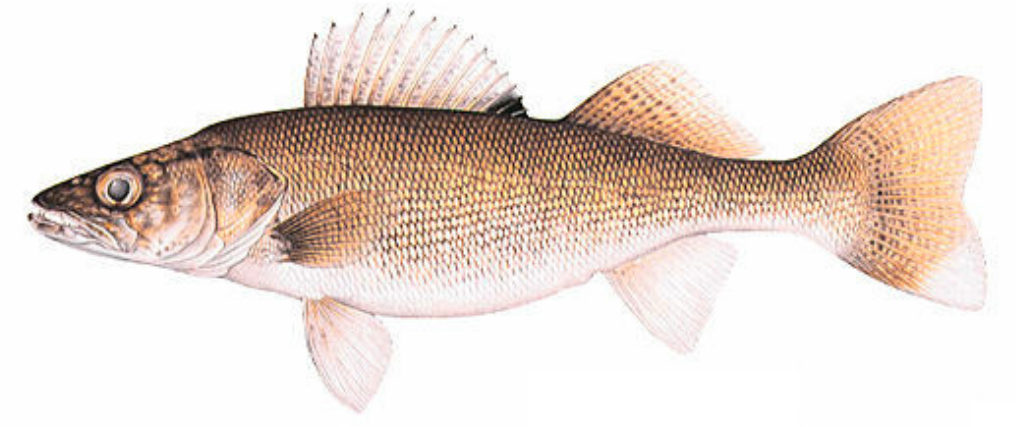
ARKANSAS GAME & FISH COMMISSION



WALLEYE AND SAUGEYE MANAGEMENT PLAN

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Goal: The goal of this plan is to maintain and enhance the walleye and saugeye fisheries within Arkansas.

Objective 1: Determine the status of the major walleye fisheries in Arkansas.

Objective 2. Establish length and creel limits for major walleye fisheries that equitably distribute the resource among anglers, protect populations from overharvest, and allow development of trophy fisheries.

Objective 3: Enhance recruitment through habitat manipulation and stocking.

Objective 4: Assess the genetic characteristics of walleye populations in Arkansas.

Objective 5: Improve walleye and saugeye production methods and capabilities.

Objective 6: Develop stocking guidelines to create optimal saugeye fisheries.

Objective 7: Increase awareness about walleye and saugeye management issues.

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Executive Summary

Walleye and saugeye are sportfishes that are prized for their excellent taste. The goal of this plan is to maintain and enhance the walleye and saugeye fisheries within Arkansas. This will be accomplished with a diversity of management actions. Population monitoring is needed to assess the status of significant walleye populations. Length and creel limits that equitably distribute the resource among anglers, that protect populations from overharvest, and that allow the development of trophy fisheries should be developed on an individual basis for major walleye fisheries. We propose to enhance recruitment of walleye through habitat manipulation, protection of adult females, and stocking. Research is needed to determine if genetically unique stocks of walleye exist because of the implications for broodstock collection efforts. This plan outlines walleye production needs and describes possible improvements to culture methods. Saugeye production capabilities need to be developed, and research is needed to determine optimal stocking rates. The strategies outlined in this plan will hopefully produce a diversity of high quality fishing opportunities for walleye and saugeye in Arkansas.

Walleye are native to Arkansas, and they are usually found in low abundance most of the year. During the March spawning season, walleye usually become concentrated on spawning shoals. These concentrations of fish often draw considerable numbers of anglers who harvest a high percentage of the fish during the spring months. Fishable walleye populations exist in the Spring River, Eleven Point River, Current River, Ouachita River, lower Kings River, Beaver Dam tailwater, lower Little Missouri River, and the eastern Saline River. Fishable walleye populations have been created in large reservoirs, such as Lake Ouachita, Norfork Lake, Bull Shoals Lake and Greers Ferry Lake. Many quality walleye have been produced in Arkansas, including the current world record of 22 pounds, 11 ounces from Greers Ferry Lake.

Walleye fisheries have been enhanced with a diversity of management tools, but stocking has been used most frequently. The current statewide creel limit on walleye is six fish with no size restrictions. Bull Shoals Lake, Norfork Lake, and Table Rock Lake are managed with an 18-inch minimum length limit and 4 fish daily limit. Greers Ferry Lake is managed as a trophy lake with an 18- to 28-inch slot limit and a 4 fish daily limit, only one of which may exceed 28 inches. Walleye were stocked into Arkansas waters from non-native strains to establish and enhance walleye populations from 1949 to 1988. However, most large stockings of non-native strains were done in large reservoirs, and the degree of genetic introgression of those stockings is unknown. Since 1988, the Arkansas Game and Fish Commission has produced enough walleye to meet stocking needs. The production of about 4,000,000 walleye fry is required to meet stocking needs during years that Greers Ferry Lake is stocked (biannually). Production needs are approximately 2,500,000 fry for years that Greers Ferry Lake is not stocked. This level of production can be maintained at the Charlie Craig State Fish Hatchery if the water supply can be maintained. Little change is anticipated in walleye stocking in the near future. The cost of producing 4,000,000 fry is approximately $25,000. At present, walleye production and stocking appears balanced with available habitat, prey and fishing pressure.

Saugeye are a cross between walleye females and sauger males. They can be stocked in waters unsuitable for walleye, and they grow to sizes desired by anglers. The fisheries literature

suggests that saugeye are useful in controlling stunted panfish populations. At the present time all saugeye fry are obtained from other states. Because saugeye can reproduce with either parent, care should be taken where they are stocked. Backcrosses with the parent fish can alter the genetic integrity of the parent fish (walleye or sauger) population. Saugeye have been stocked in four-sided levee lakes and in several southwest Arkansas lakes. Techniques need to be developed to culture saugeye in state, and research is needed to determine optimal saugeye stocking rates.

