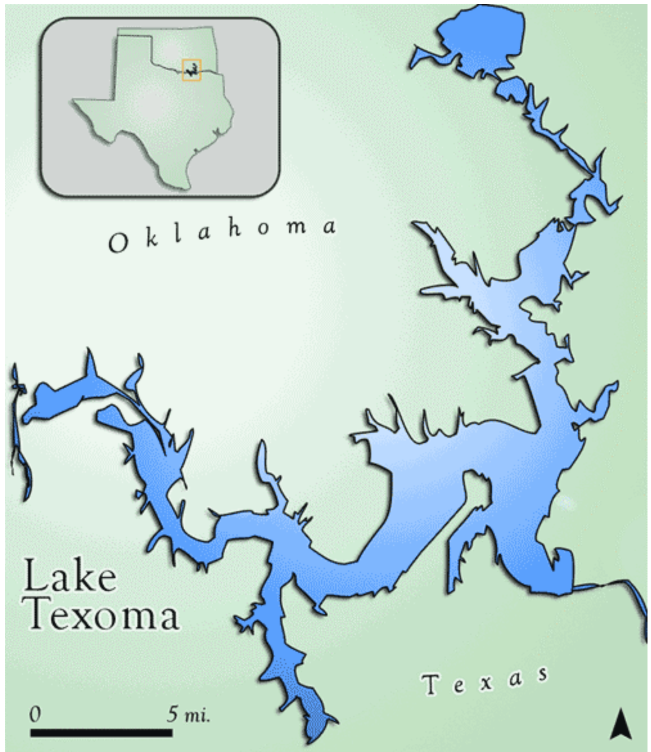
# Lake Texoma
# Fisheries Management Plan

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## Background

Lake Texoma is an 88,000 acre reservoir formed by the impoundment of the Red River 4.6 miles below its confluence with the Washita River on the Oklahoma-Texas border (Figure 1). It was impounded by the U.S. Army Corps of Engineers (USACOE) in 1944 by construction of the Denison Dam and is bounded by the southern Oklahoma counties of Bryan, Johnston, Love and Marshall and the northern Texas counties of Cooke and Grayson.

In capacity, Lake Texoma is the largest project in the Tulsa District of the USACOE and is the twelfth largest reservoir in the United States. The watershed contains 39,719 square miles in southwestern Oklahoma and northcentral Texas, as well as much of the Texas panhandle and parts of eastern New Mexico. A strongly increasing west to east precipitation gradient is present and consequentially natural vegetation consists of drought resistant grasses and shrubs in the west transitioning into tall grasses and cross timber ecosystems to the east (Patton and Lyday 2008). Agricultural operations including hay and row-crop production and livestock grazing dominate a large majority of the watershed. The lake serves multiple operation purposes including flood control to the area and downstream regions (OK, TX, AR, LA), power generation, water supply, and recreation.

Lake Texoma is one of the most popular Federal recreation facilities in the country, with more than 6 million visitors annually. In 2006, Texoma ranked first among USACOE lake projects nationwide, with visitors spending over 90 million hours at the lake (www.swt.usace.army.mil/recreat/OPSField.CFM?tblOPSField__LakeName=Lake%20Texoma). Two state parks, 26 resorts, 10 USACOE campgrounds, and 22 commercial concessionaires offer services to visitors on and around the lake. In addition, the Tishomingo and Hagerman National Wildlife Refuges provide home to native and migratory wildlife. Recreational activities contribute greatly to the economy of the entire lake area and to the benefit of local and regional businesses, cities and individuals. Several nicknames have been coined for Lake Texoma including "Playground of the Southwest" and "Striper Capital of the World".

The USACOE along with the Southwestern Power Administration manage lake elevations. The top of the flood control pool is 640 feet msl and the normal power pool is 617 feet msl. In 1992, a seasonal pool plan was implemented to enhance fish and wildlife habitat. The seasonal pool plan elevations fluctuate between 615 and 619 feet msl (Figure 2). While the seasonal pool plan outlines target elevations, fluctuations due to flood control and/or hydropower demands can occur regularly.

