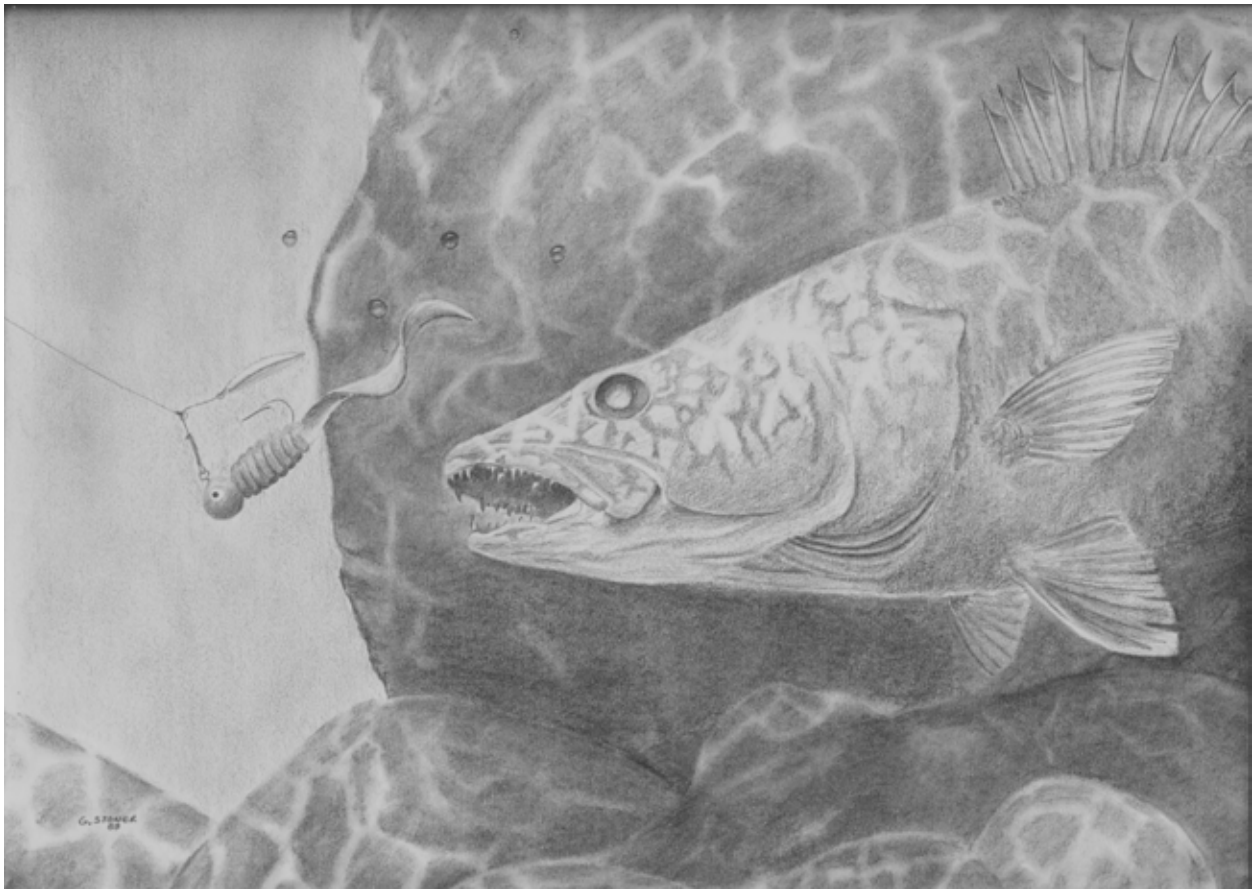
MISSOURI'S WALLEYE MANAGEMENT PLAN
2017-2026

Missouri Department of Conservation



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EXECUTIVE SUMMARY

In 2009, the first Missouri Walleye Management Plan was approved. This plan documented historical and current Walleye management and recommended goals and objectives for managing Walleye in Missouri lakes and rivers for a five (5) year period, 2010-2016. In 2016, the Fisheries Division Management Team designated a new Walleye committee which included hatchery, management, and research staff. This committee was tasked to review and update the existing plan. Tasks for the committee included reviewing priorities, adding or removing water bodies, prioritizing stocking requests, and updating the stocking matrix. The new plan will be in effect for 10 years (2017-2026).

Walleye management in the early years of the Missouri Conservation Commission consisted of stocking fish and regulating harvest. Research investigating river stockings of Walleye fry in the 1960s concluded that these stockings did not contribute to Walleye populations. Several lakes were initially stocked with Walleye and sustained Walleye populations for many years without stocking. As these lakes aged, Walleye populations declined. Research in the 1980s determined that stocking two (2) inch Walleye fingerlings was generally the most cost-effective and successful method to improve Walleye populations in these impoundments.

Walleye are native to many of Missouri's rivers and now occur in many lakes due to impounding rivers with native populations and subsequent Walleye stockings. Recent research has shown that Walleye from the Black River Basin are part of a group of Walleye known as the Eastern Highland or New River Strain. This strain is highly distinct from Great Lakes Walleye strain and any stock transfer should be avoided. This plan advocates protection of genetic integrity of unique Walleye populations by adhering to Fisheries Division's *Stock Transfer Policy.*

Approximately 1.5 million Walleye fingerlings (1 to 2-inch) will be produced annually from 2017-2026 to meet Walleye Management Objectives. Fingerlings will be stocked annually into 11 lakes (Bull Shoals Lake, Harrison County Lake, Lake of the Ozarks, Lake Jacomo, Lake Showme, Longview Lake, Mozingo Lake, Norfork Lake, Pomme de Terre Lake, Smithville Lake, and Stockton Lake). One lake (Truman Lake) will be stocked biennially. Two additional lakes (Table Rock Lake and Long Branch Lake) and one river (Salt River) will be stocked if surplus Walleye fingerlings are available. One small lake (Forest Lake) will receive advanced Walleye fingerlings (4 to 6-inch) every three years. The Black, Current, Eleven Point, and St. Francis rivers will continue to be stocked on a four-year rotation with Black River Strain Walleye. A strict transport and stocking protocol serves as a method to avoid the potential for dispersing invasive species.

Most Walleye populations are regulated with a four (4) fish daily limit and a 15-inch minimum length limit. An 18-inch minimum length limit exists on several streams, lakes in the Ozarks, and a few lakes in north Missouri. Future opportunities may exist for establishing trophy Walleye fisheries.

Implementation of this plan will provide anglers with information on Walleye populations, as well as obtain valuable angler catch and opinion data. Continued cooperation between the Missouri Department of Conservation and anglers will be invaluable as this plan is implemented.

The primary objective of this plan remains the same:

> **Provide a variety of Walleye angling opportunities in suitable lakes and rivers through biologically sound and cost-effective strategies while ensuring the protection of aquatic communities.**

To accomplish this objective, the following goals were established:

- Goal 1. Develop biologically sound and cost-effective Walleye production and distribution techniques.

- Goal 2. Provide a variety of Walleye catch and harvest opportunities for anglers.

- Goal 3. Provide timely information on angler use and preferences for decision making.

- Goal 4. Provide the public information on Walleye populations, develop materials promoting Walleye fishing, and effectively implement the Walleye plan.

BACKGROUND

Walleye (*Sander vitreus*) management is not new to Missouri. Attempts have been made to develop and manage Walleye populations since the early 1950s. Walleye management at that time consisted of stocking and regulating harvest. Walleye regulations included a closed season (April 1 to May 30), a 12-inch minimum length limit (MLL), and a five (5) fish daily limit (Funk 1967). Walleye have been introduced into nearly all large lakes, many smaller lakes, and several rivers in Missouri. Missouri studies validated that the most cost-effective method of establishing and maintaining Walleye populations is by stocking small (1 to 2-inch) fingerlings (Koppelman *et al*.1992; Banek 1997).

The 1996 statewide angler survey (Weithman 1996) indicated that Missouri anglers had a measurable interest in improving Walleye fishing quality. Six (6) percent of the respondents that mentioned a species or group of fish that needed improvement chose Walleye. As reference, other responses were: black bass, 33%; crappie, 18%; catfish, 14%; and trout, 12%.

In June 1997, a Walleye task force was appointed by Missouri Department of Conservation (MDC) Fisheries Administration and was charged with developing the *Walleye Initiative* (Allman *et al*. 1997). This was the first coordinated statewide Walleye management approach. The major goals of this initiative were to: 1) intensify and expand Walleye management, 2) identify priority lakes and rivers, 3) increase hatchery production, and 4) provide better Walleye fishing and harvest opportunities. Although the initiative recommended managing for several different types of Walleye angling opportunities, most of the waters scheduled for stockings were to be managed as harvest-oriented fisheries.

To evaluate the progress and effectiveness of the *Walleye Initiative*, a mail survey was developed and sent to over 10,000 Walleye anglers to ascertain their opinions about the quality of their Walleye fishing experiences, the 15-inch statewide MLL implemented in 2000, and to determine their level of awareness of the MDC's Walleye stocking and management programs (Reitz 2001). Over 50% of Walleye anglers fished for Walleye more than five (5) days/year, and over 60% of those anglers fished for Walleye more than ten (10) days/year. Most anglers preferred to fish for Walleye in large lakes. About 63% of anglers were unaware of MDC's Walleye management and stocking programs. The majority of all anglers preferred to catch and keep four (4), 15-inch Walleye instead of keeping two (2), 18-inch Walleye or one (1), 24-inch Walleye (Reitz 2001).

The success of the *Walleye Initiative* in creating viable fisheries dictated the development of a species plan to guide future Missouri Walleye management activities. In 2009, the first *Missouri Walleye Management Plan* was approved (Allman *et al*. 2009). This plan documented Walleye management at that time and recommended goals and objectives for managing Walleye in Missouri lakes and rivers for the next five years. In 2016, Fisheries Division Management Team designated a new Walleye committee which included hatchery, management, and research staff. This committee was tasked to review and update the existing plan. Tasks for the committee included reviewing priorities, adding or removing lakes and rivers, prioritizing stocking requests, and updating the stocking matrix. The new plan should cover the timeframe of 2017-2026.

The history of Walleye management for individual waters is in Appendix 1. This appendix contains technical information that may not be familiar to some readers of this plan but is valuable to biologists.

CURRENT MANAGEMENT

Stocking is a common technique used to enhance Walleye fisheries. Kerr (2008) estimated that in 2006 almost 869 million Walleye were stocked in North American waters. While Walleye can be found throughout the state, Missouri's best Walleye fisheries are supported by supplemental stocking of primarily fingerling Walleye. MDC hatcheries produce 1.1 to 1.7 million Walleye annually (Table 1). These fish are stocked into selected lakes and rivers to provide a variety of Walleye angling opportunities (Tables 1 and 2).

To evaluate Walleye populations, some state fishery departments have standardized sampling programs which detail methodologies (*i.e.* gear, effort, seasons) and population benchmarks. In Wisconsin, Fisheries Biologists conduct springtime Walleye population estimates using both fyke nets and electrofishing. This information is then used to set length and daily limits. In Kansas, benchmark goals differ between large and small lakes. For example, a good Walleye population in a large lake is characterized by a gill net catch rate of 17 to 34 fish/night. In a small lake, gill net catch rates for a good Walleye population are slightly lower (14 to 30 fish/night) (Kumberg *et al*. 2010). In Missouri, there are no standardized sampling protocols or benchmark parameters for Walleye fisheries due to variations in lake size, lake morphometry, water clarity, and geology. As a result, managers assess populations, as they determine necessary, for each Walleye fishery individually. This approach has produced cooperative management planning on a broad scale while allowing for flexible management implementation at the local scale. Due to its success, this approach will continue through the 2017-2026 Walleye Management Plan.

Genetics

Walleye are native to many of Missouri's rivers and now occur in several lakes due to impounding rivers with native populations and Walleye stockings. Fisheries Division's Stock Transfer Policy (Appendix 2) strives to ensure that stocking "will not be detrimental to recipient strains, species, and ecosystems." The primary method for achieving this goal is the prevention of moving strains and species among drainages and river systems without approval of the Fisheries Division Chief. In addition, the policy states that species restorations should use the most proximal source of fish or brood stock available unless a genetic diversity assessment for the species has documented a more-appropriate source for the transfer. Therefore, it follows that Walleye stocking should be conducted in a manner that uses local brood stocks and avoids mixing distinct genetic types of Walleye.

The Black River Basin in southern Missouri contains a genetic strain, hereafter the Black River Strain (BRS), that is distinct from others observed in Missouri (J. Koppelman unpublished). The Stock Transfer Policy, as well as current MDC emphasis on preserving native diversity, have led to the protection of the wild Black River Walleye populations. MDC has been stocking only Walleye from the Black and Current rivers into the Black, Current, Eleven Point, and St. Francis rivers. Additionally, brood stocks have been screened for the BRS using restriction fragment

length polymorphisms (RFLP). From 2013-2016, an average of 7% (+/- 4%) of fish captured for Black River brood stock were not BRS and therefore were not used as brood stock. These non-BRS may be individuals stocked outside of Missouri by the Arkansas Game and Fish Commission (AGFC) or the progeny of these stocked fish. Though upstream migration of AGFC fish appears to be rare (Henry *et al*. 2008), the persistent presence of non-BRS Walleye in brood stock collections suggests genetic screening of brood stock may be necessary to ensure Black River stock integrity.

Recently, more extensive research across the Walleye native range has shown that Walleye from the Black River Basin are part of a group of Walleye known as the Eastern Highland or New River strain that are highly distinct from Great Lakes Walleye and have a distribution that extends from Virginia to Missouri and roughly follows the Ohio River Valley (White *et al*. 2012, Stegman 2013, Haponski and Stepien 2014). The Black River Walleye may be distinct within this group or sister taxa to this group, but this conclusion is based on analysis with a limited number of samples (Stegman 2013, L. Berkman unpublished). Until further phylogenetic analysis suggests otherwise, stock transfer within the Eastern Highland Walleye range should be avoided and Black River brood stock should be collected only within the Black River Basin in accordance with the previous management plan.

Walleye from Smithville Lake, Lake of the Ozarks, the Salt River, Stockton Lake, Bull Shoals Lake, and Norfork Lake were also analyzed using RFLP and it was found that five other RFLP types were distributed in Missouri (J. Koppelman unpublished). It is not yet known whether these remaining Walleye types represent native Missouri Walleye or Walleye of Great Lakes origin. Without further information, use of only local brood stocks within Missouri but outside of the Black River Basin is still warranted.

Lakes

Over the past decade, Walleye have been stocked into fifteen lakes (Table 1). All of these lakes, excluding Forest Lake, were stocked with fingerling sized Walleye (1 to 2-inch). Lake stocking rates ranged from three (3) to 30 fingerlings/acre. Forest Lake was stocked with 10 advanced fingerlings (4 to 6-inch)/acre every third year. In Forest Lake, fry and fingerling stockings failed to produce a viable Walleye fishery most likely because of high bass density and stocking in spring when young Walleye are highly susceptible to bass predation, whereas stocking advanced Walleye fingerlings in fall produced a fishery that exceeded the lake management objectives (Anderson 2012).