Introduction

The walleye *Stizostedion vitreum* is an important game fish in Arkansas that is prized for its table qualities, with a high percentage of the catch being harvested. Walleye are native to the Mississippi River drainage from Arkansas north through the Great Lakes and much of Canada. A remnant population occurs in the Pearl River drainage of Mississippi. The native range of walleye in the United States has been expanded through fish stocking from coast to coast. Only the extreme southern parts of the country are excluded from the present walleye range.

Distribution of *Stizostedion vitreum*, Walleye

Barila (1980) considers walleye native to Arkansas only in the White River drainage of the northern part of the state (Figure 1). These native fish were concentrated in the larger streams with good pool and riffle development. The Greers Ferry Lake walleye population is derived largely from these native fish (Murphy et al. 1984). High water temperature and lack of suitable spawning habitat probably limited the southeastward distribution of walleye in the White River drainage (Robison and Buchanan 1988). Keith (1964) noted the presence of walleye in the upper White River in the section of the river now inundated by Beaver Lake. He also provided evidence of natural reproduction in the War Eagle River. Knapp (1958) found walleye upstream of Lake Tanycomo in the Missouri section of the upper White River. Walleye are occasionally captured in the lower Kings River. Walleye from Table Rock Lake make spawning migrations up into the Kings River and Beaver Dam tailwater. Walleye are conspicuously absent from the Buffalo River (Cashner and Brown 1977; Robison and Buchanan 1988), which may be an associated impact of Bull Shoals Dam construction. Cashner (1967) found walleye in the White River near Batesville, and they still persist today in low abundance. Three low head dams at Batesville and upstream near the Martin and Younger Access areas prohibit the migration of walleye upstream into tributary streams.

Several rivers of the Black River drainage support substantial walleye fisheries. Walleye fisheries exist in the Spring River, Eleven Point River, and Current River. Walleye appear most abundant in the trout waters of the Spring River, and Hudy (1988) estimated that 112 walleye per mile (95% confidence interval, 66-266) in the Dam 3 to Bayou Access segment of the river.

The origin of walleye in the Ouachita River drainage is problematic, although several records suggest that walleye are native to the Ouachita River. Black (1940) indicated that fishermen reported walleye from the White, Arkansas, and Ouachita River drainages. Further evidence supporting the existence of a native walleye strain in the Ouachita River was a specimen collected by Trut Holder in the University of Arkansas Museum collected on 22 July 1939 from the Ouachita River 0.5 miles southeast of Pine Ridge, Montgomery County (Black 1940).

During 13-14 August 1968, a rotenone sample on the Saline River revealed a large population of walleye near Ozment Bluff (McGill 1968). They captured 19 adult walleye weighing 41.5 lbs in the 0.25-acre sample (166 lbs/acre). There are accounts of walleye in these areas even before walleye stocking was reported (McGill 1966, Robison and Buchanan 1988). The construction of dams on the Ouachita River, a chemical spill on the Saline River of croton alcohol in 1979, and stocking of various other strains of walleye have probably affected the native walleye populations. Walleye are occasionally captured in the Little Missouri River.

Current Management

Major walleye fisheries currently exist in Greers Ferry Lake, Bull Shoals Lake, Lake Norfork, Lake Catherine, and the Spring River. These waters will be given priority consideration for stocking and will be monitored through bi-annual sampling. Minor fisheries are present in Lake Greeson, Lake DeGrey, Lake Hamilton, Saline River, Kings River, Eleven Point River, and Current River. These waters will continue to be stocked as needed to maintain the presence of a fishable walleye population. They will not receive intensive monitoring or management, excepting the Eleven Point River. The Eleven Point River is the subject of an ongoing cooperative study with the state of Missouri evaluating walleye stocking. The Kings River walleye fishery is currently monitored by the state of Missouri.

Walleye populations are evaluated primarily with annual standard sampling procedures including: cove rotenone, electrofishing, gill netting and creel surveys. Additionally, length frequency and catch per unit of effort (CPUE) information is collected for select populations during the spring spawn. Knowledge obtained from annual sampling is supplemented with research. Past research has included tag reward studies on Greers Ferry Lake and Norfork Lake to determine angler exploitation, and both studies indicated high annual exploitation of walleye. Ongoing freeze branding studies are being performed for the Current River and Eleven Point River to determine contribution of stocked fish to the walleye population and to determine growth of stocked fish. Observations made during spawning operations as well as anecdotal reports from anglers are also important in evaluating current populations.

We recommend that biannual, nightime electrofishing samples should be performed for all major stocked walleye fisheries during the March spawning period. Supplemental data can be collected by gill netting walleye using 3 to 3.5-inch bar mesh gill nets, and gill netting is especially recommended for collecting large females in reservoirs. We recommend that nets be run every 2 hours to reduce sampling mortality. Results for electrofishing the tributaries of Greers Ferry Lake, Norfork Lake, and Bull Shoals Lake indicated that a catch rate of 100 fish per hour is a good walleye population. We expect lower catch rates for samples conducted in the reservoirs, probably closer to 35 per hour in good habitat.

The current statewide creel limit on walleye is six fish with no size restrictions. However, in 1997, an 18-inch minimum length limit was placed on walleye in Greers Ferry Lake, Lake Norfork, and Bull Shoals Lake in response to higher than expected exploitation and for uniformity with Missouri Department of Conservation (MDOC) regulations on border waters. In

January 2001, a slot limit of 18 to 28-inches was implemented on Greers Ferry Lake with a daily creel of four fish, only one of which can be 28-inches or larger. This was in response to evaluation of the 18-inch minimum length limit and its effect on the walleye population. In 2001, the 18-inch minimum length limit and 4 fish per day creel limit were applied to walleye in Beaver Dam tailwater to make harvest regulations consistent with those on Table Rock Lake.