## Habitat

Natural fish habitat consists of large expanses of open water, offshore humps, and areas of limited submerged standing timber, rock, coarse gravel, and mud or sand flats. Buttonbush (*Cephalanthus occidentalis*) is common along the shorelines in many areas of the lake, growing at or above Conservation Pool elevation. This species provides good spawning and nursery habitat when seasonally inundated. Aquatic vegetation is very sparse due to fluctuating water levels and herbivorous fish. Transplanted colonies of submerged vegetation have yielded poor results.

Additional habitat includes man-made structures such as rip-rap, natural and artificial brush piles, and boat docks. The Oklahoma Department of Wildlife Conservation (ODWC) currently maintains 39 marked brushpiles to increase angler opportunities. Maps and geo-references for these structures are available on the Fish and Wildlife Digital Atlas (http://fishlab.ou.edu/odwcims/).

## **Water Quality**

Lake Texoma is classified as a eutrophic reservoir with high primary productivity. Water quality data collected through the Oklahoma Water Resources Board (OWRB) as part of their Beneficial Use Monitoring Program (BUMP) classifies Lake Texoma as supporting or partially supporting the outlined Fish and Wildlife Propagation (FWP) beneficial uses. The complete BUMP report for Lake Texoma can be viewed at http://www.owrb.ok.gov/quality/monitoring/bump.php. A brief overview of several water quality parameters is included below and in Table 1.

### Thermal and Chemical Stratification

Lake Texoma exhibits strong thermal and chemical stratification during summer months (July – mid-September) with anoxic conditions occurring below the thermocline. Depth of the thermocline varies within the lake. Upper portions of the Washita River Arm typically stratify at a depth of 30 - 40 feet, whereas the lower lake stratifies at 40 - 50 feet. This results in a greater percentage of the water column having cool, oxygenated water in the main lake basin. Lake Texoma is considered partially supporting the FWP beneficial use based on low dissolved oxygen levels recorded during the summer.

### Turbidity

A strong down lake turbidity gradient occurs within Lake Texoma. Lower lake samples had an average turbidity of 5 NTU and a secchi disk depth of 51 inches. The upper Red River arm had an average turbidity level of 59 NTU and a secchi disk depth of 13 inches.

### Productivity

A trophic state index (TSI), using Carlson's TSI (chlorophyll-a), was calculated to measure the lake's productivity. TSI values varied from upper lake to lower lake, indicating a primary productivity gradient within the lake. The upper Red River arm was classified as hypereutrophic, whereas the Washita River arm and lower lake sections ranged from eutrophic to mesotrophic.

### Conductivity

Specific conductivity ranged from 887.6 µS/cm to 3,062 µS/cm, indicating high levels of current conducting ions (chlorides and salts) in the system. These values are highest within the upper reservoir arms, notability the Red River, and generally decline in a down lake gradient.

### Salinity

Salinity values ranged from 0.30 ppt in the Washita River arm to 1.70 ppt in the Red River arm. These values are higher than the range of values recorded in other Oklahoma reservoirs.

pH

The pH values ranged from 7.13 to 8.75, representing a neutral to slightly alkaline system. The fish and wildlife beneficial use based on pH is supported.

Tailrace

Water quality and flow regime within the tailrace are greatly influenced by hydropower production (Ashby 1999). Two generation units are present and capable of elevating tailrace water levels over 6.5 feet during peaking conditions (9,005 $ft^3sec^{-1}$) producing cyclical high and low flows. These releases reflect forebay conditions characterized by low dissolved oxygen and elevated concentrations of iron and magnesium during summer stratification. Generation releases have been known to influence water quality over twelve miles downstream of the dam (Ashby 1999). Operational strategies, such as selective withdrawal and surface releases, are not possible given the current configuration of the dam. Centerlines of the penstocks are located 84 feet below normal pool level.