Across the country, fisheries managers routinely use catch rate to evaluate population density changes because it is less costly and requires less manpower than mark-recapture studies. Managers must use caution when inferring catch rate data and density are related. McInerny and Cross (2000) determined that electrofishing catch rate should only be used to evaluate population density when catchability is density independent and when the effects of confounding environmental variables are known. In Missouri, routine population evaluations commonly include early spring electrofishing targeting adult Walleye and fall electrofishing to determine age zero (0) abundance and contribution of stocked fish to the year class. Early spring electrofishing is conducted from mid-February to early April, and fall electrofishing is normally conducted in October when surface water temperature is near 60^{o} F. Managers should plan

sampling schedules so that lakes are sampled at similar temperatures each year (Borkholder and Parsons 2001).

At Stockton Lake, Walleye management began in 1970 with the stocking of four million Walleye fry. These fry stockings were successful in the new and filling lake and a low density, self-sustaining Walleye population existed for twenty years. In 1993, 682,017 (27 fish/acre) Walleye fry and 327,409 (14 fish/acre) Walleye fingerlings were stocked. To evaluate stock contribution, 50% of the 1994 stocking (354,000 fingerlings) were marked with a cold brand. Subsequent sampling indicated that these stocked fingerlings accounted for 80% of the 1994 year-class.

At Pomme de Terre Lake (PDT), natural reproduction maintained a low-density Walleye population for several years after the lake was impounded in 1961. From 1987 through 2005 Walleye fingerlings were stocked on a sporadic basis. In accordance with the 2009 *Missouri's Walleye Management Plan* (Allman *et al*. 2009), Walleye fingerlings were stocked into PDT if surplus was available (up to 47,000/year). Surplus Walleye fingerlings have been available six (6) out of the last eight (8) years (Table 1). Walleye catch rates have increased as a result of more frequent stockings.

In Missouri, Walleye in both large and small lakes exhibit excellent growth. In Bull Shoals (48,000 acres) and Norfork (22,000 acres) lakes, angler collected otoliths indicated that Walleye typically reach 18 inches by age three (3). At Stockton Lake (25,000 acres), most Walleye reach the 15-inch MLL by age two (2) and age three (3) male Walleye average almost 17 inches. In Mozingo Lake (1,000 acres), angler collected otoliths indicated that Walleye reach 15 inches in three years.

Streams

Previous attempts have been made to enhance Walleye populations in southeast Missouri streams by stocking. In the late 1960's, the Current River was stocked with 5.7 million fry. Subsequent evaluations by Fleener (1971) and Russell (1973) showed poor survival of these fry and no contribution to angler harvest.

Historically, Walleye fingerlings have been stocked in several rivers in the State (Table 1). Since 1996, 654,392 BRS Walleye fingerlings (1-2 inches) have been stocked in the Black, Current, Eleven Point, and St. Francis rivers to supplement the wild stock (Table 1). Henry *et al*. (2008) found that stocked Walleye fingerlings made a significant contribution to the Eleven Point River fishery. They determined that roughly half of each year class was comprised of stocked fish. Springtime electrofishing surveys in the Black and St. Francis rivers have shown an increase in Walleye catch rates several years after supplemental stockings when Walleye reached a size vulnerable to sampling gear. In addition to catch rates as a tool to assess stocking contribution, the percentage of oxytetracycline (OTC) marked fish in a subsample of Walleye collected has also been used. Since stocking began, most of the stocked BRS Walleye fingerlings were OTC marked. In 2006, 40 Walleye (11.5 to 17.3 inches) from the Black River were sacrificed for OTC analysis. Of the 17 Walleye collected from the 2004 year-class (7,732 fingerlings stocked), eight had an OTC mark (47%). Of the 16 Walleye from the 2003 year-class (41,505 fingerlings stocked), 13 had an OTC mark (81%). In the Eleven Point River, eight (8)

out of 13 fish from the 2010 year-class (19,328 fingerlings stocked), were found with an OTC mark (62%). Though the sample sizes were small in these evaluations, this suggested that stocking played a substantial role in year-class strength in the Black and Eleven Point rivers. Walleye otoliths from the Current River have also been examined for presence of an OTC mark to determine stocking contribution to the fishery. However, not enough data have been collected to determine Walleye year class contribution in the Current River.

The BRS Walleye have proven difficult to propagate. BRS fingerling return from rearing ponds averaged 13% compared to the average statewide return rate of 45% (Andy Cornforth, MDC, personal communication). In 2009, a committee comprised of fisheries management biologists, hatchery personnel, and resource scientists was formed. This committee developed the BRS Walleye Propagation proposal (Cornforth *et.al*. 2010). As a result, a three-year study was initiated in March 2010 to identify the limiting factors of BRS Walleye production (Figure 1). This study was extended into a seven-year study due to changes in the study design. The overall goal of the study was to enhance the Walleye fisheries in the Current, Black, Eleven Point, and St. Francis rivers with supplemental fingerling stockings. A production objective of 30,000 to 50,000 fingerlings/year with a 20-25% return from rearing ponds was set. For this to be achieved, best management practices needed to be developed to increase the efficiency of raising BRS Walleye fingerlings. The overarching conditions or factors that limits BRS Walleye fingering production, has yet to be found (Cornforth *et. al*. 2017).

In 1999 and 2002, Walleye fingerlings (1 to 2-inch) and advanced fingerlings (4 to 8-inch) were stocked into the tributaries of Mark Twain Lake. Spring electrofishing in the tributary streams, fall electrofishing in the lake, and a lake angler survey were used to evaluate the success of these stockings. Few Walleye were captured in the lake; however, electrofishing capture rates in tributaries increased following these stockings. Electrofishing capture rates in tributary streams prior to stocking ranged from 6.5 to 8.8 Walleye/hour. Electrofishing catch rates in 2002 and 2005, three (3) years after each stream stocking, were 8.4 and 19.3 fish/hour, respectively. Most Walleye captured in 2002 and 2005 were stocked as small fingerlings three (3) years prior. In fact, 78% of the Walleye captured in spring 2002 were stocked in 1999, and 98% of these were stocked as small fingerlings. In spring 2005, 89% of the captured Walleye were stocked in 1999 or 2002. Of these, 85% were stocked as small fingerlings in 2002. For both stocking years combined, overall survival of small and large fingerlings was nearly equal, indicating that stocking small fingerlings is most cost effective.

In 2005, a Walleye and Sauger (*Sander canadensis*) study focused on determining relative abundance, size structure, age structure, growth, natural mortality and exploitation was initiated in the Upper Mississippi River pools. Walleye abundance was determined to be low and additional restrictive regulations were not needed (Dames and Brown 2010).

Regulations

Prior to 1998, most Walleye populations were regulated with a four (4) fish daily limit (in the aggregate with sauger) and an 18-inch MLL or no length restrictions. In March 2000, a statewide 15-inch MLL was adopted to provide Walleye anglers with increased harvest opportunities. The 18-inch MLL was retained on several lakes (currently: Bull Shoals Lake, Lake Showme, Norfork Lake, Table Rock Lake, and Long Branch Lake) and rivers (currently:

Current, Eleven Point, and St. Francis rivers). Walleye can be harvested all year except from February 20 through April 14 walleye and sauger can be taken and possessed only between one-half hour before sunrise to one-half hour after sunset in the unimpounded portions of all streams, except the Missouri and Mississippi Rivers. In the Mississippi River Walleye regulations consist of an eight (8) fish daily limit and no length restrictions.

Angler Utilization

Angler exploitation for Walleye in Missouri has seldom been investigated. Wisconsin has investigated sustainable exploitation in numerous studies (Hansen *et al*. 1991, Beard *et al*. 2003, Schueller *et al*. 2008). In order to maintain viable fisheries, Wisconsin fisheries managers target an angler exploitation rate of 35% or less. This target is used in all Wisconsin waters, whether sustained by natural reproduction or supplemented by stocking. Kansas lakes typically exhibit high (50% or greater) angling mortality (Quist *et al*. 2004).

A handful of exploitation studies in Missouri have yielded a wide range of exploitation rates. A 1987 tagging study at Truman Lake revealed an exploitation rate of eight (8) percent. A Walleye exploitation study conducted on Stockton Lake in 1987 and 1988 estimated Walleye exploitation at approximately 15% (Tim Banek, MDC, personal communication). In 2003 and 2004, Walleye were tagged in the Missouri portion of Bull Shoals Lake. Exploitation was estimated at 61% in 2003 and 49% in 2004 when adjusted for tag loss and non-reporting. In 1995, Norfork Lake Walleye angler exploitation was documented at 29%. Longview Lake exploitation was documented at 15% in 1997 and 1998. Despite the higher exploitation in Bull Shoals and Norfork lakes, they remained viable fisheries while Longview's Walleye population declined precipitously in the early 2000s. The decline in Longview Lake's population was attributed to consecutive failed stockings when stocking was occurring at three-year intervals. This made the interval between successful stockings nine years. In Mozingo Lake, anecdotal evidence indicated a large group of anglers targeting Walleye. To determine exploitation rates and angler use, a total of 848 Walleye > 15" were tagged with reward tags from 2008-2011. The study showed an average annual exploitation of 38%, and that 60% of tags returned were by anglers specifically targeting Walleye. Walleye were harvested 90% of the time they were caught. In just three years, over 50% of the fish tagged in 2011 were caught and harvested.

It seems reasonable that Missouri's Walleye populations can sustain 25 to 30% annual exploitation under the proposed stocking regimes. Higher exploitation could be sustained in lakes that are stocked annually such as Bull Shoals Lake. Lakes with lower exploitation such as Truman Lake could be sustained with fewer fish stocked/acre.

Angler creel surveys have only been conducted on a few Missouri lakes. At Stockton Lake, angler surveys were conducted on the Big Sac Arm from 1971 through 2005, with exception of 1993, 1994, and 1995. Walleye angler catch rates were consistently low before intensive Walleye stocking began. The 1996 survey data indicate that nearly all Walleye survey statistics improved after the 1993 and 1994 stockings, with sublegal (<18 inches) Walleye catch rates much better than in any of the previous surveys. Consequently, Walleye were stocked biennially at the rate of 25 to 30 small fingerlings/acre. In 2000, the MLL was reduced from 18 inches to 15 inches, aimed at creating a more harvest-oriented fishery. Angler harvest rate objectives of 0.1 to 0.2 Walleye/hour and at least 1 lb./acre Walleye harvested were established to measure

stocking success. Since 2000, when Walleye stocked in 1998 recruited into the fishery, and through 2005, the last angler survey, the harvest rate objective was achieved every year except 2000. The weight harvested/acre objective was achieved every year except 2004. The lack of creel data since 2005 has not allowed Walleye harvest goals to be evaluated.

Anglers at Pomme de Terre Lake were surveyed in 2010 and 2011. Since Walleye were not stocked with any regularity until 2009 and the Walleye fishery was just beginning to become established, limited Walleye creel data is available. Anglers spent 0.4 hours/acre fishing for Walleye in 2010 and 0.3 hours/acre in 2011. Catch rates were 0.10 and 0.30 Walleye/hour in 2010 and 2011, respectively. The mean length of Walleye caught was 13.8 and 14.6 inches in 2010 and 2011, respectively. Harvested Walleye averaged 19.0 and 19.7 inches long in 2010 and 2011, respectively. Anglers released only 11.5% of the legal-size Walleye they caught in 2010 and none (0%) in 2011.

Angler exploitation in both the Black and Current rivers has been investigated using reward tags. Two Walleye exploitation studies have been conducted on the Black River. In the 1990s, a total of 406 Walleye (> 15 inches) were tagged with reward tags. Harvest rates, after adjusting for angler compliance and tag retention, averaged 17%. In 2009 and 2010, 416 Walleye (> 15 inches) were tagged and Walleye harvest was estimated to be 35%. In the Current River, 375 Walleye (12.9-31.9 inches) were tagged in 2009 and 2010. Walleye harvest rates averaged 17%.

Walleye have been stocked into Missouri's rivers since the 1960s. A majority of management efforts have focused on collecting biological data with little data collected from stakeholders. Biological efforts have included tracking trends in catch rates after stocking through annual electrofishing surveys, estimating stocking contributions to year-class strength using OTC, reward tag studies investigating angler exploitation rates, and juvenile Walleye telemetry studies. Although much of the biological data collected suggest that supplemental stockings have positively impacted Walleye fisheries and are key to sustaining populations in these systems, limited data exist on the impacts of these stockings on stakeholders.

To date, only three (3) angler mail surveys have been conducted that have targeted Missouri Walleye anglers since the 1996 Statewide Angler Survey. In 2000, a statewide Walleye angler survey was conducted (Reitz 2001). A total of 8,053 anglers were surveyed, with 4,058 (approximately 50%) completing and returning the questionnaire. Statewide, 60% of anglers preferred to fish for Walleye in lakes and only 11% preferred to fish for Walleye in rivers or streams. Overall Walleye satisfaction was rated poor on an excellent to poor scale. Results from this survey are likely not representative of rivers due to the limited number of angler responses that preferred to fish for Walleye in rivers.

In 2001, a mail questionnaire was sent to potential Walleye anglers living within 25-miles of the lower Current River from Van Buren, MO to the Arkansas state line (Mayers 2003). Sixty-six percent of the surveys to deliverable addresses were returned by anglers. On average, 8.09 trips were made that year per Walleye angler, totaling an estimated 13,661 Walleye fishing trips made on the Current River. Based on the Weithman (1991) survey, 13,661 fishing trips on the Current River would have an equivalent value of $450,813. In addition, 80% of all anglers surveyed and 92% of Walleye anglers surveyed, supported Walleye stocking in the Current River. Lastly, the

most popular "other water" to fish for Walleye was the Black River, followed by the Eleven Point River. This survey provided empirical data showing that demand for angling opportunities and high public support for stocking of Walleye in these rivers.

In 2012, a Walleye mail survey entitled "*Black River Strain Walleye Angler Mail Survey for the Current, Black, St. Francis, and Eleven Point Rivers*" was approved. In 2014, 25,099 mail questionnaires were sent to potential Missouri Walleye anglers living within a 45-mile buffer around these rivers. A total of 3,835 useable responses were obtained from 22,099 deliverable addresses. In addition, 54 anglers who had returned a Walleye reward tag were also surveyed. The results from this questionnaire are being compiled.

CULTURE AND STOCKING

Walleye are spawned and reared by MDC for supplemental stocking at selected locations statewide. Walleye have been cultured at various MDC hatcheries over the years but are now raised primarily at Chesapeake and Lost Valley hatcheries. Details regarding culture procedures are included in Appendix 3.

GOALS, OBJECTIVES, AND STRATEGIES

Primary Objective: Provide a variety of Walleye angling opportunities in suitable lakes and rivers through biologically sound and cost-effective strategies while ensuring the protection of aquatic communities.

Goal 1. Develop biologically sound and cost-effective Walleye production and distribution techniques.

Objective 1.1. Ensure the most efficient culture and stocking techniques are used.

Strategies:

- Use an adaptive management approach to Walleye culture to meet annual stocking requests.
- Follow MDC biosecurity protocols before transporting Walleye to and from hatcheries.
- Obtain suitable brood stock from selected Missouri waters.
- All surplus Walleye fry will be returned to the system where brood stock were collected.
- Coordinate within Fisheries Division to use boat stocking methods to distribute Walleye offshore in stocked, public waters.

Objective 1.2. Maintain genetic integrity of unique Walleye populations.