The availability of forage is believed to greatly influence growth of walleye populations. The stocking of trout and walleye together in Greers Ferry Lake may have been a factor that influenced the production of the world-record sized walleye. Hays (1980) found that walleye in Bull Shoals Lake ate almost exclusively trout one month after trout were stocked into the reservoir from the net pens. He found that walleye switched to eating 3- to 4-inch shad after the rainbow trout had dispersed several months later. He concluded that walleye appear to prefer rainbow trout to shad if the trout are less than 9 inches TL.

As with most warm water fish, higher than normal spring/early summer water levels in lakes and reservoirs have positive effects on survival and recruitment of young walleye. Natural walleye production responds favorably to higher than normal post-spawn water levels of 90 to 120 days duration. The response is similar to that exhibited by largemouth bass with increased survival and recruitment. This is a very effective and inexpensive method of enhancing walleye populations where applicable. This has led to requests for more input into water level management in Corps of Engineers (COE) reservoirs. Cooperative agreements with the COE are needed to provide elevated spring/early summer water levels in one out of every three years. Lakes with reproducing walleye populations such as Greers Ferry, Norfork, Bull Shoals, and Ouachita would benefit greatly.

History of Stocking

Because of limited natural reproduction and recruitment and high exploitation, stocking is thought to be necessary to maintain the walleye fisheries in the State. Techniques have been developed to spawn walleye in state, and enough are produced to cover most of our stocking needs. At present, walleye production and stocking appear to be balanced with habitat, available prey, and fishing pressure. However, fishing pressure and harvest of walleye appear to be increasing, which may create the need for investigations of walleye populations to design optimal management strategies.

Fifty or more years ago when the Arkansas Game and Fish Commission (AGFC) was establishing walleye populations in large reservoirs, little consideration was given to the potential impacts from the introduction of non-native strains of walleye. Since a source of eggs within Arkansas was not readily available, eggs and fry were obtained from various sources. Walleye fry or eggs have been obtained in the past from at least nine state conservation agencies, two federal hatcheries and two private hatcheries (Hulsey 1966, McGill 1966a, 1966b, 1966c, 1966d, 1966e, Appendix 2). Hence, we have the potential of having walleye with origins from Montana, Kansas, Missouri, Nebraska, Iowa, Colorado, Oklahoma, Minnesota, South Dakota and Ohio. In some instances, efforts were made to obtain and stock lake-strain walleye from

other states, because they were thought to be better suited to reservoirs (Andrew Hulsey, personal communication). Stocking of non-native strains has greatly reduced the probability of a true, native population remaining in the State. The overall effect of the introduced strains is unknown. The genetic make up of walleye in Arkansas has not yet been sufficiently studied to determine what contributions or impacts these various strains have made on present walleye populations. A thorough genetic analysis of the walleye from Greers Ferry Lake and the Ouachita River, present broodstock sources, is imperative to determine if either population has unique genetic qualities.

In 1988, the AGFC acquired the capability to spawn and hatch a significant number of walleye from Greers Ferry Lake and, since that time, has stocked only walleye produced from the Greers Ferry Lake population back into that system. Only riverine-spawning fish are currently collected for walleye production needs.

Walleye were first stocked in Arkansas in 1949 into Norfork Lake. Before the mid-1980's, most stockings were made into the larger man-made reservoirs to establish or enhance populations (Hulsey 1966; Appendix 2). Several larger reservoirs in the northern parts of the State have developed good walleye populations as the result of stocking and/or the expansion of native fish populations, including Bull Shoals Lake, Lake Norfork, Greers Ferry Lake, and Table Rock Lake. South Arkansas has good walleye populations in Lake Ouachita, Lake Hamilton, and Lake Catherine. Walleye are also found in Lake Greeson and Gilliam Reservoir. Recent stockings have been made in DeGray Lake and Beaver Lake in an effort to establish a viable population there. Most rivers were not regularly stocked with walleye until the mid to late 1980's, when hatchery production capabilities were developed (Appendix 2). Also, river stockings prior to 1988 were done with non-native fish from other states. Fishable riverine walleye populations that are maintained by regular stocking exist in the Current River, the Eleven Point River, Spring River, Saline River, and the Ouachita River. Other rivers that have been occasionally stocked with walleye include the Strawberry River, the White River near Batesville, the Little Missouri River, the Caddo River, and the South Fork of the Spring River.

Walleye stockings have not always lead to development of a sustainable fishery. Some examples of stocking failures occurred at Beaver Lake, Dierks Lake, DeQueen Lake, Nimrod Lake, Blue Mountain Lake and earlier stockings in DeGray Lake. River stockings at Illinois Bayou, the Big Piney River, and the Mulberry River also failed to produce fishable populations. Stocking fry into an unsatisfactory environment probably caused most stocking failures. The failure of the Beaver Lake stockings is poorly understood because walleye were native to the area and suitable habitat conditions are believed to be present. The lake was stocked with fry, fingerling, and adult walleye but a viable walleye fishery was never produced and stocking was discontinued in 1981.

Stocking fingerling walleye from nursery ponds or hatcheries has been effective but is costly (Appendix 3). Present walleye stocking consists of:

North Arkansas Reservoir Stockings

- Greers Ferry Lake 300,000 fingerlings from nursery pond and direct hatchery stockings every other year. All fingerlings from Greers Ferry Lake brood stock.
- Norfork Lake up to 75,000 fingerlings through the nursery pond annually. Brood stock source from Greers Ferry Lake or White River drainage.
- Bull Shoals up to 200,000 fingerlings through the nursery pond or direct stocking annually. Brood stock source from Greers Ferry Lake or White River drainage.
- Beaver Lake 50,000 fingerlings annually for three years. White River drainage source. Continuance of program to be determined.

