010)
 Enemy Swim Lake (2010)
 Horseshoe Lake (2010)
 Pickerel Lake (2010)
 Reetz Lake (2010)
 Roy Lake (2010)
 Waubay Lake (2010)

305-406 mm (12-16 in) PSL and with at most one fish $\geq$ 406 mm (16 in)

New Wall Lake (2010)
 Newell Lake (2010)
 Waggoner Lake (2010)

356 – 457 mm (14-18 in) PSL and with at most one fish $\geq$ 457 mm (18 in) as of 2010

Campbell Slough (Day Co, 2017)
 Clear Lake (Marshall Co, 2019)
 Cochrane Lake (2016)
 Enemy Swim Lake (2017)
 Horseshoe Lake (2019)
 Lake Sharpe (2012)
 New Wall Lake
 Newell Lake (2019)
 Waggoner Lake (2019)
 Pickerel Lake (2017)
 Reetz Lake (2019)
 Roy Lake (2019)
 Waubay Lake (2016)