Strategies:

- Conform to MDC's stock transfer policy.
    - ✓ Waters with fish demonstrating unique genetic strains (*e.g*. Black River strain) will only be stocked with these same native strains as assessed by RFLP.
    - ✓ Work with Arkansas Game and Fish Commission (AGFC) personnel to conduct a genetic assessment of Walleye in the Black River Basin.
    - ✓ Conduct a genetic assessment from water bodies throughout Missouri to verify native strain brood stock integrity.

Goal 2. Provide a variety of Walleye catch and harvest opportunities for anglers.

Objective 2.1. Gain a better understanding of Walleye habitat in Missouri rivers and lakes and adjust management efforts to respond to or enhance habitat conditions as they exist today or as conditions change over time.

Strategies:

- Evaluate habitat conditions (*e.g*., structure, physico-chemical conditions, water level management, flows, etc.) to identify any factors that may limit the success of Walleye management, including supplemental stocking, on selected rivers and lakes.
    - ✓ In addition to physico-chemical and limnological parameters, these evaluations should include consideration of: a) proximity to other Missouri Walleye waters; b) a thorough evaluation of prey availability; and c) the status (e.g., density, growth rates, condition factor, etc.) of other sportfish species in the selected waterbody.

- Conduct habitat evaluations on other waterbodies before implementing new stocking efforts.
    - ✓ In addition to physico-chemical and limnological parameters, these evaluations should include consideration of: a) proximity to other Missouri Walleye waters; b) a thorough evaluation of prey availability; c) the status (e.g., density, growth rates, condition factor, etc.) of other sportfish species in the selected waterbody; and d) potential impacts on species of conservation concern that may result from more intensive Walleye management on selected waters.
- Conduct habitat enhancement projects to improve cover and substrate conditions in selected waters and locations.
- Work with the U.S. Army Corps of Engineers (USCOE) and Southwestern Power Administration (SWPA) to manage water levels on selected lakes to promote and enhance fish habitat.

Objective 2.2. Create catch and harvest orientated Walleye fisheries (fish 15 inches and larger) in ten lakes.

Strategies:

- Annually stock Harrison County Lake, Lake Jacomo, Lake of the Ozarks, Longview Lake, Mozingo Lake, Pomme de Terre Lake, Smithville Lake, and Stockton Lake with up to 30 fingerling (1 to 2-inch) Walleye/acre (Table 2).
- Stock Truman Lake on a biennial schedule (even years) with 1.5 Walleye fingerlings (1 to 2-inch) /acre (Table 2). If fingerlings are available, stock Truman Lake on odd years with up to 1.5 Walleye fingerlings (1 to 2-inch) /acre (Table 2).
- Stock Forest Lake every three years with 10 advanced Walleye fingerlings (4 to 6-inch) /acre (Table 2).
- Regulate these Lakes with a 15-inch MLL and a four (4) fish daily limit.
- Conduct stocking success evaluations. Methods may include, but are not limited to:
    - ✓ Annual early-spring electrofishing surveys to evaluate adult Walleye populations.
    - ✓ Mark-Recapture surveys to determine Walleye densities.
    - ✓ Fall electrofishing surveys to evaluate first-year growth and relative abundance of age zero (0) Walleye.
    - ✓ Angler creel surveys.
    - ✓ Exploitation studies.
    - ✓ OTC or microchemistry analysis.
- Add or remove water bodies from this category as appropriate.

Objective 2.3. Provide high-quality Walleye fisheries (fish 18 inches and larger) in three (3) lakes.

Strategies:

- Annually stock Bull Shoals and Norfork lakes with eight (8) Walleye fingerlings (1 to 2-inch)/acre (Table 2). If surplus is available, stock up to two additional Walleye fingerlings (1 to 2-inch)/acre per year (Table 2).
- Annually stock Lake Show-Me with 20 Walleye fingerlings (1 to 2-inch)/acre (Table 2).
- Regulate these lakes with an 18-inch MLL and a four (4) fish daily limit.
- Conduct stocking success evaluations. Methods may include, but are not limited to:
    - ✓ Annual early-spring electrofishing surveys to evaluate adult Walleye populations.
    - ✓ Mark-Recapture surveys to determine Walleye densities.
    - ✓ Fall electrofishing surveys to evaluate first-year growth and relative abundance of age zero (0) Walleye.
    - ✓ Angler creel surveys.
    - ✓ Exploitation studies.
    - ✓ OTC or microchemistry analysis.
- Add or remove water bodies from this category as appropriate.

Objective 2.4. Provide supplementary Walleye angling opportunities in selected lakes.

Strategies:

- If surplus fingerlings are available, periodically stock the James River Arm of Table Rock Lake and Long Branch Lake up to rate of 10 Walleye fingerlings (1 to 2-inch)/acre (Table 2).
- Regulate these lakes with an 18-inch MLL and a four (4) fish daily limit.
- Conduct stocking success evaluations. Methods may include, but are not limited to:
    - ✓ Annual early-spring electrofishing surveys to evaluate adult Walleye populations.
    - ✓ Mark-Recapture surveys to determine Walleye densities.
    - ✓ Fall electrofishing surveys to evaluate first-year growth and relative abundance of age zero (0) Walleye.
    - ✓ Angler creel surveys.
    - ✓ Exploitation studies.
    - ✓ OTC or microchemistry analysis.
- Add or remove water bodies from this category as appropriate.

Objective 2.5. Manage and monitor riverine Walleye fisheries and provide a variety of Walleye angling opportunities.

Strategies:

- Stock the Black, Current, Eleven Point, and St. Francis rivers with 1,300 to 1,500 Walleye fingerlings (1 to 2-inch)/river mile on a four-year rotation (Table 2). These rivers will only receive BRS Walleye.
- Work with AGFC personnel to manage the Walleye populations in the south flowing rivers in southern Missouri. Activities may include brood stock collection, transfer of

brood stock and/or Walleye eggs, fry, and fingerlings. All collection and transfer work will follow MDC biosecurity and stock transfer protocols.

- If surplus fingerlings are available, periodically stock the North and South Fork Salt rivers with up to 1,300 Walleye fingerlings (1 to 2-inch)/river mile (Table 2). Unless new genetic collections demonstrate a unique Walleye strain in these rivers (Objective 1.2), lake strain Walleye can be used.
- Manage the Current, Eleven Point, and St. Francis rivers with an 18-inch MLL and a four (4) fish daily limit.
- Manage the Black and Salt rivers with a 15-inch MLL and a four (4) fish daily limit.
- Determining status of Walleye populations (parameters may include: relative abundance, size structure, age structure, growth, natural mortality and exploitation) in the Osage and Meramec rivers.
- As appropriate, recommend and implement harvest regulations, habitat manipulations, and fish stockings.
- Conduct stocking success evaluations. Methods may include, but are not limited to:
  - ✓ Annual early-spring electrofishing surveys to evaluate adult Walleye populations.
  - ✓ Mark-Recapture surveys to determine Walleye densities.
  - ✓ Exploitation studies.
  - ✓ OTC or microchemistry analysis.
- Add or remove water bodies from this category as appropriate.

Objective 2.6. Investigate the potential of providing anglers with an opportunity to catch and harvest 10-pound or larger Walleye.

Strategies:

- Involve anglers in the process to identify potential waters where more restrictive regulations could be suitable to achieve this objective.
- Conduct FAMS modeling to selected fisheries to determine if additional restrictive regulations can achieve this objective.
- As appropriate, apply management, regulation, and stocking strategies to achieve this objective.

Goal 3. Provide timely information on angler use and preferences for decision making.

Objective 3.1. Obtain data regarding fishing effort, catch, and harvest statistics from anglers.

Strategies:

- Coordinate with MDC's Resource Science Division staff to design angler creel surveys to better quantify Walleye angler statistics.
- As funding allows, conduct angler surveys for a minimum of two consecutive years on Walleye fisheries maintained by stockings.
- As funding allows, determine Walleye exploitation rates from selected waters for a minimum of two consecutive years.

Objective 3.2. Obtain opinion information from anglers.

Strategies:

- Use optional questions in angler surveys to assess Walleye angler opinions.
- As funding allows, solicit statewide Walleye angler opinions through mail surveys every ten years.
- Complete the "*Black River Strain Walleye Angler Mail Survey for the Current, Black, St. Francis, and Eleven Point Rivers*" report in FY19.

Goal 4. Provide the public and fisheries professionals with information on Walleye fisheries, develop materials promoting Walleye fishing, and effectively implement the Walleye plan.

Objective 4.1. Designate a Walleye program coordinator and related committee members.

Strategies:

- The Fisheries Division Chief will appoint, and as needed, replace the Walleye program coordinator to lead the Walleye committee composed of Fisheries Division staff and other MDC staff involved in Walleye management.
- The Walleye program coordinator, in consultation with the Fisheries Division Management Team, will replace committee members as job responsibilities change or committee members leave the Department.
- The Walleye program coordinator, in consultation with the Walleye committee and the Fisheries Division Management Team, will update the Walleye plan or make necessary adjustment to the goals, objectives, and strategies as appropriate.
- The Fisheries Division Chief will appoint, as needed, a Fisheries Management Biologist to the North Central Division of the American Fisheries Society Walleye Technical Committee.

Objective 4.2. Provide the public with current information on Walleye fishing opportunities.

Strategies:

- Include Walleye information in annual fishing prospects.
- Involve media personnel during Walleye population sampling.
- Submit a *Missouri Conservationist* article regarding Walleye management, angling opportunities, or unique Missouri Walleye strains.
- Publish the Walleye Management Plan on MDC's web page.
- Work with Outreach and Education Division to produce a web-based Walleye fishing opportunities map.
- Work with Outreach and Education Division to create a media campaign that could include appropriate promotional items (i.e. bumper stickers, hats, posters, t-shirts, etc.) emphasizing MDC's Walleye management efforts.

Objective 4.3. Assess current Walleye sampling methods, regulations, and stocking rates.

Strategies:

- Work with Resource Science Division staff to establish standardized sampling collection methods and/or benchmark population parameters for Walleye fisheries maintained by stockings.
- All Walleye sampling information will be entered into Fisheries Information Network System (FINS).
- Assist and coordinate Walleye regulation enforcement with Protection Division.
- Adjust Walleye regulations where necessary and appropriate.
- By July 1, 2025, Fisheries Management Biologists will provide the Walleye Planning Committee (WPC) a summary report of all management activates for waterbodies listed in Table 2. The WPC will compile these reports for the Fisheries Division Management Team by December 31, 2025. This information will be used to develop individual waterbody Walleye objectives and modify stocking rates, priority rankings, and regulations for the next Walleye management plan (2027-2036).

Objective 4.4. Assess contaminant levels in harvestable Walleye.

Strategies:

- At the request of Missouri Department of Health and Senior Services, collect Walleye for contaminant analysis.
- Investigate non-lethal contaminant collection techniques and apply as appropriate.

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APPENDIX 1

SPECIFIC WALLEYE WATERS INFORMATION

Lakes

Bull Shoals Lake
Ozark Region
Fisheries Management Biologist: Nathan Recktenwald

A Walleye population was present in the upper White River of northern Arkansas and southern Missouri prior to the lake's impoundment in 1952. Of the lake's 48,000 acres, approximately 27% of the lake is in Missouri with the remainder located in Arkansas. In 1995, an 18-inch MLL and a four (4) fish daily limit were established by MDC. The AGFC adopted these regulations in 1998.

Between 1953 and 1956, MDC stocked an unknown number of Walleye. Also, from 1961 to 1981, AGFC stocked an unknown number of Walleye on a limited and periodic basis. Between 1983 and 1990, AGFC annually stocked Walleye fingerlings released from a large rearing pond located adjacent to the west Sugarloaf Arm. During this eight-year period, AGFC estimated that more than 1.6 million Walleye were stocked. During the 1990's, MDC stocked more than 7.4 million Walleye, comprised of 37% fry and 63% fingerlings (<4 inches). Total annual fingerling stocking densities averaged 8.5 fish/acre for both agencies combined from 2002 to 2006. Since 2007, MDC's annual stocking density goal was raised to eight (8) fish/acre (N=384,000) for the entire lake, which currently remains in place.

Brood stock Walleye destined for Chesapeake Fish Hatchery have been collected from the Forsyth, MO area since 1993 using nighttime electrofishing methods during the March spawning season. Catch per unit effort (CPUE) estimates are suspect due to the selective collection of mature Walleye. In 2003 and 2004, a total of 1,963 Walleye (9.3 to 30.5 inches) were tagged to determine post-spawning dispersal and angler exploitation. The tag return rate exceeded 47%. Nearly 80% of the fish were reported caught within the 25-mile reach between Powersite Dam and Bear Creek at the MO/AR state line. Adjusting for tag loss and angler non-reporting, exploitation was estimated at 61% in 2003 and 49% in 2004. Approximately 76% of the Walleye caught were by anglers specifically fishing for Walleye; double the observed value from a late 1980's angler survey.

A limited number of Walleye are captured in conjunction with standard April nighttime electrofishing sampling. Most fish captured are age one (1), ranging from five (5) to 12 inches. From 1983 through 1989, spring electrofishing capture rates for Walleye averaged 0.2 and 0.05 fish/hour on the Forsyth and Theodosia arms, respectively. From 1990 to 1999, the age one (1) mean capture rate was 3.2 fish/hour in Forsyth and 1.7 fish/hour in Theodosia, which can be contributed to the increased stocking rates in the 1990's. From 2000 to 2006, the mean age one (1) Walleye capture rate was 6.3 fish/hour in Forsyth and 2.8 fish/hour in Theodosia. From 2006 to 2015 the mean age one (1) capture rate was 12.6 fish/hour in Forsyth and 2.5 fish/hour in Theodosia. In 2016, the electrofishing sample sites were modified to increase replication and

include more areas of the lake. In an effort to compare recent data to historical trends, a subset of the new sites located in historical coves, was used to calculate a mean CPUE. This resulted in a three (3) age one (1) fish/hour in both Forsyth and Theodosia in 2016. The age one (1) year class samples have provided useful population trend estimates. Future management goals should take into consideration historical catch rates and angler preferences.

The Twin Lakes Walleye Club (TLWC), based in Mountain Home Arkansas, was regularly surveyed to determine angler catch rates starting in 2010. From 2010 to 2013, the club collected otoliths to determine length-at-age estimates; Walleye typically reached 18 inches in length by age three (3). In the future, the Walleye fishery should be managed through stocking, spring electrofishing surveys, angler surveys, communication and data sharing with AGFC and TLWC, and through specific research projects as needed.

Forest Lake
Northeast Region
Fisheries Management Biologist: Mike Anderson

Forest Lake was constructed in 1952 and filled to its 573-acre pool by 1956. The surrounding land became Thousand Hills State Park in 1952.

During the spring of 1953, 1954, and 1955, 250,000, 200,000, and 200,000 Walleye fry were released, respectively. A total of 29 Walleye were sampled using gill nets and seines in 1956. Age three (3) Walleye ranged in size from 16 to 21 inches. In 1971, 700,000 Walleye fry from Blind Pony Hatchery were stocked. These fish grew to a satisfactory length of 11.6 inches by age two (2), but survival, as reflected by low electrofishing catch rate, was probably very low. Although unverified, the poor survival was probably due to inadequate forage for young Walleye. From 1974 through 1977 few Walleye (<25 total) were observed during standard spring electrofishing.