South Arkansas Reservoir Stockings

- Lake Catherine 10,000 fingerlings annually from Lake Catherine brood stock.
- Lake Hamilton 10,000 fingerlings annually from Lake Catherine brood stock every third year.
- Lake Ouachita up to 150,000 fingerlings through the nursery pond every third year. Lake Catherine brood stock.
- Lake Greeson up to 100,000 fingerlings through the nursery pond every third year. Lake Catherine brood stock source.

River Stockings

- Eleven Point River 20,000 fingerlings annually. Brood stock from White River drainage.
- Spring River 20,000 fingerlings annually. Brood stock from White River drainage.
- Current River 20,000 fingerlings annually. Brood stock from White River drainage.
- Saline River 20,000 fingerlings annually. Brood stock from Lake Catherine.
- Ouachita River below Remmel Dam 20,000 fingerlings annually. Lake Catherine brood stock.
- White River at Batesville 20,000 fingerlings annually. Brood stock from White River drainage or Greers Ferry Lake.
- Little Red River below Searcy 20,000 fingerlings annually. Brood stock from Greers Ferry Lake.

Although 360,000 fingerlings are needed for these rivers, river stocking requests are dependent upon hatchery production success and are not always fulfilled. Current walleye stocking will be maintained at the aforementioned levels unless changes are needed because of the results of annual sampling and research.

Societal Challenges

Walleye fishing provides economic benefits to several local economies and to the state. Walleye tournaments are held annually on Greers Ferry Lake. At least two Professional Walleye Tournaments (PWT) Circuit tournaments have been held in Arkansas, one on Norfork Lake and another on Lake Ouachita. Several resorts and marinas on Greers Ferry Lake consider walleye anglers a significant contributor to their annual income.

Over the years a significant amount of resistance has been encountered when both population sampling and the walleye-spawning project is conducted. Unfortunately, these events coincide with the tournament schedules and a significant portion of angling effort for walleye. We have been fairly successful in avoiding conflicts with anglers, but there is still the perception by some anglers that our spawning activities negatively impact the fish and their fishing. To alleviate some conflict, the Greers Ferry Lake spawning project is conducted bi-annually. However, conflicts are inevitable with our continued reliance on wild fish for broodstock. Although the preferable solution is to one day use the hatcheries to maintain walleye broodstock for spawning, public education programs explaining walleye management goals and methods may help the public become more tolerant. Wild fish are the only practical source of broodstock in the short term.

Saugeye Management

The saugeye, a hybrid of the walleye (Stizostedion vitreum) and sauger *Stizostedion canadense* has been produced in several states. The saugeye is a fast growing (Leeds et al. 1987) predatory fish that has shown promise in controlling stunted crappie populations (Boxrucker 1992; Summers et al. 1994). They also seem to be more tolerant of warm and/or turbid waters than walleye (Leeds et al. 1987), which could increase the areas suitable for saugeye stocking and should be reviewed for expanding the stocking program in the future. Saugeye is not a sterile hybrid and is capable of producing offspring with either parent. Backcrosses may weaken genetic integrity and reduce the odds for future survival of the parent walleye population (Leeds et al. 1987). For this reason, saugeye stocking should be limited to areas that do not have reproducing walleye or sauger populations. Another concern is escapement of saugeye from the stocked reservoir, as in the case of escapement from Crown Lake into the Strawberry River. Saugeye stocking should be limited to levied lakes, the Red River drainage, and Lake Hinkle where the chance of escape is very low.

Saugeye have been stocked in Crown Lake, Lake Hogue, Lake Frierson, Bois d'Arc Lake, Lake Jack Nolan, Lake Hinkle, Lake Millwood tailwater, Wilhelmina Lake and Gillham Reservoir. To date, all saugeye fry have been obtained from outside sources, because attempts to produce them in Arkansas have not been successful. However, the Andrew Hulsey State Fish Hatchery may have the capability to successfully produce saugeye by holding the males in tanks, injecting them to maintain fertility, and then using them to fertilize walleye eggs by the same process as walleye spawning. The saugeye eggs and fry would be handled the same as in walleye

production. The present stocking requirements could be met with 60,000 saugeye fingerlings annually.

Saugeye stocking requests usually number approximately 60,000 fingerlings annually. The Red River drainage requires 30,000 to 40,000 fingerlings annually for Bois d'Arc Lake, Gillham Reservoir, Little River, and Lake Hinkle. The remainder of saugeye production is scheduled for four-levee lakes in Fisheries Districts 3 and 4 (east Arkansas).

Goal and Objectives of the Walleye Plan

Goal: The goal of this plan is to maintain and enhance the walleye and saugeye fisheries within Arkansas.

Objective 1: Determine the status of the major walleye fisheries in Arkansas.

A. Conduct biannual electrofishing population evaluations on major walleye fisheries during the spring spawning season.
   a. Plot sex specific length frequency histograms to determine size structure.
   b. Use electrofishing data to determine population trends over time.

B. Assess contribution of stocked walleye to Greers Ferry fisheries.
   a. Conduct freeze branding studies to determine the percent contribution of marked fish stocked into tributary streams.
   b. Obtain permits to use oxytetracycline to mark fish stocked through the nursery pond.

C. Determine migration patterns of walleye in Greers Ferry Lake using radio telemetry.

Objective 2. Establish length and creel limits for major walleye fisheries that equitably distribute the resource among anglers, that protect populations from overharvest, and that allow development of trophy fisheries.

A. Assess exploitation for major walleye fisheries.
   a. Conduct tag reward studies on major walleye fisheries to determine the percent of fish tagged that are harvested, as resources permit.