Historic fish kills associated with chronic dissolved oxygen levels have prompted the USACOE to release a continuous flow of nearly 50 cfs from an adjacent floodgate during summer stratification. This released water receives aeration as it sprays from the cracked gate and cascades down baffles prior to spilling into the tailrace. Ashby (1999) acknowledges a positive benefit of this supplemental release during non-generation periods but suggests that results decline during peaking generation. ODWC monitoring further implies that a localized refuge may be provided for aquatic organisms and supports the continued use of this practice during summer stratification (mid-July to mid-September) as it appears to reduce fish stress and associated mortality.

## Fishery

Management of the Lake Texoma fishery is shared between the ODWC and Texas Parks and Wildlife Department (TPWD) and is a valuable lesson in multi-jurisdictional cooperative management. In efforts to establish consistency for anglers and allow more effective enforcement capabilities, joint management efforts have gradually been realized. A special Lake Texoma fishing license was created in 1979 allowing anglers to fish the lake in either state's jurisdiction without purchasing two separate licenses. This further allowed more effective law enforcement capabilities and provided monetary support for increasing management collaboration between the states. By 1997, ODWC and TPWD standardized regulations for all fish species previously managed under separate regulations. Joint sampling, data sharing, and annual meetings continue to support an open dialogue and cooperative management.

The major sportfish in Lake Texoma include largemouth bass (*Micropterus salmoides*), smallmouth bass (*M. dolomieu*), spotted bass (*M. punctulatus*), white bass (*Morone chrysops*), striped bass (*M. saxatilis*), white crappie (*Pomoxis annularis*), black crappie (*P. nigromaculatus*), blue catfish (*Ictalurus furcatus*), channel catfish (*I. punctatus*), and flathead catfish (*Pylodictis olivaris*). The primary forage species include threadfin and gizzard shad. Lake Texoma has produced numerous Oklahoma and Texas state record fish. Quality fish caught at Lake Texoma are also eligible for Lake Record status in both states. Information about these programs can be found at the ODWC website (www.wildlifedepartment.com) or the

TPWD website (www.tpwd.state.tx.us). The fish stocking history for Lake Texoma is included in Table 2. Special fishing regulations which apply to Lake Texoma include:

| | |
|---|---|
| Largemouth, Smallmouth, and Spotted Bass: | 5 combined per day, 14-inch minimum size limit for largemouth and smallmouth bass. |
| All Crappie: | 37 per day, 10-inch minimum size limit. |
| Striped Bass and/or Striped Bass Hybrids: | 10 combined per day, of which only two may be 20-inches or longer. Culling is prohibited. |
| White Bass: | 25 per day, no minimum size limit. |
| Channel and/or Blue Catfish: | 15 combined per day, 12-inch minimum size limit with only one blue catfish greater than 30-inches per day. |
| Flathead Catfish: | 5 per day, 20-inch minimum size limit. |
| Alligator Gar: | 1 per day, angling for alligator gar by any method is prohibited from May 1 through May 31, within the boundaries of Hagerman National Wildlife Refuge and from the State Hwy 99 / US Hwy 377 Bridge upstream to the I-35 Bridge. |
| Other Species: | Statewide regulations. |

**Black Bass**
Lake Texoma contains three species of black bass; largemouth bass, spotted bass, and smallmouth bass and is one of the best black bass lakes in the region. Over the past 15 years, Texoma has averaged a statewide ranking of 9$^{th}$ place overall and 5$^{th}$ place for average winning weight in bass tournaments reporting results to ODWC. Complete tournament results for Lake Texoma are summarized in Table 3.