Walleye fry and fingerlings were again stocked in 1980 (15,000, 1.5-inch fingerlings), 1981 (73,108, 1.4 to 1.8-inch fingerlings), and 1982 (392,160 fry and 338,816, 1.5 to 2.0-inch fingerlings). Adult yellow perch (1,200) and 72,000, 1-inch fingerling yellow perch were stocked in 1980 and 1981, respectively, to provide forage for Walleye. A 10 to 20 fish/hour early spring adult Walleye capture rate was established as a desirable objective range. An 18-inch MLL and a four (4) fish daily limit were implemented in 1981. The initial purpose of developing the Walleye population was primarily as an experimental means of controlling excessive white crappie recruitment. Spring Walleye electrofishing capture rates in 1983 and 1984 were five (5) and one (1) fish/hour, respectively, and improved to 13 fish/hour in 1985 and nine fish/hour in 1986. The Walleye stockings were determined to have failed to produce a viable fishery. Because Walleye management activities had been discontinued and anglers had not reported catching Walleye, the 18-inch MLL was rescinded in 1996 to avoid raising angler expectations.

Northeast regional Fisheries staff nominated Forest Lake and it was selected by Fisheries Administration to evaluate stocking success of large fingerling Walleye (6 to 8-inch) in a small lake. In October 2002, 5,740 Walleye fingerlings averaging 6.1 inches were stocked into Forest

Lake. In order to determine the stocked Walleye's contribution, the stocked fingerlings were cold-branded on their left side directly behind the pelvic fin. With the adoption of the statewide 15-inch Walleye MLL, Forest Lake became regulated by statewide Walleye regulations prior to the October 2002 Walleye stocking. A March 2005 electrofishing survey yielded a capture rate of 62 Walleye/hour 15 inches or longer, which exceeded the 50 fish/hour objective. Of these fish, 39 fish/hour originated from the 2002 year-class (brand visible), and 23 fish/hour were possibly natural recruits (contained no visible mark). The stockings provided a substantial boost to the population evidenced by increases in electrofishing catch rate. The Proportional Size Distribution (PSD) of the stocked fish was 100% and mean average length after three (3) growing seasons was 16.1 inches. A second stocking of 5,730 advanced Walleye fingerlings occurred in fall 2005, and 7,158 were released in fall 2007. A spring 2007 electrofishing survey yielded a catch rate of 63 stock-size Walleye per hour, of which 40/hour had a clearly visible mark. Due to miscommunication with marking the 2005 year-class of Walleyes before they were stocked, all marked fish captured were from the 2002 year-class. The final stocking of Walleye during the Forest Lake Advanced Walleye Stocking Management Evaluation was in fall 2010 with the release of 5,800 advanced fingerlings. All management objectives were met during subsequent electrofishing surveys in 2010 and 2011. In 2012, indices fell slightly below management objectives for catch rate of stock and quality-sized fish. This was most likely due to the 2010 year-class not being fully recruited to the fishery and poor weather conditions following up to the survey. Due to a mechanical breakdown in 2013, a follow-up survey was conducted in 2014 to access the 2010 stocking. Disappointingly, only twenty-two, 15-inch or larger Walleye were captured, and 90 percent of these had a clearly visible brand. Possible reasons for the low catch rate was a majority of the Walleye had spawned and moved off-shore, high angler harvest due to increased awareness and popularity, and emigration during a high-water event in 2013. The most recent stocking of advanced Walleye fingerlings occurred in fall 2014. That stocking was evaluated by electrofishing in spring 2017. A total of 43 Walleyes were captured in just over one (1) hour of electrofishing resulting in a PSD of 88 and a PSD20 of 72. Four (4) fish were 25-inches or longer with the largest measuring 27.5 inches. Twenty-Two Walleye still retained a clear and visible brand from 2010, the last year of the advanced walleye stocking project. Advanced Walleye fingerlings will continue to be requested on a three-year basis with the next stocking in 2018. The final report, Forest Lake Advanced Walleye Stocking Management Evaluation, 2002-2010, can be found on SharePoint.

Lake Jacomo
Kansas City Region
Fisheries Management Biologist: Jake Allman

Lake Jacomo is a 970-acre lake that is owned by Jackson County Parks and Recreation. This lake was impounded in the late 1950's. Walleye appeared in the lake early on and anglers remember catching them in the 1970's. The first recorded MDC stocking was for a research project in 1987 when 488,750 fry, 14,619 fingerlings (2-inch), and 8,755 advanced fingerlings (4-inch) were stocked. Many Lake Jacomo anglers remember this as the heyday of walleye fishing. Walleye fishing declined until the late 2000s. Walleye fingerling stockings resumed at Lake Jacomo in 2001 when 20,000 surplus Walleye fingerlings were stocked. In 2004, a double stocking (40,950) of Walleye fingerlings occurred. The stockings since then have remained at a rate of 20/acre every other year.

Since 2004, Walleye are sampled each spring along the dam and catch rates have increased each year. In 2004 electrofishing catch rates were 27 Walleye/hr, in 2005 they were 39 Walleye/hr, and in 2006 as a reflection of the double stocking in 2004, catch rates jumped to 101 Walleye/hr. Walleye catch rates have returned to the 40-50 fish/hour range and it is anticipated that annual walleye stocking (20 fish/acre) will provide results similar to the double stocking in 2004. It is hoped we can return to angler comments like this from the 2006 season: "*Walleye fishing in 2006 was amazing for Missouri! Not many guys target just Walleyes like me, but 2006 was the BEST year for really quality fish and hopefully continued stockings keeps that going. I caught some really big ones also (over 25" fish) and I just loved that. Last time I can remember catching as many BIG Walleyes at Lake Jacomo was back in the 70's fishing with my Dad and I was just a kid*."

Lake of the Ozarks
Central Region
Fisheries Management Biologist: Greg Stoner

A six (6) year tagging study initiated in 1977 revealed that, although highly migratory throughout most of the year, the majority of Lake of the Ozarks (LOZ) Walleye concentrate in or near the Harry S Truman (HST) Dam Tailwater in the spring. This indicates that the HST discharge channel is the primary Walleye spawning area for the LOZ population. No other significant spawning runs are known to exist. Tagging information also revealed relatively low angler exploitation of approximately 14% for Walleye > 15 in.

As a result of the closure of HST Dam in 1977, a decline in the Walleye fishery was observed in creel surveys on the Osage and Niangua arms of LOZ from 1981 to 1984. During this time, the average length of fish harvested increased due to poor recruitment. In 1983, the U.S. Army Corps of Engineers (COE) attempted to maintain continuous flows during the spawning period. It is assumed that the increase in age one (1) Walleye observed in 1984 was a result of that effort. High releases from HST in 1984 also resulted in a good year class. Although the 1983 and 1984-year classes were considered above average for the period following 1979, they should not be considered so in historical terms.

In 1987, a study was initiated by MDC to look at the reproductive physiology and behavior of Walleye in the HST Tailwater during the spawning period. The study found that the testosterone, estradiol, and blood protein levels of LOZ Walleye were abnormal compared to other Walleye populations. Abnormal blood chemistry and unusually long periods of spawning activity were thought to be the result of the absence of one or more environmental cues, such as continuous flows, gradually increasing water temperatures, or suitable spawning habitats. These cues can be directly affected by intermittent releases from HST Dam. By using sonic tracking devices implanted in mature Walleye, a positive correlation between water releases at HST Dam and upstream migration of Walleye during the spawning season was found.

In 1990, an interim operating agreement was accepted by the COE. This agreement calls for 45 days of continuous water release from one turbine unit operating at half capacity during the Walleye spawning period, provided that water is available in excess of the normal flood pool in

Truman Lake. This release is requested annually by fisheries management personnel to begin at, or just prior to, the peak of Walleye spawning activity. The purpose of this agreement is to simulate river conditions in an effort to improve spawning success for Walleye and other species.

Standard electrofishing surveys for Walleye on LOZ take place in the spring when water temperatures (F) reach the low to mid-40's and continues until temperatures reach the low 50's. In most years this corresponds roughly to the period of from March 15th-April 5th. Overall densities of Walleye observed during electrofishing surveys in the HST Tailwater have changed very little since 1984, with the mean electrofishing catch rates for the periods (1985-2006) averaging approximately 56/hour. As of 2007, continuous water releases are requested to begin 36-48 hours prior to the first brood stock collection. This concentrates Walleye in the Tailwater and allows fisheries crews to collect the requested number of brood stock in one (1) or two (2) days as opposed to the six (6) or eight (8) days required prior to 2007. Catch rates from 2007 through 2016 have averaged 134/hour.

The HST Tailwater has proven to be the most reliable place in Missouri to collect Walleye brood stock. An unusually high female to male ratio is observed in this area. Walleye produced by MDC Hatcheries using LOZ brood stock are stocked in Missouri and other states.

Since 1991, Walleye have been stocked biennially at a rate of six (6) fingerlings/acre with occasional stocking of surplus fry and fingerlings. Due to current plans to collect all non-Black River brood stock from LOZ, this annual stocking rate should be maintained.

The Walleye fishery will be monitored annually with electrofishing surveys in the HST Tailwater.

Lake Showme
Northeast Region
Fisheries Management Biologist: John Lorenzen

Lake Showme is a 225-acre lake owned by the City of Memphis in Scotland County. Walleye were first stocked by the City of Memphis in 1992 at 3.8 fish/acre. Walleye were then stocked again in years 1993 and 1997 at similar densities. In 2009, MDC took over stocking efforts and Walleye were stocked at 15 fish/acre and again in 2011 at 20 fish/acre. Natural recruitment has been documented though the percentage of natural recruits to stocked Walleye is unknown.

Management began in 2000 with a spring electrofishing survey. Relative abundance for Walleye was low in 2000 with a CPUE of 18; however, a PSD of 94 and a PSD-P of 11 indicated a moderate size structure. In 2005, CPUE increased dramatically to 178 fish/hour of electrofishing and size structure increased with a PSD of 96 and a PSD-P of 24. Stock size Walleye CPUE was between 129 and 257 from 2006 through 2014 and PSD-P has ranged from 29 to 51 during the same time period. The most recent spring electrofishing occurred in 2017, resulting in a CPUE of 46 fish/hour electrofishing, a PSD of 95, and a PSD-P of 14. Walleye sampling will take place again in spring 2017. Making Lake Showme a priority for Walleye stocking is imperative as it is a heavily used lake for northeast Missouri. The city and local anglers are adamant that a quality fishery for Walleye remains a top priority for their lake.

Long Branch Lake
Northeast Region
Fisheries Management Biologist: Mike Anderson

Walleye were initially stocked into Long Branch Lake (2,430 acres) in 1986. From 1986 through 1988 various sizes of fingerlings were stocked at densities ranging from four (4) to 27 fish/acre. In 1992, fingerlings were stocked at two (2) fish/acre. Between 1991 and 1994, spring electrofishing catch rates for Walleye 10 inches in length or longer ranged from 108 to 218 fish/hour. In 1997, the catch rate dropped to 29 fish/hour. All sampling has been conducted along the dam.

A project comparing the relative survival of fry, fingerlings, and large fingerlings was completed in 2006. Walleye fry, fingerlings (1 to 2 inches), and advanced fingerlings (≥ 5 inches) were stocked in 1995, 1998, and 2001. Stocking rates ranged from 540 to 694 fry/acre, 50 small fingerlings/acre, and five advanced fingerlings/acre. Zooplankton monitoring occurred bimonthly during the first summer the fish were stocked. Stocking success was evaluated using fall electrofishing. The 1995 and 1998 Walleye stocking efforts were considered a failure for numerous reasons. It was discovered that significant mortality occurred with the large fingerlings due to transport stress and an aeration malfunction in the transport truck. Water levels in the Lake were high in 1995 and 1998 and stayed high for long periods of time. High turbidity persisted throughout the summer months during those years contributing to low zooplankton abundance.

In 2003, early spring electrofishing resulted in the capture of 12 Walleye and only two (2) of these were from the 1998 year-class (2001 year-class was not sexually mature). Survival was better in 2001. Not only was the 2001 water level moderated by very low water at the beginning of the year, there was also substantial terrestrial vegetation growing below the full pool elevation of 791 feet. Decaying vegetation helped to rapidly precipitate suspended clays after heavy rains. Clearer water may have led to higher zooplankton abundance in spring 2001. Other contributing factors included the reduction of adult gizzard shad and the flooding of terrestrial vegetation that most likely increased invertebrate prey abundance in the littoral zone. The capture rate of 42 age zero (0) fish/hour in fall 2001 far exceeded either the 15 fish/hour or nine (9) fish/hour in 1995 and 1998, respectively. Fifty Walleye/hour (≥ 10 inches) were captured during early spring electrofishing surveys in 2004. Scale samples revealed that a majority of the fish captured (45 fish/hour) originated from the 2001 year-class, and the remainder were from the 1998 year-class. PSD of the 2001 year-class was 82 and mean length at age three (3) was 15.8 inches. The ratio of the number of Walleye stocked to the number captured for fry, small fingerlings, and large fingerlings was 116,172:1, 4,978:1 and 3,105:1, respectively. According to previous surveys, no Walleye stocked as fry in 1995 and 1998 were identified during electrofishing surveys, so the low water conditions were probably favorable for fry survival in 2001. Electrofishing surveys conducted from 2001 to 2003 show that the proportionate return of Walleye stocked in 1998 and 2001 were five (5) to seven (7) times higher for fish stocked as large fingerlings. The 2004 survey indicated the proportionate return of Walleye stocked as large fingerlings was only 1.6 times higher.

It appears that fry and small fingerlings (1-2 inches) are more cost effective, under suitable Lake conditions (i.e., stable water level, clear water) than advanced fingerlings. Walleye fingerlings were stocked at approximately 10 fish/acre in 2011, 2014, and 2015. Currently, Walleye populations are not being actively managed as Long Branch is a surplus only lake and water clarity and conditions fluctuate dramatically resulting in unfavorable conditions for Walleye.

Longview Lake
Kansas City Region
Fisheries Management Biologist: Jake Allman

In the early 1990's, Longview Lake was known as a quality Walleye fishery in the Kansas City metropolitan area. Spring electrofishing catch rates for Walleye increased from 56 fish/hour in 1990 to over 120 fish/hour in 1993 and 1994. Electrofishing surveys in late March and early April became challenging with up to 50 anglers along the dam pursuing Walleye. Competition with anglers was so great that staff had to walk the dam and inform anglers of our activities and ask them to step back from the water and remove their fishing gear while we sampled. According to the 1994 creel survey, 10% of the total fishing effort on Longview Lake was spent targeting Walleye with a catch rate of 0.1 legal (18-inch) fish/hour. This is a very high percentage of anglers targeting Walleye – much higher than many of Missouri's Walleye lakes. This percentage may be higher than documented as the creel survey did not capture angling effort from bank fishermen fishing for Walleye along the dam. During the prime Walleye years at Longview, the lake received good publicity about the quality of Walleye fishing. This history led to Longview Lake being included in the Missouri Walleye Management Plan as a regular recipient of Walleye fingerlings. However, in 1996 catch rates dipped to 35 fish/hour and continued to decline prompting managers to seek ways to bolster the population.