B. Assess the need for minimum length limits or slot limits on a case-by-case basis for all walleye fisheries.

C. Evaluate Greers Ferry Trophy Walleye Project through electrofishing, reward-tag exploitation, and an angler creel survey.

Objective 3: Enhance recruitment by habitat manipulation and stocking.

A. Obtain agreements with the U.S. Army Corps of Engineers to hold lake levels high during spring tri-annually to allow for successful spawning and recruitment.

B. Maintain current stocking rates and locations of walleye and saugeye.

Objective 4: Assess genetic characteristics of walleye populations.

A. Collect tissue and determine genetic heritage of brood stock sources and all major and minor walleye fisheries.

Objective 5: Improve walleye and saugeye production capabilities.

A. Develop hatchery facilities for maintaining captive brood stock at Charlie Craig, Hulsey, or Spring River Hatchery.

B. Develop alternative brood stock collection sites at Kings River and below Beaver Dam.

C. Develop hatchery capability to produce saugeye.

Objective 6: Develop stocking guidelines to create optimal saugeye fisheries.

A. Determine appropriate saugeye stocking rates for reservoirs.

B. Determine value of saugeye for panfish control and as a sport fish.

Objective 7: Increase awareness concerning walleye and saugeye management issues.

A. Produce a short life-history article for the AGFC magazine that includes the reasoning behind current walleye management practices.

B. Develop one-day clinics on walleye fishing and management.

C. Outfit at least one of the mobile aquarium units with a chiller, and feature walleye in the mobile aquarium.

D. Develop information and guidelines specifically for Enforcement.

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Appendix 1: Culture Methods

Egg Collection

The pond culture of walleye has not yet developed to the point that walleye broodstock can be raised or held year round at a hatchery facility in Arkansas' southern climate. The major obstacle to maintaining broodstock is high (lethal) water temperature. As a result, wild broodstock collected from Greers Ferry Lake and the Ouachita River must be utilized at the present time.

The Greers Ferry egg collection or spawning project is conducted bi-annually at the junction of the lake and riverine systems of the three primary tributaries to the lake: South Fork, Middle Fork, and Devil's Fork of the Little Red River. The project begins when water temperatures reach 50 degrees Fahrenheit, usually about the second week of March. Fish collection and artificial spawning is conducted from about 5:00 p.m. to 2:00 a.m. daily, sometimes including weekends. This schedule is maintained in order to minimize user conflict and public complaints stemming from collection activities (electrofishing and netting) that allegedly interfere with angler use. Unfortunately it seems that whenever a spawning project is underway a few public complaints continue despite efforts to the contrary.

At Greers Ferry, the fish are captured either by electrofishing or gill netting. Only gravid females are kept and utilized. The females and males (2 or more) are stripped of eggs and milt into a pan containing approximately a quart of water. They are then carefully stirred for five minutes using soft bristle brushes to insure good fertilization. The eggs are then treated with an equal volume of one molar solution protease and again stirred for five minutes. The protease removes the sticky, protein layer from the surface of the eggs and prevents clumping. The eggs are then placed in hardening trays with a screen bottom and staged in the river. After a minimum of two hours, the eggs are then boxed in Styrofoam egg boxes with no more than one quart of eggs per gallon of water. The eggs are then transported to the Charlie Craig State Fish Hatchery at Centerton. The brood walleye are returned to the lake immediately after spawning.

The South Arkansas walleye project collects broodstock by electrofishing. Females are staged by tubing and observing the eggs. Females and males that are close to spawning are transported to the Andrew Hulsey State Fish Hatchery where they are held in tanks. The egg development in females is checked at regular intervals. When ready to spawn they are subjected to the same type process as in the Greers Ferry spawning project. The South Arkansas project can produce an equal number of eggs with less fish handling and less angler conflict.

Hatching

The Charlie Craig State Fish Hatchery at Centerton seems to have nearly perfect water for the hatching of walleye. The facility has the capacity to hatch out 4 to 5 million fry. Presently, the facility has ample capacity to meet our production needs. The greatest limiting

factor to walleye production is egg collection. The crew at the Charlie Craig Hatchery is well experienced and has had hatching rates averaging upwards of 80 percent. This success rate well offsets added transportation cost.

The eggs from the Greers Ferry project arrive at the hatchery early in the morning. Upon arrival, the eggs are cleaned, counted volumetrically, tempered and placed in McDonald hatching jars. Water flows through the jars are adjusted to achieve an upwelling in the bottom that keeps the eggs tumbling. As time progresses dead eggs are removed and hatched fry will swim up out of the jars into aquariums. Hatched fry are counted to assess hatch rate and fry production. The hatch rate is very good for both the Greers Ferry and South Arkansas projects but Greers Ferry eggs usually exhibit a better hatch rate. Hatch rates as high as 82% have been obtained but the average is about 75%. When the fry are about four days old they are placed in plastic bags with oxygen, packed in Styrofoam boxes, and transported to the stocking site.

Pond Preparation

Hatchery ponds or nursery ponds are prepared 2 – 3 weeks prior to stocking the fry. Cottonseed meal and liquid fertilizer (11-37-0) are applied at a rate of 200 pounds and 4 gallons per acre, respectively. An additional application of liquid fertilizer at a rate of 2 gallons per acre at a later date may be necessary to maintain the desired plankton concentrations in the pond. Soluble fertilizer (Strive brand; 12-52-4) can be used instead of the liquid fertilizer at a rate of 4 lbs/acre. The fry arrive packaged 50,000 to the box. The fry are tempered at a rate of 15 minutes per degree Fahrenheit difference between the packaged water and the nursery pond. The recommended stocking rate is no more than 100,000 walleye or saugeye fry per surface acre of pond. The ponds are sampled periodically through the grow-out period with a bobby-mesh seine to determine size and survival. Desired size for harvest is 1 ½ -inches for hatchery ponds and 3-inches for nursery ponds.