Largemouth Bass
The largemouth bass is the dominant black bass species in Lake Texoma. Florida-strain largemouth bass were stocked consistently throughout the 1990s to increase abundance of trophy-sized bass. The current Oklahoma lake record largemouth bass was caught in 2009 and weighed 11.2 lbs. Catch rates and relative weights for legal-sized fish are consistently within the range of acceptable values for a quality fishery. Recruitment of young bass is occasionally below acceptable values. This was true during the most recent survey conducted in 2010. Catch rates and size structure of largemouth bass are included in Table 4 and Figures 3 and 4, respectively. Growth rates for largemouth bass were within acceptable levels when compared to other major reservoirs within the region (Figure 5). Largemouth bass from Lake Texoma were tested for Largemouth Bass Virus (LMBV) in 2002. These results indicated that approximately one-quarter of the population carried LMBV. Fish kills resulting from LMBV were never confirmed at Lake Texoma.

Spotted Bass

Spotted bass make up a small portion of the black bass population at Lake Texoma. Catch rates, size structure, and growth rates of the spotted bass population are listed in Table 5 and Figures 6 - 8, respectively.

Smallmouth Bass

Smallmouth bass were first stocked in 1981 and have developed into a quality smallmouth bass fishery. The population is self-sustaining and has expanded to most of the available habitat within the lake. Numerous Oklahoma state record smallmouth bass have been produced at Lake Texoma. The largest on record was caught in 2003 and weighed 7.8 lbs. Sampling data is limited for smallmouth bass given their preference for deeper, rock and bolder type habitat. These habitats are not effectively sampled by daytime electrofishing. Spring electrofishing samples conducted during 2010 resulted in an overall catch rate of 7.3 fish/hr with 4.0 fish/hr exceeding 14 inches. Size distribution and growth rates are included in Figures 9 and 10, respectively.

**Temperate Bass**

White Bass

White Bass are native to the Lake Texoma watershed and contribute to the recreational fishery. Fishing for white bass is especially popular during the spring when they make their spawning run up the numerous tributaries of the lake. The National Sand Bass Festival was started in 1963 as business men and community leaders attempted to bring the natural resources of Madill and Marshall County into the spotlight. Historic densities of white bass were phenomenal. Lake aging and the expansion of the striped bass population has likely masked this once dominant pelagic predator. Despite a perceived decline from decades ago, the white bass population continues to provide diverse angling opportunities.

Catch rates for white bass have increased over the past five years as the lake has recovered from drought conditions and a shad kill during the winter of 2000/2001. Catch rates and size structure of the Lake Texoma white bass fishery are included in Table 6 and Figures 11 and 12, respectively.

Striped Bass

The evolution of the Lake Texoma striped bass fishery has required intensive management and regulation adjustments. ODWC introduced 1,013,133 striped bass into the reservoir from 1965 to 1974 to create an additional sport fishery and to provide a biological control on shad populations (Harper and Namminga 1986). Natural reproduction was verified in 1973, 1975, and each year thereafter (Mauck 1986). To protect the developing population a 1 fish/day bag limit was originally imposed in 1967. Ten years later this bag limit was raised to 3 fish/day and later to 5 fish/day in 1980. Populations of striped bass and forage fish were in excellent condition and yielded numerous trophy fish in the early 1980’s (Mauck 1986). The current lake record was caught in 1984 weighing 35.12 pounds. By 1980, Lake Texoma had become nationally recognized for its excellent striped bass fishery and experienced increasing fishing pressure. In 1982, liberal bag limits were instituted allowing anglers to harvest 15 fish/day of which only 5 could exceed 20 inches.

Angling pressure and environmental factors have combined to shape the Lake Texoma striped bass fishery. Artificial lures were the primary method of fishing prior to 1985 when bait fishing made its debut (Mauck 1986). This technique allowed anglers and guides to more effectively target trophy fish and regularly harvest bag limits. It became the opinion that live bait fishing was a contributing factor to declining numbers of large fish, prompting biologists to conduct a fishing mortality survey. Hysmith et al. (1992) demonstrated that post-release mortality of striped bass caught on live bait (57.6%) far surpassed those caught with artificial baits with treble hooks (32.3%) and single hooks (15.7%). These results further showed that this discrepancy was higher for fish over 20 inches with mortality estimates as high as 71% when caught with live bait.