From 1996 to 2002, interest in fishing for Walleye at Longview Lake declined along with Walleye numbers. We continued to receive many phone calls and emails from concerned anglers wanting to discuss the Walleye fishery at Longview Lake. In 2000 and 2001, a volunteer angler Walleye creel was conducted. These anglers reported catch rates of 0.06 legal Walleye/hour and 0.05 legal Walleye/hour in 2000 and 2001, respectively. This decline is even more significant given the reduction in the MLL from 18" in 1994 to 15" in 2000. Catch rates for all Walleye had been as high as 1.8 fish/hour in 1989. Clearly angler catch rates declined dramatically in the absence of successful stockings.

Originally it was hoped that the Walleye population would be self-sustaining. Beginning in 1990, we noticed a lack of two (2) year old males on the spawning banks and initiated a supplemental stocking regime of 30 fingerling Walleye/acre every third year beginning in 1993. The rapid decline in the Walleye fishery began with two poor stocking in 1993 and 1996. To document the contribution to the fishery of stocked fish, fingerlings were freeze-branded both years. Larger fingerlings were stocked in 1996 (2-4") to see if holding these fish in the hatchery a little longer and stocking them when they switched from zooplankton to larval fish and macroinvertebrates as their primary prey items would be more successful. Unfortunately, the fish arrived at the lake in poor condition both years due to a *Columnaris* infection that may have been a result of the branding activities. In effect, this rendered the 1993 stockings and 1996 stockings as virtual non-events. Because of the three (3) year gap between stocking events, these

failed stockings meant the population was the remains of the 1987 stocking and what little recruitment was occurring. This led to the reduction in angler catch rates over the next six (6) years.

In 2001, we began requesting 50 fingerlings/acre annually in an attempt to rebuild the population. During this study, approximately 560,000 Walleye fingerlings were stocked into Longview Lake. Stocking rates ranged from a low of 47/acre/year to a high of 78/acre/year and averaged 54 fish/acre. Condition of the stocked fish varied from year to year from fair to good.

A one-time stocking of 9,441 (10.2 fish/acre) advanced fingerlings (4 to 6-inch fish) in 2002 showed potential by improving the catch rate of Walleye in the fall of that year and in 2005 at the dam. However, the 2002 stocking also included 51 fish/acre of 1 to 2-inch fingerlings, so little can be inferred as to the success of the advanced fingerlings.

As a result of these stockings, Walleye electrofishing catch rates have rebounded. From 1991 to 1995, the average catch rate was 105 fish/hour of electrofishing. From 1996 to 2000, the average catch rate plummeted to 32 fish/hour. The last five years of the project, the average catch rates increased to 87 fish/hour, despite sampling difficulties in 2010 and 2012. In 2009, we recorded our highest catch rate in the lake's history with 142 fish/hour being collected. During this stocking regime, we documented two (2) of the three (3) highest catch rates in the lake's history in 2005 and 2009. The decision was made to reduce the annual stocking to 20 fish/acre to maintain the population. It was determined that regular stockings were more important than higher density stockings in order to minimize the impact of a failed stocking. Catch rates have only slightly dipped since stocking rates have dropped to 20 fish/acre, but his can be attributed to poor sampling conditions in 2015.

Mark Twain Lake and Salt River Tributaries
Northeast Region
Fisheries Management Biologist: Ross Dames

Walleye fry were initially stocked in Mark Twain Lake in 1984-1986 at an average density of 512 fry/acre. Angler surveys conducted in the Lake from 1984 through 1993 documented the developing Walleye fishery beginning in 1986 and lasting into 1989. Although Walleye fishing effort was relatively low during these years (5% of total effort), Walleye angling at Mark Twain Lake was growing in popularity. Angler catch rates in 1988 reached 0.027 fish/hour and Walleye harvest was 0.5 lbs/acre. The fishery declined dramatically after 1988, possibly due to harvest by illegal methods during spring runs (as reported by Conservation Agents), and high natural mortality, based on visual observations by anglers and MDC staff in 1987 and 1988. Walleye stocking in the lake resumed in 1989 and continued through 1996 with stockings of one (1) to two (2) inch or two (2) to four (4) inch fingerlings, or a combination of both. Despite these continued efforts, Walleye density in the lake remained too low for a significant fishery to develop.

Fingerling (1 to 2 inches) and advanced fingerling (4 to 8 inches) Walleye were released at 17 sites in tributary streams of Mark Twain Lake during 1999 and 16 sites in 2002. Spring electrofishing in the tributary streams, fall electrofishing in the lake, and a lake angler survey

were used to evaluate the success of these stockings. Few Walleye were collected in the lake; however, electrofishing capture rates in tributaries increased following these stockings. Electrofishing capture rates in tributary streams prior to stocking ranged from 6.5 to 8.8 fish/ hour in 1997 and 1998. Electrofishing catch rates in 2002 and 2005, three years after each stream stocking, were 8.4 and 19.3 fish/hour, respectively. Most Walleye captured in 2002 and 2005 were stocked as small fingerlings three (3) years prior. In fact, 78% of the Walleye captured in spring 2002 were stocked in 1999, and 98% of these were stocked as small fingerlings. In spring 2005, 89% of the captured Walleye were stocked in 1999 or 2002. Of these, 85% were stocked as small fingerlings in 2002. For both stocking years combined, overall survival of small and large fingerlings was nearly equal, indicating that stocking small fingerlings is most cost effective.

Even though the overall electrofishing capture rate of Walleye in spring 2005 was more than double any previous year, it was far below our target criteria of 50 Walleye/hour. However, the capture rate at one site in the North Fork Salt River was 30 fish/hour and was 54 fish/hour at a site in the South Fork Salt River. These results indicate the potential for a stream Walleye fishery around Mark Twain Lake, especially in North Fork and South Fork Salt rivers. Future stream stocking of Walleye around the lake should focus on sustaining a moderate stream fishery by stocking only those sites where survival was highest and that yielded the most adult fish during spring surveys.

Fingerling Walleye were stocked in both the North Fork and South Fork Salt rivers every other year since 2009. Brief electrofishing surveys conducted on known spawning shoals in each river two (2) to three (3) years after each stocking indicate a moderate population of adult Walleye in these streams. Electrofishing capture rates on these sites have ranged from 13 to 225 fish/hour, and Walleye up to 26 inches long were captured.

Mozingo Lake
Northwest Region
Fisheries Management Biologist: Tory Mason

Mozingo Lake (1,006 acres) is located three (3) miles east of Maryville on US 136, in Nodaway County. Mozingo Lake is the only large lake fishing opportunity for many miles and receives very high fishing pressure. The lake was initially stocked in 1993 and 1994 with Largemouth Bass, Bluegill, and Channel Catfish. In 1996, Mozingo Lake received its first stocking of 26,340 Walleye fingerlings. Mozingo Lake was stocked with 10,000 Walleye fingerlings in 2000 and 2002. From 2006 to 2015, 20,000 fingerlings have been stocked in even-numbered years (biennially), for a total of 148,000 fingerlings since 1996. Since 2004, Mozingo Lake has been monitored with nighttime electrofishing to evaluate stocking success every spring. Average electrofishing effort has been 3.06 hours/year. Spring electrofishing catch rates have averaged 99 Walleye > 15 inches/hour since 2009, representing good survival.

Walleye were initially protected by an 18-inch MLL, but the MLL was reduced to 15 inches on March 1, 2007 to provide greater harvest opportunities for the increasing number of Walleye anglers. Because anecdotal evidence showed a large increase in anglers targeting Walleye, a total of 848 Walleye > 15” were tagged with reward tags from 2008-2011 to determine

exploitation rates and angler use. The study showed an average annual exploitation of 38% from 2008-2011, and that 60% of tags returned were by anglers specifically targeting Walleye, followed by crappie (23%), and bass (16%). Walleye were harvested 90% of the time they were caught. Of note, after the study was completed, a large number of tags were returned by three anglers fishing the dam from March 15th - April 6th, 2011, and collectively accounted for 35% annual exploitation of the 2011 tagging class. In just three (3) years, over 50% of the fish tagged in 2011 were caught and harvested. By utilizing otoliths from angler-harvested fish when available, age and growth has been determined and shows Walleye reaching the harvestable size of 15 inches in three (3) years.

Walleye continue to be a highly sought sport fish in Mozingo Lake for local anglers as well as anglers from nearby Iowa, Kansas, and Nebraska. Sampling data continues to show that Walleye survive and grow well in Mozingo Lake, and often reach trophy size by age six (6). With that said, current stocking rates have not met the harvest-oriented objective in 1997 Missouri Walleye Management Plan. Mozingo anglers continually inquire on the status of the Walleye fishery, and the consensus is that anglers desire more Walleye harvest opportunity. To make Mozingo a true harvest-oriented fishery, to account for the high angler use and exploitation shown in the 2008-2011 study, it is recommended that biennially stockings are changed to annual stockings of 30 fingerlings/acre.

Norfork Lake
Ozark Region
Fisheries Management Biologist: Nathan Recktenwald

A Walleye population was present in the upper North Fork of the White River of northern Arkansas and southern Missouri prior to the lake's impoundment in 1944. The U.S. Army Corps of engineers owns and operates the lake for power generation and flood control. Of the lake's 22,000 acres, approximately five (5) percent of the lake is located in Missouri with the remainder located in Arkansas.

Between 1949 and 1982, AGFC stocked unknown numbers and sizes of Walleye. From 1982 through 1989, AGFC stocked Walleye fingerlings via a rearing pond adjacent to the Lake. During this period, AGFC estimates that 326,000 fingerlings were stocked for an average stocking rate of 2.1 fingerlings/acre annually. A 1990 study, indicated that 33% of the 1990 year-class was composed of stocked fish. From 1991 to 1996, MDC stocked Walleye at a rate of 9.2 fish/acre and AGFC stocked Walleye at a rate of 4.1 fish/acre.

MDC conducted a short-term, probability access angler survey on the upper lake during March and April of 1993 and 1994. Effort directed toward Walleye angling made up approximately seven (7) percent of the total angling pressure (1 hour/acre). Angler catch and harvest rates for anglers targeting Walleye were 0.09 fish/hour and 0.08 fish/hour, respectively. The Walleye harvest (0.2 fish/acre) made up less than four percent of the total harvest. Nearly 90% of all Walleye caught were harvested.

In 1995, Walleye from the upper lake and from the dam area were tagged with T-bar anchor reward tags, and approximately 84% of tagged fish were caught within three (3) months. As for

Walleye movement, approximately 66% of Walleye tagged in the upper lake were recaptured in the upper half of the Lake, while 96% of the Walleye tagged near the dam were recaptured in the lower half of the Lake. Approximately 58% of all recaptured Walleye were caught within five (5) miles of where they were originally tagged. Angler exploitation, adjusted for tag retention and angler reporting, was 29%. In 1995, an 18-inch MLL and a four (4) fish daily limit were implemented by MDC. In 1998, AGFC adopted the same regulations.

In 1986, annual sampling of the spawning Walleye population in the upper tributaries of the lake began using nighttime electrofishing methods. The mean CPUE for the stream spawning samples was 35 fish/hour for the period from 1986 through 1990 and more than doubled, in conjunction with the increased stockings, to 81 fish/hour during the period from 1991 to 2005. The mean CPUE from 2006 to 2011 was 87.3 fish/hour. After 2011, flooding caused gravel to accumulate below the upper tributaries, thus eliminating stream access for spring spawning surveys.

A limited number of Walleye are captured in conjunction with standard April nighttime electrofishing sampling. From 1984 to 1989, the mean CPUE specifically for age one (1) Walleye (5 to 12 inches) was 0.2 fish/hour. From 1990 to 1999 the age one (1) mean capture rate was 2.2 fish/hour, which can be contributed to the increased stocking rates in the 1990's. From 2000 through 2006, the mean capture rate was 1.8 fish/hour. From 2006 to 2015 the mean capture rate was 2.6 fish/hour. In 2016, sample sites were modified to increase replication and include more areas of the lake. In an effort to compare recent data to historical trends, a subset of new sites located in historical coves, was used to calculate a mean CPUE. This resulted in a three age one (1) fish/hour for 2016. The age one (1) year class samples have provided useful population trend estimates. Future management goals should take into consideration historical catch rates and angler preferences.

The Twin Lakes Walleye Club (TLWC), based in Mountain Home Arkansas, was regularly surveyed to determine angler catch rates starting in 2010. From 2010 to 2013, the club collected otoliths to determine length-at-age estimates; Walleye typically reached 18 inches in length by age three (3). In the future, the Walleye fishery should be managed through stocking, spring electrofishing surveys, angler surveys, communication and data sharing with AGFC and TLWC, and through specific research projects as needed.

Pomme de Terre Lake
Southwest Region
Fisheries Management Biologist: Craig Fuller

Walleye were present in the Osage River basin and the Pomme de Terre (PDT) River prior to its impoundment in 1961. Natural reproduction maintained a very low-density Walleye population in PDT Lake for several years after it was impounded. No supplemental Walleye stockings were made until 1987. From 1987 through 2005, Walleye fingerlings were stocked on a sporadic basis. In accordance with the 2009 Missouri's Walleye Management Plan, Walleye fingerlings are stocked into PDT Lake if surplus are available (up to 47,000/year). Fortunately, surplus Walleye have been available six (6) out of the last eight (8) years (2009 – 2016). In 2012 and 2016, no surplus was available; therefore, no Walleye were stocked.

As a result of more frequent stockings, since the Walleye Management Plan was implemented, a quality Walleye fishery has been developed at PDT Lake. The Walleye population is assessed by sampling in the spring using electrofishing gear within the lake near the dam and in the lake's two main tributaries (PDT River and Lindley Creek). In 2015 within the lake, the Walleye catch rate was 66.7 fish/hour, compared to 68.0 and 137.0 fish/hour in 2012 and 2011, respectively. Walleye size structure within the lake is good with Relative Stock Density (RSD) values ranging from 23 to 53 during 2011 through 2015. In 2015 within the tributaries, Walleye catch rate was 30.4 fish/hour, compared to 38.2 and 44.9 fish/hour in 2014 and 2012, respectively. Size structure is also good with the tributaries, with RSD values ranging from 48 to 64 during the period 2012 through 2015.

The most recent creel information from PDT Lake is from 2010 and 2011. Since Walleye were not stocked with any regularity until 2009 and the Walleye fishery just beginning to become established, limited Walleye data is available in the creel. Anglers spent 0.4 hours/acre fishing for Walleye in 2010 and 0.3 hours/acre in 2011. Catch rates were 0.10 and 0.30 Walleye/hour in 2010 and 2011, respectively. The mean length of Walleye caught was 13.8 and 14.6 inches in 2010 and 2011, respectively. Harvested Walleye averaged 19.0 and 19.7 inches long in 2010 and 2011, respectively. Anglers released only 11.5% of the legal-size Walleye they caught in 2010 and none (0%) in 2011.

Smithville Lake
Northwest Region
Fisheries Management Biologist: Eric Dennis

The Walleye population in Smithville Lake was monitored each spring from 2007-2015. Due to minimal natural reproduction, Smithville Lake continues to receive supplementary stockings of Walleye fingerlings (1 to 2-inch biennially at a rate of 30/acre (Table 1). During this evaluation period, Smithville Lake received to total of 864,000 Walleye fingerlings (1 to 2-inch). Supplementary Walleye stocking will continue to be necessary to maintain a viable Walleye fishery at Smithville Lake.