Appendix 2:
Walleye Stockings

DATE	WATERS	NUMBERS	SIZE	SOURCE OF BROODSTOCK
*1985	Augusta Lake N. P.	50,000	Fing.	Colorado
*1986	Augusta Lake N. P.	20,000	Fing.	Colorado
*1987	Augusta Lake N. P.	500,000	Fry	Colorado
*1988	Augusta Lake N. P.	400,000	Fry	Colorado
1964	Beaver Lake	3,949,370	Fry	Kansas, Nebraska and Minnesota
1964	Beaver Lake	187	Adults	Beaver Tailwaters
1965	Beaver Lake	50,000	Fry	Unknown
1966	Beaver Lake	1,200,000	Fry	Unknown
1967	Beaver Lake	8,500	Fing.	Unknown
1969	Beaver Lake	250,000	Fry	Beaver Tailwaters
1970	Beaver Lake	250	Yrl.	Beaver Tailwaters
1970	Beaver Lake	450,000	Fry	Beaver Tailwaters
1971	Beaver Lake	350,000	Fing.	Beaver Tailwaters
1972	Beaver Lake	150,000	Fry	Oklahoma
1972	Beaver Lake	100,000	Fing.	Beaver Tailwaters
1981	Beaver Lake	25,000	Fing.	Greers Ferry
1991	Big Piney	6,375	Fing.	Colorado
1991	Blue Mountain Lake	14,025	Fing.	Colorado
1976	Bob Kidd Lake	3	Adults	Beaver Tailwaters
1965	Bull Shoals Lake	700,000	Fry	200,000 for Missouri and the rest from unknown source
1966	Bull Shoals Lake	150,000	Fing.	Unknown
1969	Bull Shoals Lake	75,000	Fing.	Beaver Tailwaters
1984	Bull Shoals Lake	410,000	Fing.	Iowa
1984	Bull Shoals Lake	40,000	Fing.	Greers Ferry
1988	Bull Shoals Lake	256,000	Fing.	Colorado
1989	Bull Shoals Lake	250,000	Fing.	Greers Ferry
1990	Bull Shoals Lake	150,000	Fing.	Greers Ferry
1991	Bull Shoals Lake	96,200	Fing.	Greers Ferry
1996	Bull Shoals Lake	139,875	Fing.	Greers Ferry
1997	Bull Shoals Lake	190,560	Fing.	Greers Ferry
1998	Bull Shoals Lake	28,500	Fing.	Bull Shoals
*1987	Bull Shoals Lake N.P.	500,000	Fry	Colorado
1997	Caddo River	4,700	Fing.	Ouachita River
1985	Current River	4,500	Yrl.	Colorado

1988	Current River	17,580	Fing.	Greers Ferry
1989	Current River	45,000	Fing.	Greers Ferry
1990	Current River	56,750	Fing.	Greers Ferry
1991	Current River	15,175	Fing.	Greers Ferry
1992	Current River	20,000	Fing.	Missouri
1993	Current River	35,000	Fing.	Greers Ferry
1994	Current River	20,000	Fing.	Greers Ferry
1995	Current River	35,000	Fing.	Missouri
1996	Current River	35,400	Fing.	Greers Ferry
1997	Current River	60,000	Fing.	Greers Ferry
1998	Current River	10,000	Fing.	Bull Shoals
1999	Current River	35,500	Fing.	Ouachita River
1978	Dequeen Lake	1,300,000	Fry	Kansas and Nebraska
1976	Dierks Lake	500,000	Fry	Greers Ferry
1977	Dierks Lake	43,200	Fing.	Greers Ferry
1988	Eleven Point River	18,000	Fing.	Greers Ferry
1989	Eleven Point River	45,000	Fing.	Greers Ferry
1990	Eleven Point River	52,250	Fing.	Greers Ferry
1991	Eleven Point River	34,075	Fing.	Greers Ferry
1992	Eleven Point River	30,725	Fing.	Missouri
1993	Eleven Point River	70,000	Fing.	Greers Ferry
1994	Eleven Point River	15,000	Fing.	Greers Ferry
1995	Eleven Point River	50,000	Fing.	Missouri
1996	Eleven Point River	103,900	Fing.	Greers Ferry
1997	Eleven Point River	70,000	Fing.	Greers Ferry
1998	Eleven Point River	30,000	Fing.	Bull Shoals
1999	Eleven Point River	35,945	Fing.	Ouachita River
1991	Gillham Lake	28,900	Fing.	Colorado
1976	Gilliam Lake	500,000	Fry	Kansas
1977	Gilliam Lake	700,000	Fry	Kansas
1999	Greers Ferry Devil's Fork	23,000	Fing.	Greers Ferry
1962	Greers Ferry Lake	1,500,000	Fry	Ohio
1963	Greers Ferry Lake	400,000	Fry	Missouri
1972	Greers Ferry Lake	35,000	Fry	Greers Ferry
1974	Greers Ferry Lake	100,000	Fry	Greers Ferry
1975	Greers Ferry Lake	150,000	Fing.	Ohio
1980	Greers Ferry Lake	20,000	Fing.	Wisconsin
1981	Greers Ferry Lake	40,000	Fing.	Iowa
1985	Greers Ferry Lake	60,000	Fing.	Colorado
1987	Greers Ferry Lake	300,000	Fing.	Colorado
1988	Greers Ferry Lake	300,000	Fing.	Greers Ferry
1989	Greers Ferry Lake	300,000	Fing.	Greers Ferry
1991	Greers Ferry Lake	172,400	Fing.	Greers Ferry
1991	Greers Ferry Lake	22,500	Yrl.	Greers Ferry