By the late 1980's it was apparent that a combination of environmental factors were having a significant impact on the population. Discharge of flood waters reduced the number of large fish due to entrainment, while winter kills of threadfin shad reduced the forage base and negatively impacted year-class strength. Another environmental factor, known as the "temperature-dissolved oxygen squeeze", also negatively affected striped bass distribution and survival during the summer months. Striped bass are a temperate species, preferring a temperature range from 64 – 75 °F. Due to the thermal and chemical stratification that occurs at Lake Texoma (and many other lakes in the southern U.S.) preferred temperatures often experience anoxic or sub-lethal dissolved oxygen concentrations for striped bass. This results in stripers being "squeezed" into a narrow band of water that meets their temperature and oxygen needs. Stripers become stressed when these conditions cannot be met in the lake. Stratification and the resulting impact on the striper population vary each year due to a number of environmental factors. Generally, stratification occurs at deeper, cooler depths in the lower lake sections, whereas upper lake areas experience warmer temperature and less suitable conditions for striped bass. This effect can influence the distribution of striped bass into the lower basin of the reservoir during the summer months. Overcrowding and insufficient forage availability can play a large role in the overall stress and survival of striped bass during the summer months.

In 1989, the regulation was adjusted to a 15 fish/day creel with only 1 fish > 20 inches. A joint angler creel survey by the ODWC and TPWD was initiated in 1987 to determine catch rates, fishing pressure, and harvest estimates and ran through 1999 (Hysmith et al. 2000). During this 13-year survey, striped bass anglers accounted for 63.6% of the angling effort and harvested an estimated 854,032 striped bass annually (range 474,459 to 1,233,066). Weight of harvested striped bass averaged 1,706717 pounds annually but saw yearly estimates as high as 2,883,333 pounds.

Despite efforts to reduce the harvest of larger fish in the population, striped bass were not reaching their historic trophy sizes and regulations were ineffective in reviving numbers of striped bass greater than 20 inches (Moczygemba and Hysmith 1994). In an attempt to reduce the impacts of catch and release mortality, the ODWC and TPWD adopted a regulation decreasing the bag limit to 10 fish/day while increasing the number > 20 inches to two fish daily. This regulation was adopted in 1996 and remains in effect today.

Since 1993, winter gill-net data has been jointly collected by ODWC and TPWD and indicates that the striped bass population has remained stable in recent years. The percentage of fish ≥ 20 inches in the population has averaged 21.7% since the latest regulation change in 1996. Catch rates and size distribution data are presented in Table 7 and Figures 13 and 14. This population data mirrors the current regulation which allows 20% of the harvest to exceed 20 inches. Age and growth data was last collected in 2008. These data are presented in Figure 15. Growth rates for Lake Texoma striped bass are generally slower than other reservoir populations in the southeast United States. Estimates from annual population samples indicate total mortality is approximately 50% for striped bass age-1 and older (ODWC, unpublished data). Natural mortality is intensified in years following a threadfin shad kill. The decline of fish collected in gillnets during 2002 reflects forage limitations the prior summer due to a harsh 2000/2001 winter. Angler harvest and catch and release mortality are also major contributors to the total mortality rate (Hysmith et al. 1992).

The current length and bag limit restrictions on Lake Texoma striped bass are the result of many years of combined fishery population surveys, angler surveys, public hearings and various harvest regulation modifications by ODWC and TPWD. Approximately 200 guides operate on the lake and guided trips account for 60% of the directed effort for striped bass and comprise 77% of the total harvest (Moczygemba et al. 2005). The striped bass fishery at Lake Texoma is estimated to provide in excess of $25 million annually to the local economy (Schorr et al. 1995) making it arguably the single-most valuable fishery resource in Oklahoma. Since the establishment of the current regulations, the striped bass population remains stable and the majority of anglers are satisfied with their Lake Texoma fishing experience (Hunt and Ditton 1998). Fortunately, the desires of the angling public and the production capabilities of the lake align.