Electrofishing surveys were conducted after dark along the face of the dam during Walleye spawning. Sampling trips were typically spread out over a 2-3-week period and averaged at least four (4) sampling trips each spring. Walleye electrofishing catch rates averaged 184 fish/hour from 2007-2015 with a high of 280 Walleye/hour in 2015 and a low of 122 Walleye/hour in 2009. Average catch rates during this evaluation were down slightly from the previous evaluation from 2001-2006 that averaged 262 Walleye/hour.

Our sampling method of targeting Walleye at the dam during spawning runs does not provide a good population estimate or size distribution of Walleye in Smithville Lake. Samples regularly consist of 98% sexually mature males staging along the face of the dam. As a result of only targeting sexually mature Walleye, PSD and RSD values are heavily skewed. Smithville Lake Walleye PSD values averaged 92 from 2007-2015. Smithville Lake Walleye RSD values averaged 34 over that same evaluation period with a high of 57 in 2014 and a low of 18 in 2011.

Walleye continue to be a highly sought sportfish in Smithville Lake. The data continues to show that Walleye grow well in Smithville Lake and often reach trophy size. Current stocking rates do not produce a harvest-oriented fishery. I recommend that we change the biennial stocking of Walleye in Smithville Lake to an annual stocking of 30 Walleye fingerlings/acre and utilize any surplus Walleye fingerlings the hatchery produces to turn Smithville Lake into a harvest-oriented fishery rather than the incidental catch fishery that it is today. Angler surveys are needed if we want to truly evaluate the Walleye fishery in Smithville Lake.

Stockton Lake
Southwest Region
Fisheries Management Biologist: Ben Parnell

Stockton Lake Walleye management began in 1970 with the stocking of four million Walleye fry. The Walleye fishery opened under statewide regulations with a four (4) daily limit and no MLL. In 1971, an 18-inch MLL was imposed to protect small Walleye from harvest. Early fry stockings were successful in the new and filling lake. A low density, self-sustaining Walleye population was maintained for twenty years until intensive Walleye stocking began in 1993. In 1993, 682,017 (27 fish/acre) Walleye fry and 327,409 (14 fish/acre) Walleye fingerlings were stocked. In 1994, 50% of the 354,000 (14 fish/acre) Walleye fingerlings stocked were marked with a cold brand. Subsequent sampling indicated that stocked fish accounted for 80% of the 1994 year-class.

Angler surveys were conducted on the Big Sac Arm of the Lake from 1971 through 2005, with exception of 1993, 1994, and 1995. Walleye angler catch rates were consistently low before intensive Walleye stocking began. The 1996 Big Sac survey data indicate that nearly all Walleye survey statistics improved after the 1993 and 1994 stockings, with sublegal (<18 inches) Walleye catch rates much better than in any of the previous surveys. Based on the positive results of the 1993 and 1994 experimental Walleye stockings, and as recommended by the *Walleye Initiative*, routine Walleye stockings began on an alternate year basis at stocking rates of 25 to 30 small fingerlings/acre. In 2000, the MLL was reduced from 18 inches to 15 inches, aimed at creating a more harvest-oriented fishery. Angler harvest rate objectives of 0.1 to 0.2 Walleye/hour and at least 1 lb./acre Walleye harvested were established to measure stocking success. Since 2000, when Walleye stocked in 1998 recruited into the fishery, and through 2005, the last angler survey, the harvest rate objective was achieved every year except 2000. The weight harvested/acre objective was achieved every year except 2004. The lack of creel data since 2005 has not allowed Walleye harvest goals to be measured.

In 2012, an adjustment was made to the Stockton Lake Walleye stocking regime. The stocking schedule was switched from biennial (i.e. every other year) to an annual basis. The stocking rate was also reduced from approximately 750,000 to 300,000 (2-4 inch) fingerlings. This lowered the overall annual stocking rate of 15 to 12 (2-4 inch) Walleye fingerlings/surface acre. These adjustments were made to create a more consistent Walleye fishery from year to year and to bring more balance to the sport fishery.

Current adult Walleye sampling consists of late-March electrofishing along the dam and main lake points. Overall, sampling effort is just under two (2) hours of shock time. Since 2010,

sampling has taken place every year except for 2016. From 2010-2015, spring electrofishing catch rates have ranged from 41 to 62 fish/hour, meeting the objective two (2) out of the last six (6) years of sampling. The six (6) year average was 54.3 fish/hour which is below the goal of 60-120 fish/hour. However, since the implementation of the new stocking regime, the objective has been met two (2) out of the last three (3) years of sampling. Since 2010, PSD goals have been met every year and RSD goals have been met every year with the exception of 2013. Walleye growth continues to be good with most fish reaching the 15-inch MLL by age two (2). Mean average length of age three (3) male Walleye has been almost 17 inches, which falls within our objective of 16-18 inches.

Current young of the year Walleye sampling consists of fall electrofishing, which is a used to assess age zero (0) year-class strength. Before the implementation of an annual stocking regime this sampling was also used to assess the contribution of natural recruitment to a specific year class. This sampling is conducted within both the upper portions of the Big Sac and Little Sac arms, as well as the dam area. Since 2010, the dam area has produced anywhere from 9.3 to 31 fish/hour with an average of 20.6 fish/hour. The upper Little Sac sites have ranged from 3 to 40 fish/hour with an average of 20.3 fish/hour. The upper Big Sac sites have produced very few age zero (0) fish since 2010, with three years, 2010, 2013 and 2016 producing 6, 8 and 6 fish/hour respectively. Prior to the new stocking regime, years in which Walleye were not stocked, produced virtually no age zero (0) fish. This supports previous studies that have shown that there is little to no natural Walleye recruitment in Stockton Lake. The exception to this was in 2011, which produced a catch rate of 17.3 fish/hour at the dam and five (5) fish/hour at the upper Little Sac site. These results suggest that conditions in 2011 must have been ideal for natural recruitment.

Stockton Lake is often considered a premier Walleye fishing destination within the state. We believe that the existing Walleye regulations, along with the revised stocking regime will continue to support our goal of maintaining a harvest-oriented Walleye fishery. We have recently completed the final field season of the 2015-2016 Stockton Lake Creel Survey. This is the first angler survey conducted on Stockton Lake since 2005. The access portion of this survey was designed to target Walleye harvest in the lower portion of the lake. No data is currently available, but the results of this study should provide up to date information in regard to Walleye catch rates, harvest, and angler preferences on Stockton Lake. Results from this study, along with the continuation of standardized Walleye population sampling, should provide support for future Walleye management recommendations.

Table Rock Lake
Southwest Region
Fisheries Management Biologist: Shane Bush

Table Rock Lake supports a low-density Walleye population. Walleye were first stocked as fry in 1957 as the lake was filling. It is believed that many of these Walleye escaped through Table Rock Dam during a flood prior to the dam's completion. Fry and fingerlings have been stocked periodically in subsequent years by both the MDC and the AGFC. The AGFC currently stocks Walleye annually in the Arkansas portions of Table Rock Lake (Cricket Creek and/or Kings River) and the Kings River is the main source of the AGFC's Walleye brood stock. There is a

strong Walleye spawning run each spring up the Kings River, where much of the natural reproduction of Walleye in Table Rock Lake takes place. Early spring electrofishing capture rates typically range from 50 to 125 fish/hour in the Kings River.

Walleye have been sampled periodically near Table Rock Dam in the past as well. These samples typically yielded few individuals and were terminated in 2010. A fair Walleye population exists in the White River Arm from Eagle Rock up to Beaver Lake Dam. This population has never been sampled, but anglers have reported catching a fair number of Walleye in this stretch throughout the year. Reports of Walleye being caught throughout the rest of the main stem portions of Table Rock Lake are scattered at best. Angler creel data from the Mid-White River Arm indicated very low fishing pressure and catch rates, however a few Walleye of various sizes are collected throughout the lake each year by fishermen and during spring black bass electrofishing sampling. Angling pressure for Walleye in the James River Arm is also very low, with most Walleye caught by anglers fishing for White Bass in the upper portions of the James River Arm in the spring.

In an effort to establish a Walleye spawning run in the James River, Walleye fingerlings were stocked in the James River Arm at approximately 10/acre (9,000 acres)/year from 2003 to 2005. These Walleye were produced from brood stock that were collected from the Kings River and raised in the MDC hatchery system. The first documented natural reproduction of these stocked fish occurred in 2008. Early spring nighttime electrofishing is conducted annually in the James River from Cox Access to Blunk's Access. Catch rates are variable among years and inconsistent data makes it difficult to determine the contribution of natural reproduction to the population. Table Rock Lake is currently scheduled to only receive surplus Walleye fingerlings. Surplus Walleye were stocked in the James River Arm in 2010, 2013, 2014, and 2016. Electrofishing catch rates from two (2) years post stocking indicate that these surplus stockings are greatly contributing to the Walleye population in the James River Arm. The highest electrofishing catch rate to date occurred in 2015 at 86 Walleye/hour, with the majority of Walleye in the sample from the 2013 surplus stocking. Continued monitoring will be necessary to determine if stocking in the James River Arm ever yields catch rates approaching those in the Kings River Arm.

Table Rock Lake Walleye exhibit very good growth rates, with males and females averaging in excess of 18 and 21 inches, respectively, at age three (3). Walleye harvest is regulated by an 18-inch MLL and a four (4) fish daily limit. Due to the dense black bass population, there are currently no plans to aggressively manage for Walleye in Table Rock Lake.

Truman Lake
Kansas City Region
Fisheries Management Biologist: Chris Brooke

A substantial Walleye population was present in the upper Osage River basin, including the South Grand, Pomme de Terre, and Sac rivers, prior to the impounding of Truman Lake. Local residents often speak of Walleye annually covering the shoals that Truman Lake eventually flooded, "you could shine a spotlight over the water at night and see the riffles glowing with eyes".

Truman Lake filled (55,600 acres) in November 1979. The lake opened with a Walleye regulation of no MLL and four (4) fish daily limit. Walleye fry, fingerlings, or combinations of both were stocked annually from 1980-1986 at densities ranging from 1-66/acre. The goal of these stockings was to establish a brood stock population in the lake. Other than 25 adults stocked in 1993, Walleye were not stocked in Truman Lake from 1987-2000.

From 1985-1987 spring electrofishing surveys for Walleye were conducted on the Pomme de Terre, Sac, and Marais des Cygnes rivers. The objectives were to locate Walleye spawning areas and determine exploitation rates. Highest catch rates were achieved in 1986 when 40 and 22 Walleye/h were caught in the Sac and Marais des Cygnes rivers, respectively. In 1987, catch rates were 16 Walleye/h in the Sac River, 6/hr in the Pomme de Terre River, and 3/h in the lake. Growth of Walleye was good with males averaging about 18-inches and females 20-inches at age three (3). A tagging study revealed an exploitation rate of eight (8) percent.

The Lake has a low density, quality-sized Walleye population. Creel surveys in the lower lake reveal that less than one (1) percent of anglers fish for Walleye and that few Walleye are caught. Most of the Walleye that are caught are incidental catches. The average length of harvested Walleye is 18-inches. Most of the Walleye anglers catch fish during the spring spawning runs up the Sac, Marais des Cygnes, and Pomme de Terre rivers. Even though few Walleye were caught in the creel area, many anglers are interested in Walleye.

In March 2000, there was a Walleye regulation change. Truman Lake and its tributaries are now under the new statewide 15-inch MLL for Walleye; the daily limit (4) and possession limit (8) remain unchanged. In 2001 Truman Lake was added to the list of waters to receive Walleye stockings; stocking 150,000 (2.7/acre) Osage Basin Walleye fingerlings (1"-2" fish) in odd years beginning in 2003 and is also eligible for surplus stockings if available. Beginning in 2001, surplus Walleye have been stocked annually every year with the exceptions of 2008, 2012, and 2016. Stocking rates have varied from a low of 1.6/acre to a high of 8.1/acre.

Rivers

Black River

Southeast Region
Fisheries Management Biologist: Paul Cieslewicz

Prior to 1995, very little data existed on Walleye in the lower Black River below Clearwater Dam. Reportedly, “lake-strain” Walleye were stocked in Clearwater Lake in the 1950s or 1960s (Rich Wehnes, MDC, personal communication). Few, if any, were caught by anglers in Clearwater Lake, and it was suspected that many of these fished escaped over Clearwater Dam into the Black River downstream. Historical river sampling was limited to daytime summer electrofishing surveys, which collected few Walleye. Since 1995, Walleye have been sampled at night with electrofishing and gillnets during the spring spawning period. The Black River supports a low density, but high-quality population. Fish up to 15 lbs have been captured. Growth is good with males reaching 16 inches at age three (3).

Two (2) Walleye exploitations studies have been conducted on the Black River. From 1991 through 1994, a Walleye exploitation study was completed. In the 1990s, a total of 406 Walleye (> 15 inches) were tagged with T-bar reward tags. Harvest rates, after adjusting for angler compliance and tag retention, averaged 17%. In 2009 and 2010, 416 Walleye (> 15 inches) were tagged with Carlin dangler tags. Walleye harvest, after adjusting for angler compliance and tag retention, was estimated to be 35%.

These reward tag studies have also led to a better understanding of the movement patterns and the longevity of adult Walleye in these rivers. To date, anglers have reported 219 tag returns from the Black River exploitation studies. Eight (8) of these fish were reportedly caught in the Current River and one (2) in the Little Red River. This movement between the Current and Black rivers has also been documented during MDC electrofishing surveys. Electrofishing surveys have also shown that Walleye remain in the Missouri portion of these rivers for many years. Tagged Black River Walleye have been recaptured multiple times and up to eight (8) years after initial tagging.

In 1999, a three-year supplemental Walleye stocking program was approved for the Black River. The objective was to create large year classes of Walleye by stocking fingerling Walleye (2 inches) at the rate of 1,000 fingerlings per river mile (40,000 total). This stocking program has been changed and now the Black River is on a four-year stocking rotation (Table 1 & 2). Due to hatchery production problems, fingerlings have only been stocked in 2000 (7,719 fingerlings), 2003 (41,505), 2004 (7,732), 2008 (30,282), and 2013 (13,489).

Some effort has also been made to assess the relative contribution of fingerling stockings to the Walleye populations in these rivers. Annual springtime electrofishing surveys have shown an increase in Walleye catch rates several years after supplemental stockings when Walleye reached a size vulnerable to our sampling gear. In addition to catch rates, the percentage of oxytetracycline (OTC) marked fish in a subsample of Walleye collected has also been used. Since stocking began, most BRS Walleye fingerlings that have been stocked in these rivers have been OTC marked. In 2006, 40 Walleye (11.5 to 17.3 inches) from the Black River were sacrificed for OTC analysis. Of the 17 Walleye collected from the 2004 year-class (7,732 fingerlings stocked), eight (8) had an OTC mark (47%). Of the 16 Walleye from the 2003 year-class (41,505 fingerlings stocked), 13 had an OTC mark (81%). Though the sample size was small, this was good evidence that stocking played a substantial role in year-class strength in the Black River

In 2007, a juvenile Walleye movement study was conducted on the Current and Black rivers due to young-of-year (YOY) Walleye being absent in annual electrofishing surveys (Knuth and Siepker 2011). Radio telemetry was used to assess the movement of 30 juvenile Walleye (10-12 inches) in these two rivers. Weekly, diurnal tracking results showed large amounts of movement occurring after initial stocking and movement being very minimal midway through the study after Walleye found suitable habitat. More movement was seen in the Current River than in the Black River. A maximum total movement of 76.6 miles was seen in the Current River and 47 miles in the Black River. Only one (1) fish moved into Arkansas but soon after returned to Missouri. Most of the movement in the Current River was upstream with 13 fish moving up and the greatest distance traveled being 65.1 miles from the release point. In the Black River only

six (6) fish moved downstream, the greatest distance traveled being 32 miles. Upstream movement in the Black River was impeded by Clearwater Lake Dam.