1992	Greers Ferry Lake	44,500	Fing.	Greers Ferry
1994	Greers Ferry Lake	272,766	Fing.	Greers Ferry
1996	Greers Ferry Lake	441,580	Fing.	Greers Ferry
1997	Greers Ferry Lake	320,000	Fing.	Greers Ferry
1999	Greers Ferry Lake	300,000	Fing.	Greers Ferry
1999	Greers Ferry S. Fork	25,000	Fing.	Greers Ferry
1977	Greeson Lake	500,000	Fing.	Oklahoma
1991	Greeson Lake	200,000	Fing.	Greers Ferry
1981	Hillary Jones	2,000	Fing.	Greers Ferry
1991	Illinois Bayou	6,375	Fing.	Colorado
1959	Lake Catherine	200,000	Fry	Ohio
1961	Lake Catherine	106,080	Fry	Nebraska
1974	Lake Catherine	400,000	Fry	Ohio
1976	Lake Catherine	300,000	Fry	Oklahoma
1979	Lake Catherine	150,000	Fing.	Kansas
1991	Lake Catherine	10,626	Fing.	Colorado
1993	Lake Catherine	13,800	Fing.	Greers Ferry
1994	Lake Catherine	23,450	Fing.	Greers Ferry
1995	Lake Catherine	10,000	Fing.	Colorado
1996	Lake Catherine	13,115	Fing.	Ouachita River
1998	Lake Catherine	25,000	Fing.	Ouachita River
1999	Lake Catherine	10,375	Fing.	Ouachita River
*1975	Lake Catherine N. P.	200,000	Fry	Oklahoma
1970	Lake Degray	500,000	Fry	Missouri
1970	Lake Degray	1,000,000	Fry	South Dakota
1971	Lake Degray	1,000,000	Fry	Oklahoma
1971	Lake Degray	1,000,000	Fry	Wisconsin
1997	Lake Degray	25,000	Fing.	Ouachita River
1998	Lake Degray	25,000	Fing.	Ouachita River
1999	Lake Degray	25,530	Fing.	Ouachita River
1950	Lake Greeson	500,000	Eyed Eggs	Montana
1959	Lake Greeson	288,000	Fry	Ohio
1961	Lake Greeson	212,000	Fry	Nebraska
1962	Lake Greeson	150,000	Fry	Ohio
1963	Lake Greeson	510,000	Fry	Colorado
1966	Lake Greeson	1,050,000	Fry	Unknown
1999	Lake Greeson	70,000	Fing.	Ouachita River
*1980	Lake Greeson N.P.	960,000	Fry	Kansas
1958	Lake Hamilton	200,000	Fry	Missouri
1961	Lake Hamilton	106,080	Fing.	Nebraska
1962	Lake Hamilton	80,000	Fry	Ohio
1967	Lake Hamilton	5,000	Fing.	Unknown
1975	Lake Hamilton	150,000	Fing.	Oklahoma
1976	Lake Hamilton	125,000	Fing.	Oklahoma
1979	Lake Hamilton	100,000	Fing.	Kansas

1981	Lake Hamilton	175,000	Fing.	Kansas
1983	Lake Hamilton	34,000	Fing.	Iowa
1988	Lake Hamilton	201,000	Fing.	Colorado
1990	Lake Hamilton	165,000	Fing.	Greers Ferry
1994	Lake Hamilton	5,000	Fing.	Greers Ferry
1995	Lake Hamilton	88,050	Fing.	Colorado
1996	Lake Hamilton	35,800	Fing.	Ouachita River
1998	Lake Hamilton	103,928	Fing.	Ouachita River
*1980	Lake Hamilton N.P.	640,000	Fry	Kansas
1974	Lake Hinkle	200,000	Fing.	Ohio
1991	Lake Hinkle	20,400	Fing.	Colorado
1979	Lake Nimrod	12	Intermediate	Kansas
1991	Lake Nimrod	14,025	Fing.	Colorado
1961	Lake Ouachita	106,080	Fry	Nebraska
1963	Lake Ouachita	612,000	Fry	Colorado
1965	Lake Ouachita	1,204,500	Fry	Unknown
1966	Lake Ouachita	1,250,000	Fry	Unknown
1974	Lake Ouachita	974,000	Fry	Oklahoma
1976	Lake Ouachita	500,000	Fing.	Ohio
1989	Lake Ouachita	29,700	Fing.	Greers Ferry
1990	Lake Ouachita	400,000	Fing.	Greers Ferry
1993	Lake Ouachita	525,000	Fing.	Greers Ferry
*1983	Lake Ouachita N. P.	1,100,000	Fry	Iowa
1987	Lake Ouachita	245,000	Fing.	Colorado
1974	Lake Poinsett	50,000	Fry	Greers Ferry
1991	Lee Creek	5,100	Fing.	Colorado
1991	Little Missouri River	5,313	Fing.	Colorado
1998	Little Missouri River	5,100	Fing.	Ouachita River
1991	Mulberry River	5,100	Fing.	Colorado
1949	Norfork Lake	100,000	Eyed Eggs	Ohio
1950	Norfork Lake	500,000	Eyed Eggs	Montana
1958	Norfork Lake	100,000	Fry	Missouri
1963	Norfork Lake	500,000	Fry	Missouri
1964	Norfork Lake	40,000	Fing.	Missouri
1965	Norfork Lake	150,000	Fry	Unknown
1983	Norfork Lake	116,000	Fing.	Greers Ferry
1984	Norfork Lake	200,000	Fing.	Iowa
1984	Norfork Lake	89,400	Fing.	Greers Ferry
1986	Norfork Lake	56,300	Fing.	Colorado
1989	Norfork Lake	27,000	Fing.	Greers Ferry
1993	Norfork Lake	180,000	Fing.	Greers Ferry
1995	Norfork Lake	25,000	Fing.	Missouri
1996	Norfork Lake	180,000	Fing.	Greers Ferry
1999	Norfork Lake	150,000	Fing.	Greers Ferry