Current River
Ozark Region
Fisheries Management Biologist: John Ackerson

Approximately 90 miles of the Current River, prior to its entering Arkansas, supports Walleye. The Current River is the largest river in the Ozark region, with a mean annual flow at Doniphan of more than 2,800 cubic feet/second (CFS).

Walleye fishing in the Current River is a popular activity. An angler mail survey revealed an estimated 13,661 Walleye fishing trips were made on the Current River in 2001 (Mayers 2003). Walleye trips accounted for 29.4% of the estimated 46,539 total fishing trips made in the lower Current River in 2001. An angler mail survey was conducted in 2014; an estimated 9,181 Walleye fishing trips were made on the Current River in 2001.

A study of the life history of Walleye in the lower Current River of Missouri was conducted between 1964 and 1967 (Fleener 1967). Fleener concluded that the Walleye population was very limited and recommended that Walleye fry be stocked for two (2) successive years followed by biennial stockings, in an effort to increase the population. Fleener reported the mean length of age three (3) Walleye to be 17.3 inches. From 1967 to 1971, a study was conducted to evaluate fry stocking and the Walleye population. A total of 5.8 million Walleye fry were stocked in an eleven pool stretch of river between Van Buren and Doniphan in 1968-1969. Conclusions were that the fry stockings did not contribute to the Walleye population (Fleener 1971; Russell 1973). During the study, the estimated density of Walleye was 18 to 22/mile, with 75% of the population <20 inches and 10% >24 inches. Annual angler harvest of Walleye was estimated to be less than two fish/mile.

A Walleye plan for the Current River was developed and implemented in January of 2000 (Mayers 2000). Since 2000, spring nighttime electrofishing capture rates for Walleye during the spawning season typically range from six (6) to 19 Walleye/hour.

A propagation study to determine the limiting factors for rearing the unique BRS of Walleye was initiated in 2010 and is ongoing. Since 1986, AGFC annually stocked Walleye fingerlings (1 to 2-inch) in their 30.0-mile portion of the Current River. Numbers stocked annually range from 10,000 to 40,000, with a yearly mean of 26,000 (867 fish/mile). Their stockings' genetic makeup and impact on the river's Walleye population is not known. BRS Walleye fingerlings (52,000 1 to 2-inches) are requested every four (4) years in rotation with the Black, Eleven Point and St. Francis rivers. Past stockings include 2003 (52,000), 2005 (48,000), 2007 (28,000), 2012 (74,000) and 2016 (10,000) (Table 1). Most of these fish were marked with OTC but not enough conclusive data have been collected to determine Walleye year class contribution to date.

Eleven Point River
Ozark Region
Fisheries Management Biologist: Blake Stephens

There is a limited Walleye fishery on the Eleven Point River in Missouri. Area anglers generally fish the Arkansas portion of the Eleven Point River or the Current River when fishing for Walleye. Spring electrofishing catch rates from 1998-2002 have averaged 2.6 fish/hour. Stocking of the BRS fingerlings and advanced fingerling Walleye in Missouri was initiated in 1998 and has varied from zero to 14,597 (1.8 to 8-inch mean length) fish/year until 2002. These fingerlings were the offspring of Current and Black River brood stock collected in spring samples. Due to challenges in raising BRS Walleye in our hatcheries, requested stocking numbers of 6,500 (advanced fingerlings 4 to 6-inch mean length) were rarely met and erratic surplus stockings have made evaluations very difficult. Since 1986, AGFC has stocked Walleye fingerlings (15,000-105,000) on a nearly annual basis.

In 1999-2002, MDC and AGFC independently cold-branded stocked Walleye on opposite sides of the fish to determine stocking success. In 2002, sampling 42% of the Walleye captured in Arkansas had a brand. Sixty-eight percent of the marked fish captured in Arkansas had been stocked in Arkansas, and the remaining 32% had been stocked in Missouri. In 2000-2006, 15% of the Walleye captured in Missouri had a brand, 99% of which had been stocked in Missouri. In Missouri, we are not seeing evidence of mixed populations, giving further evidence that BRS Walleye are unique to Missouri.

In December of 2004, an angler reward tagging study (Carlin dangler tags) was initiated. Electrofishing samples were conducted monthly to tag and monitor previously tagged Walleye. During the study (2004-2009), 438 Walleye were tagged with angler reward tags of $10, $50 or $100. A total of 289 of the tagged fish were stocked as advanced fingerlings (mean length 8.3 inches) and 149 were adult Walleye (12.6-32.3 inches) that were collected by electrofishing. Anglers returned a total of 30 tags during the study, yielding a 6.8% overall return rate. Only seven (7) of the 289 stocked Walleye were returned (2.4%), resulting in an overall decreased return rate of Walleye. For adult Walleye, 23 of the 149 were returned for a 15.4% return rate, not adjusting for any tag loss or non-reporting. Walleye travel distances ranged from 0-114 miles (Current River) downstream, indicating major movements into Arkansas. Many of the recaptured tagged Walleye were found several months or years after tagging, suggesting Walleye may be returning to our standard sample site, passing through or not vulnerable to sampling during all time periods.

A propagation study focusing on increasing the BRS Walleye survival was started in 2010 and is ongoing. In 2010 and again in 2014 an average of 18,000 1-2” BRS Walleye fingerlings were stocked in the Eleven Point. Sampling efforts in 2013-2014 focused on the second objective in the propagation study, assessing the relative stock contribution of hatchery-raised Walleye into the river with a goal of 50% stocking contribution. Catch rates remained low (<3fish/hr) in 2013 and 2014 targeted Walleye samples, but of the 13-fish aged in the 2010 year class, at least 8 (62%) were stocked fish according to OTC marks.

St. Francis River
Southeast Region
Fisheries Management Biologist: Dave Knuth

The upper St. Francis River, above Wappapello Lake, historically supported a Walleye population. According to local Protection Division personnel and citizens, Walleye numbers gradually declined in the 1960s and 1970s. This Walleye decline is most likely due to the construction of Wappapello Lake.

In January 1996, a proposal was approved to restore the upper St. Francis River Walleye population. Justification included improving biodiversity by reintroducing an extirpated species and creating additional angling opportunities. The objective was to restore a self-sustaining Walleye population using limited and short-term stocking. Eastern Highland Strain Walleye (formerly called Black River strain) were considered genetically similar to the former St. Francis River genotype, and therefore were used as brood stock. A total of 196,108 fingerlings (1 to 2-inch) were stocked in the upper St. Francis River from 1996-1998.

Nighttime spring electrofishing was used to evaluate the stockings. Catch rates were indicative that stocking efforts were contributing to the Walleye population. In 1998, catch rate was only 1.9 fish/hour, but was significantly higher (4.2 to 12.3 fish/hour) in the following years when stocked fish recruited to the gear. Catch rate peaked in 2002 (12.3 fish/hour). After stocking had ceased it was apparent that that a self-sustaining Walleye population was not established.

In 2010, the St. Francis River was included in another stocking program, which also includes the Eleven Point, Current, and Black rivers, that will each be stocked on a four-year rotation. In 2011, the St. Francis River received 9,000 (1-2 inch) fingerling Walleye and 70,472 in 2015. From 2011-2016, only five adult Walleye have been collected during 14 hours of springtime electrofishing effort. The low number of fingerlings stocked in 2011 were likely not detectable in our electrofishing surveys and the 2015 fingerlings should be fully recruited to the gear in the next few years. Stock contribution will continue to be monitored using electrofishing catch rates and it is expected to see increases in our catch rates in years following successful stockings.

APPENDIX 2

CONSERVATION OF AQUATIC ORGANISMS:

A POLICY FOR PRESERVING GENETIC, SPECIES, AND ECOSYSTEM INTEGRITY WHEN STOCKING AQUATIC SPECIES

Fisheries Division
Missouri Department of Conservation
October 1997

Background

Stocking aquatic organisms is often necessary to accomplish certain goals in aquatic resource management and thus is an integral function of Fisheries Division. For example, stocking fish is an important management technique for providing quality fishing in Missouri. Stocking new waters and replenishing populations that are not self-sustaining are common aquatic management practices. In addition, restoration of threatened or endangered fish, mussels, or other aquatic species can include stocking or transfer of individuals among drainages.

Since the Division's number one priority is to maintain or improve aquatic ecosystem integrity, it is important to properly plan and evaluate transfers in order to avoid harming native biota at the genetic, species, and ecosystem levels. It is assumed, according to population genetics principles, that each drainage basin is potentially inhabited by a different form or strain of each aquatic organism present. Mixing genetic strains through stocking has the potential to dilute or eliminate native gene pools, which can have long-term, negative effects on a species' success and, subsequently, can disrupt ecosystem integrity. Stocking hybrid and closely related species can negatively impact native species through competition, disease introduction,

and genetic introgression. Introduction of species that add to or create new trophic levels can change the ecology of a system, which can have negative effects on native fauna.

Although the Department of Conservation has responsibility for all aquatic species in Missouri, including those stocked by non-Department entities, this policy is intended specifically for stockings conducted as part of Fisheries Division programs. Therefore, it is the responsibility of Fisheries Division personnel to plan and conduct introductions or supplemental stockings according to guidelines set forth in this policy.

The following definitions are provided for clarification: a congener is another species of the same genus. A conspecific is a different strain of the same species. A drainage basin is a river and its tributary streams. An exotic species is not native to this country. A hybrid contains any proportion of two or more species' genomes. An introduction is the release of a species, strain, or hybrid into waters where it does not already occur. A native species or strain occurs naturally within a geographic area. A naturalized species is not native to Missouri but has established a self-sustaining population(s) within the state. A strain is an organism that is distinguished from related organisms by some feature. A transplant is a species that is native to the United States but not to Missouri.

Policy

Fisheries Division will strive to assure that any stocking conducted as part of Division programs, whether for fishing or species restoration purposes, will not be detrimental to recipient strains, species, and ecosystems. The following guidelines are provided for Division use when planning and executing aquatic species stocking. They have been written to assist the Division in its goal:

"TO ENSURE THE LONG-TERM SURVIVAL OF NATIVE AQUATIC PLANTS AND ANIMALS BY IMPROVING THE CONDITIONS AND PROCESSES THAT SUSTAIN THEM SO THAT PEOPLE MAY BENEFIT FROM THEIR VALUES IN THE FUTURE."

Guidelines

1) The transfer or introduction of conspecifics between drainage basins is not a desirable conservation practice. When such action is the sole means of producing or maintaining populations of aquatic organisms, geographic and genetic sources of gametes or organisms must be approved by the Fisheries Division Administrator. Bluegill, largemouth bass, fathead minnows, and channel catfish have been widely stocked for decades and may be transferred between Missouri drainage basins, but their conspecifics may not be obtained from sources outside of Missouri without approval by the Fisheries Division Administrator.

2) Rainbow trout and brown trout are not native to Missouri, but rainbow trout have become naturalized, and there are established stocking practices for both species in Missouri. Introductions into additional streams or impoundments, or enhancements of existing populations beyond established stockings, must be approved by the Fisheries Division Administrator.

3) Species restoration requires the use of genetically similar strains. Reintroductions to establish viable populations in an extirpated area shall use the most proximal source of brood stock or individuals, provided that genetic characteristics have been determined to be appropriate for population establishment. All species restorations must be approved by the Fisheries Division Administrator.

4) Currently stocked transplant species, such as muskellunge and striped bass, as well as hybrid striped bass and hybrid sunfish, are not subject to source and strain considerations, unless stocking threatens native congeners. However, an evaluation of the potential impacts of stocking

additional predators or species that would alter the trophic relationships within an ecosystem must be included in all initial stocking requests for such species in public waters, and the requests must be approved by the Fisheries Division Administrator.

5) The introduction of exotic species, excluding grass carp, must be approved by the Fisheries Division Administrator and will only be approved for closed systems with no potential for escape. Stocking grass carp is considered an acceptable method of aquatic plant control, and the use of this species for private and public impoundment stockings will not be restricted by this policy.

4 Nov. 97

Norman P. Stucky
Fisheries Division Administrator

APPENDIX 3

CULTURE AND STOCKING

Brood Stock Collection, Egg, and Fry Production

Brood stock Walleye are not maintained at MDC hatcheries. Each year, as spawning time nears, adult Walleye are collected from the wild using boat-mounted electrofishing equipment and gillnets. Brood stock Walleye are collected beginning in mid-February to early-March from Bull Shoals Lake and the Black River. At Stockton Lake and Lake of the Ozarks downstream from Truman Dam, collecting usually occurs from mid-March to the first week in April, when water temperatures approach 46° to 50° F. After spawning, brood stock are returned to the waters of their origin.

Males and females are treated for zebra mussels while in transit using the following protocol. Hauling tanks are treated with 750 parts/million (ppm) potassium chloride for one hour, followed by a two hour treatment using 25 ppm formalin. Tank water temperature is maintained at the same water temperature as the water of origin, or if possible, warmed with 60° F well water to induce egg development.

If possible, eggs are collected from ovulating females and fertilized with semen at the site of capture. However, most females are not ready to ovulate at capture and must be transported to a hatchery. Females are injected with human chorionic gonadotropin (HCG) at 250 International Units (IU)/pound of body weight to induce ovulation. Ovulation occurs between 10 and 100 hours after the intramuscular HCG injection. At intervals, a small quantity of eggs is collected from each female to determine the stage of egg development. Egg extraction is accomplished by inserting a 2 mm glass tube into the female's ovivent. The eggs are "staged" using a dissecting scope. Each female is categorized as to their approximate time of ovulation. Periodic egg staging is conducted on females in the early stages of egg development.

Semen from male Walleye can be collected in advance, preserved and stored for later use. To increase semen production males are also injected with 125 IU of HCG, usually 24 hours after females are injected. To store semen, males are anesthetized and then dried with towels to prevent water from contacting and activating the semen. Semen is hand-stripped into dry plastic test tubes and kept cool in an ice water bath. It is preferred to collect 10 ml of semen from three to five males/test tube to ensure genetic diversity. Each tube of semen is transferred to a 50 ml tissue culture flask. Prepared Walleye semen extender is added to the flask at a ratio of one part semen to two parts semen extender. The solution is stored at 38° F for later use.

Females ready to ovulate are anesthetized and blotted dry with towels to prevent the eggs from contacting and absorbing water which can affect their viability. Eggs are then hand-stripped into a dry six (6) to eight (8) quart bowl and kept free of water and other debris. Eggs are fertilized using the dry method (semen applied directly to the eggs). Preserved semen can be used alone or in conjunction with fresh semen. While stirring with a turkey feather to mix the semen with the eggs, a small amount of hatchery water is added to activate the sperm. This gentle stirring continues for one minute. A Fuller's earth solution is added to prevent the eggs from adhering to

each other during the water hardening process. Stirring continues for another four minutes after adding the Fuller's earth solution. The eggs are then poured into a floating basket and allowed to water harden for three to four hours. A gentle lifting and lowering of the basket washes the eggs. Once water hardened, the eggs can be moved and placed in incubation jars. Generally, a maximum of two (2) quarts, or approximately 230,000 eggs, are siphoned or poured into a 2.5-quart plastic McDonald hatching jar and incubated near 60° F. Dead eggs are siphoned off daily. Eggs are "rolled" vigorously to minimize fungus infections. When eyed, samples of eggs are collected and observed under a dissecting scope to determine the approximate hatching percentage. At 60° F the eggs hatch in seven (7) to ten (10) days and the fry swim-up and out of the hatching jars into large aquaria. These aquaria are equipped with airlines around the drain screens to produce a bubble wall to prevent fry from being sucked against the drain screen. The fry remain in these tanks approximately three (3) days, after which they can be stocked into grow-out ponds, transferred to other facilities, or stocked into lakes and streams.

Phase I Fingerling Production

Ponds designated for Walleye production are either filled the previous fall or completely drained and refilled four weeks prior to fry stocking. Ponds that have the possibility of fish infiltration from the water source are filtered using large bags made of 285 micron filter cloth. The bags are cleaned daily. Air diffuser hoses are placed in these ponds if the facility has the capability. Three to four weeks prior to stocking the ponds are fertilized with organic fertilizers such as dehydrated alfalfa meal, soybean meal, cottonseed meal, cow manure, sheep manure, or fresh turkey manure. Fertilizers are applied at 100 to 250 pounds/acre/week for up to eight (8) weeks. This amount is applied in one treatment or divided into two (2) treatments/week. During the rearing period zooplankton populations are monitored weekly. The ponds are stocked with Walleye fry approximately three (3) days after hatching. Stocking rates vary from 100,000 to 200,000 fry/acre, depending on the hatchery facility. Dissolved oxygen levels are monitored daily. Temperature and pH levels are monitored weekly. Air pumps are activated at the first sign of low dissolved oxygen and stay on until the ponds are harvested. Shining a flashlight close to the pond's surface for a few minutes at night attracts plankton and Walleye fingerlings. This method helps to determine Walleye survival and growth. Fingerlings are harvested approximately 35 days after stocking when zooplankton populations can no longer support standing stocks of fingerlings. The Walleye fingerlings usually average 1.5 to 2.0 inches in length at harvest. Fish are loaded into water-filled transport tanks for distribution to the stocking locations.

Phase II Advanced Fingerling Production

Fingerlings harvested from ponds are transferred to tanks in a hatchery building. Walleye density in tanks is initially 0.5 lbs/cubic foot. Water flows are maintained at 15 gallons/minute. Low light levels are maintained over the tanks continuously. Commercially prepared feed is dispensed from automatic feeders every five (5) minutes at a rate of five (5) to six (6) percent body weight/day. The initial training period lasts 21 days. After three (3) weeks, feeders are adjusted to feed every 15 minutes at approximately eight (8) percent body weight/day. Soon after the three (3) week training period, fingerlings are graded by size. Weights are monitored every two (2) weeks to track growth and tank density. Fish are divided into additional tanks

when the density reaches one to two (2) pounds/cubic foot to prevent overcrowding. Automatic feeders continue to dispense feed every 15 minutes, with growth closely monitored. Therapeutics are used to control disease as needed, with bacterial infections the most common problem. Phase II fish are harvested and distributed by late September at approximately six (6) to eight (8) inches in length.

Transport and Stocking

All transport tank water and fish must be follow biosecurity protocols. Until recently, Walleye stocking consisted of releasing fish directly from the transport truck into a stream or Lake at a public access point. Predation on stocked Walleye by shoreline predators can be significant (Santucci and Wahl 1993). Research has shown that Walleye can take up to three (3) years to disperse after stocking in large lakes (Parsons and Pereira 1997) and survival can be enhanced by stocking Walleye away from the vicinity of shoreline predators (Hoxmeier 1999). As a result, it is recommended that small fingerling Walleye be stocked offshore in several locations by boat. Stocking rates for all waters are listed in Table 2.

Table 1. Walleye Stockings in Missouri, 2011-2017.

2" Fingerlings and Fry – Lake Strain										
Water Body	**Region**	**Acres**	**Size**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017(a)**
Stockton Lake	SW	25,000	2"		302,491	319,811	303,284	301,203	300,014	300,127
Smithville Lake	KC	7,200	2"		225,773		218,800		245,816	262,466
Bull Shoals Lake	Ozark	48,000	2"	435,954	354,199	352,188	353,759	452,769	437,437	170,397
Bull Shoals Lake	----	----	fry			1,531,929	4,005,279	1,200,000	400,000	250,000
Lake of the Ozarks	Central	55,000	2"	543,547		354,775		330,499		273,817
Lake of the Ozarks	----	---	fry	5,023,800	1,842,000	4,190,126	1,335,000	2,576,605	505,234	
Norfork Lake	Ozark	22,000	2"	221,130	161,380	227,175	277,895	225,625	268,269	0
Longview Lake	KC	930	2"		18,630	18,968	19,701	18,600	19,170	22,600
Mozingo Lake	KC	1,000	2"		20,104		23,520		20,110	41,173
Bilby Lake	NW	110	2"		2,778		3,150		2,705	
N & S Fork Salt Rivers	NE	46 miles	2"	65,933		63,126		61,091		67,793
Lake Jacomo	KC	970	2"	19,974		19,907		19,400		23,085
Pomme de Terre Lake	SW	7,820	2"	52,874		52,452	53,107	47,000		55,683
Truman Lake	KC	55,600	2"	161,866		185,070	171,272	166,947		188,022
Long Branch	NE	2,400	2"	24,057			27,456	24,000		29,331
Table Rock Lake (James River Arm)	SW	9,000	2"			96,275	93,575		83,946	
Lake Showme	NE	225	2"	4,519						5,771
Total Number of Fingerlings Stocked				**1,529,854**	**1,085,355**	**1,689,747**	**1,545,519**	**1,647,134**	**1,377,467**	**1,690,265**
Total Number of Fry Stocked				5,023,800	1,842,000	5,722,055	5,340,279	3,776,605	905,234	250,000

4-6" Advanced Fingerlings – Lake Strain										
Forest Lake	NW	573	4-6"				6,042			0

2" Fingerlings – Black River Strain										
Current River	Ozark	40 miles	2"		74,000				10,000	
Black River	SE	31 miles	2"			13,489				0
Eleven Point River	Ozark	10 miles	2"				17,148			
St Francis River	SE	39 miles	2"	9,892				70,472		

(a) An additional 11,543 fingerlings were stocked into Harrison County Lake. AGFC was provided 288,492 BRS fry (surplus), which produced 20,107 fingerlings.

Table 2. Walleye Stocking Schedule (in priority) 2017-2026.

Fingerlings (1-2”) Lake Strain (a)															
Water Body	**Production Category**	**Region**	**Priority**	**Acres**	**Stocking Rate**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Stockton Lake	P	SW	1	25,000	12/A	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
Smithville Lake	P	NW	2	7,200	30/A	216,000	216,000	216,000	216,000	216,000	216,000	216,000	216,000	216,000	216,000
Bull Shoals Lake	P	Ozark	3	48,000	8/A	384,000	384,000	384,000	384,000	384,000	384,000	384,000	384,000	384,000	384,000
Lake of the Ozarks	P	Central	4	55,000	3/A	165,000	165,000	165,000	165,000	165,000	165,000	165,000	165,000	165,000	165,000
Norfork Lake	P	Ozark	5	22,000	8/A	176,000	176,000	176,000	176,000	176,000	176,000	176,000	176,000	176,000	176,000
Mozingo Lake	P	NW	6	1,000	30/A	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Longview Lake	P	KC	7	930	20/A	18,600	18,600	18,600	18,600	18,600	18,600	18,600	18,600	18,600	18,600
Lake Jacomo	P	KC	8	970	20/A	19,400	19,400	19,400	19,400	19,400	19,400	19,400	19,400	19,400	19,400
Truman Lake	P	KC	9	55,600	2.7/A	0	150,000	0	150,000	0	150,000	0	150,000	0	150,000
Lake Showme	P	NE	10	225	20/A	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500
Harrison County Lake	P	NW	11	280	30/A	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400
Pomme de Terre Lake	P	SW	12	7,820	6/A	47,000	47,000	47,000	47,000	47,000	47,000	47,000	47,000	47,000	47,000
Truman Lake	S	KC	13	55,600	2.7/A	150,000	0	150,000	0	150,000	0	150,000	0	150,000	0
Bull Shoals Lake	S	Ozark	14	48,000	2/A	96,000	96,000	96,000	96,000	96,000	96,000	96,000	96,000	96,000	96,000
Table Rock Lake (James River Arm)	S	SW	15	9,000	10/A	90,000	90,000	90,000	90,000	90,000	90,000	90,000	90,000	90,000	90,000
Norfork Lake	S	Ozark	16	22,000	2/A	44,000	44,000	44,000	44,000	44,000	44,000	44,000	44,000	44,000	44,000
Long Branch Lake	S	NE	17	2,400	10/A	24,000	0	0	24,000	0	0	24,000	0	0	24,000
N & S Fork Salt Rivers	S	NE	18	46 miles	1,300/Mi	60,000	0	60,000	0	60,000	0	60,000	0	60,000	60,000
				Production Request		**1,368,900**	**1,518,900**	**1,368,900**	**1,518,900**	**1,368,900**	**1,518,900**	**1,368,900**	**1,518,900**	**1,368,900**	**1,518,900**
				Surplus Request		**464,000**	**230,000**	**440,000**	**254,000**	**440,000**	**230,000**	**464,000**	**230,000**	**440,000**	**314,000**
				Total Request (b)		**1,832,900**	**1,748,900**	**1,808,900**	**1,772,900**	**1,808,900**	**1,748,900**	**1,832,900**	**1,748,900**	**1,808,900**	**1,832,900**

Table 2 cont. Walleye Stocking Table (in priority) 2017-2026.

Water Body	Production Category	Region	Acres	Stocking Rate	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Advanced Fingerlings (4-6")(Lake Strain)														
Forest Lake	P	NW	573	10/A	5,730(c)	5,730			5,730			5,730		
Black River Strain Fingerlings (1-2") (d)														
Current River	P	Ozark	40 miles					52,000				52,000		
Black River	P	SE	31 miles		40,000				40,000				40,000	
Eleven Point River	P	Ozark	10 miles			15,000				15,000				15,000
St Francis River	P	SE	39 miles				51,000				51,000			

(a) Surplus fry will be stocked back into the system where brood stock were collected.
(b) If production of lake strain fingerlings exceeds total yearly request (for example: 1,845,900 in 2017), remaining Walleye fingerlings will be distributed according to overall priority (Stockton - 300,000 then Smithville 216,000….).
(c) In 2017, mechanical failure at the hatchery resulted in the complete loss of fingerlings. Consequently, advanced fingerlings were requested in 2018.
(d) If Black River strain production for any given year is ≥25% of the yearly request, then all surplus fingerlings will used to fill the most recent deficit stockings. Otherwise, the surplus fingerlings (up to 24% extra) will be stocked with the annual request.

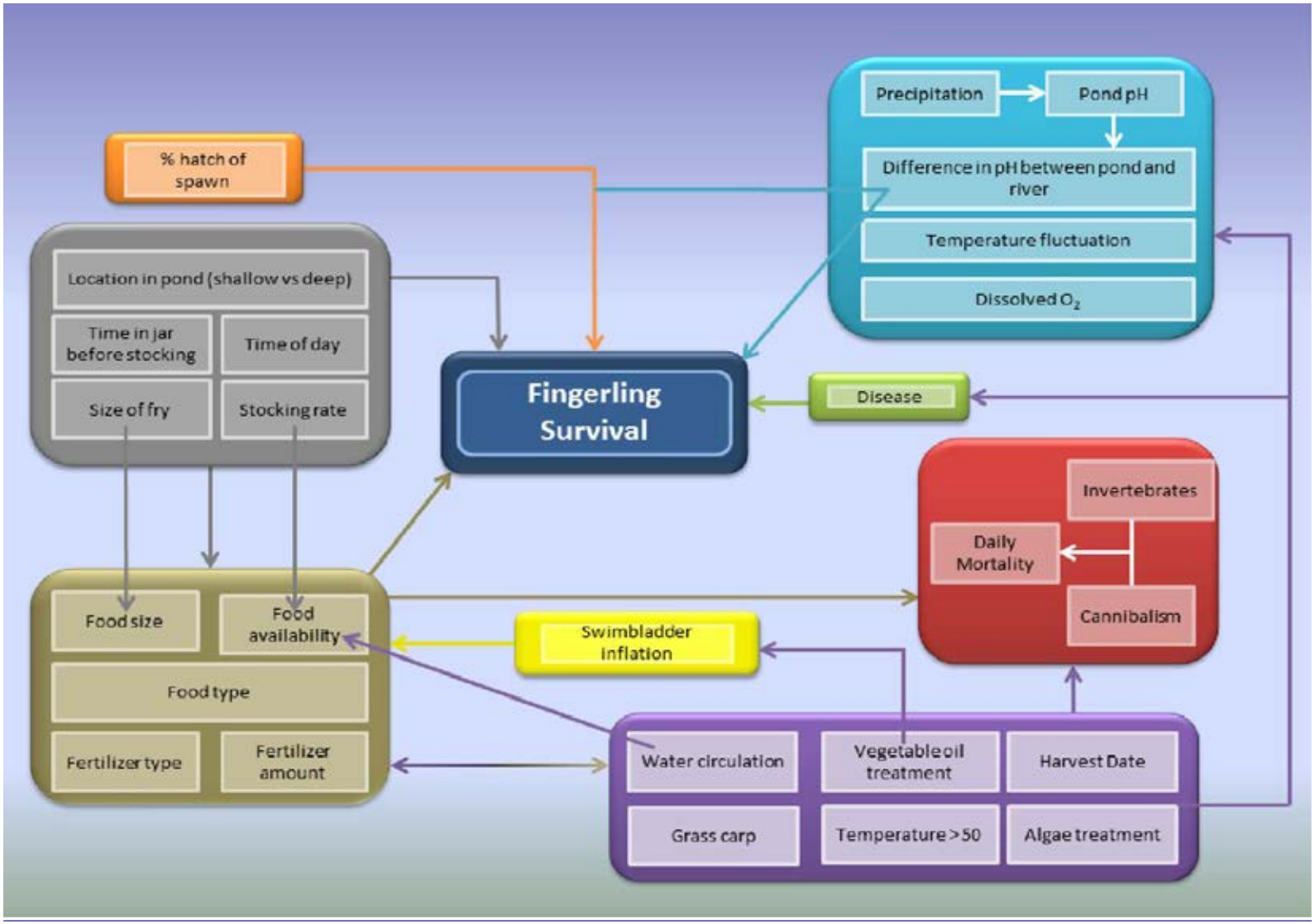

Figure 1. Potential limiting factors affecting 40-day fingerling survival of Black River Walleye.

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