1986	Ouachita River	4,200	Fing.	Colorado
1989	Ouachita River	13,500	Fing.	Greers Ferry
1993	Ouachita River	11,100	Fing.	Greers Ferry
1994	Ouachita River	19,780	Fing.	Greers Ferry
1996	Ouachita River	8,625	Fing.	Ouachita River
1997	Ouachita River	5,400	Fing.	Ouachita River
1998	Ouachita River	13,139	Fing.	Ouachita River
1999	Ouachita River	8,350	Fing.	Ouachita River
1979	Saline River	218,000	Fing.	Kansas
1991	Saline River	29,750	Fing.	Colorado
1992	Saline River	6,400	Fing.	Missouri
1992	Saline River	3,325	Fing.	Greers Ferry
1993	Saline River	24,000	Fing.	Greers Ferry
1994	Saline River	20,900	Fing.	Greers Ferry
1998	Saline River	34,000	Fing.	Ouachita River
1999	Saline River	10,450	Fing.	Ouachita River
1981	Sequoyah Lake	5,000	Fing.	Greers Ferry
1965	Shepard Lake	200,000	Fry	Unknown
1989	S. F. Little Red River	15,000	Fing.	Greers Ferry
1996	S. F. Little Red River	10,000	Fing.	Greers Ferry
1987	Spring River	10,000	Fry	Colorado
1988	Spring River	12,000	Fing.	Greers Ferry
1989	Spring River	245,000	Fing.	Greers Ferry
1990	Spring River	48,000	Fing.	Greers Ferry
1991	Spring River	34,075	Fing.	Greers Ferry
1992	Spring River	43,225	Fing.	Missouri
1993	Spring River	70,000	Fing.	Greers Ferry
1994	Spring River	60,000	Fing.	Greers Ferry
1995	Spring River	50,000	Fing.	Missouri
1996	Spring River	128,200	Fing.	Greers Ferry
1997	Spring River	77,500	Fing.	Greers Ferry
1998	Spring River	14,500	Fing.	Bull Shoals
1999	Spring River	39,975	Fing.	Ouachita River
1996	Strawberry River	10,000	Fing.	Greers Ferry
1981	Swepco Lake	600,000	Fry	Greers Ferry
1991	White River	21,250	Fing.	Colorado
1991	White River	20,000	Fing.	Greers Ferry
1992	White River	45,000	Fing.	Missouri
1993	White River	24,000	Fing.	Greers Ferry
1993	White River	9,890	Fing.	Greers Ferry
1994	White River	73,514	Fing.	Greers Ferry
1968	Wilson Lake	1,400,000	Fry	Beaver Tailwaters

*** An asterisk by the year indicates a nursery pond stocking.**

Saugeye Stockings

DATE	WATERS	NUMBERS	SIZE OF FISH	SOURCE OF BROODSTOCK
1999	Bois d Arc Lake	22,000	Fing.	Ohio
1997	Bois d Arc Lake	5,697	Fing.	Ohio
1996	Bois d Arc Lake	6,435	Fing.	Ohio
1995	Bois d Arc Lake	7,000	Fing.	Ohio
1997	Crown Lake	3,300	Fing.	Ohio
1995	Crown Lake	14,400	Fing.	Ohio
1993	Crown Lake	10,000	Fing.	Ohio
1991	Crown Lake	21,177	Fing.	Kansas
1999	Gillham Reservoir	17,375	Fing.	Ohio
1998	Gillham Reservoir	13,700	Fing.	Ohio
1997	Gillham Reservoir	28,300	Fing.	Ohio
1996	Gillham Reservoir	26,910	Fing.	Ohio
1995	Gillham Reservoir	30,000	Fing.	Ohio
1994	Gillham Reservoir	25,000	Fing.	Iowa
1993	Gillham Reservoir	30,000	Fing.	Ohio
1992	Gillham Reservoir	380	Fing.	Ohio
1991	Gillham Reservoir	15,000	Fing.	Kansas
1997	Hinkle Lake	10,000	Fing.	Ohio
1995	Hinkle Lake	10,235	Fing.	Ohio
1994	Hinkle Lake	87,500	Fing.	Ohio
1993	Hinkle Lake	1,000	Fing.	Ohio
1997	Jack Nolen Lake	2,000	Fing.	Ohio
1996	Jack Nolen Lake	5,310	Fing.	Ohio
1995	Jack Nolen Lake	4,200	Fing.	Ohio
1998	Lake Frierson	2,080	Fing.	Ohio
1997	Lake Frierson	8,000	Fing.	Ohio
1996	Lake Hinkle	54,000	Fing.	Oklahoma
1999	Lake Wilhelmina	3,000	Fing.	Ohio
1997	Lake Wilhelmina	2,500	Fing.	Ohio
1997	Lake Wilhelmina	378	Yrl.	Ohio
1996	Little River	8,550	Fing.	Ohio
1999	Lower Lake Hogue	8,000	Fing.	Ohio
1997	Lower Lake Hogue	7,000	Fing.	Ohio
1996	Lower Lake Hogue	6,075	Fing.	Ohio
1994	Lower Lake Hogue	7,500	Fing.	Iowa
1995	Millwood Tailwaters	12,000	Fing.	Ohio

Appendix 3: Costs

Walleye Project Expenditures

Site	M&O	Labor	Total
Craig Hatchery	$1,200	$4,800	$6,000
Greers Ferry Project	$6,000	$13,440	$19,440
South AR Project	$1,000	$5,000	$6,000

Walleye Fingerling Production

	Cost/Acre
Nursery Pond	$270
Hatchery Pond	$540