**Catfish**

Blue Catfish

Blue catfish have become an important and increasingly sought after sportfish at Lake Texoma. A former world record blue catfish (121.5 lbs) was caught from the Texas side of Lake Texoma in 2004 using rod and reel. The current Oklahoma state record blue catfish was caught in 1988 and weighed 118 lbs. Sampling data indicates that Lake Texoma has an abundant and stable blue catfish population. Mauck and Boxrucker (2004) estimated total annual mortality for Lake Texoma blue catfish to be 18.8%. Creel surveys conducted in 2006 and 2007 indicated that blue catfish make up 66.7% of the total catfish harvest at Lake Texoma (Kuklinski 2008). The average length of harvested blue catfish during that survey was 18.7 inches in 2006 and 24.7 inches in 2007. Blue catfish take approximately 13 years to reach ≥ 30 inches in Lake Texoma (Kuklinski 2008; Table 8). Of the twelve premier blue catfish fisheries in Oklahoma that were evaluated by Kuklinski 2008, only two reached 30 inches faster than Lake Texoma (one year faster in both cases). Changes to sampling protocol implemented in 2009 will require several years of sampling to determine a quality baseline for catch rates. Decreased catch rates for larger individuals in 2009 is likely an artifact of sampling design and is not considered an actual reduction in the population. Catch rates for blue catfish are included in Table 9.

Channel Catfish

Channel Catfish are omnivorous, feeding on a wide variety of organic matter, dead and alive. Some of the more common foods are fish, mussels, snails, insects and crayfish. Creel surveys conducted in 2006 and 2007 indicated that channel catfish make up 32.0% of the total catfish harvest at Lake Texoma (Kuklinski 2008). The average length of harvested channel catfish during that survey was 15.2 inches in 2006 and 17.8 inches in 2007. Catch rates for channel catfish have remained inconsistent over the last decade (Table 10; Figure 16). This is likely due to sampling bias rather than population fluctuations. During the 1980s, relative weights were consistently below acceptable values (90). Relative weights have improved and generally exceeded acceptable values over the last two samples.

**Crappie**
Lake Texoma contains both white crappie and black crappie. Angling for crappie is popular during the spring spawn and throughout the year around boat docks. Sampling for crappie has been intermittent over the last decade. Previous data indicates that Lake Texoma has a low abundance of crappie with inconsistent recruitment. Growth rates for crappie are good and consistently exceed acceptable values. Crappie catch rates, growth rates, and size structure from past trap-netting surveys are presented in Tables 11, 12 and Figure 17, respectively.

**Shad**
Productive water within the lake allows for an abundant shad population consisting of both gizzard and threadfin shad. These species compose the majority of diet for predators within the lake, especially pelagic predators such as striped bass. Adult gizzard shad are able to reach large sizes and can outgrow gape limits of many predators. Threadfin shad adults are considerably smaller, rarely exceeding 6 inches in length. Threadfin are temperature sensitive and stress at temperatures below 45°F. Four significant threadfin shad die-offs have been reported due to unusually cold winters (1981/1982, 1987/1988, 2000/2001, and 2009/2010). In a few instances, broodstock have been added following these events to jump start the population and to appease public pressure. The utilization of shad for live bait fishing is very popular, particularly with fishing guides.

Age-0 shad abundance, as measured by surface-set gill-net samples, is high and dominated by threadfin shad (Kuklinski 2010). Relative densities of age-0 shad (gizzard and threadfin combined) are similar between the Red and Washita River arms during most years of study but numbers decline within the lower lake (Kuklinski 2010 and J. Boxrucker, pers. comm..). Differences in between-arm catches were more evident with age-0 gizzard shad being found more routinely in the Red River arm. Shad densities vary annually but are not significantly different in most years.

**Paddlefish**
Paddlefish (*Polyodon spathula*) are native to the Red River drainage. The construction of Denison Dam in 1944 blocked upstream migrations to spawning grounds and led to extirpation of the paddlefish from Lake Texoma and upstream. The United States Fish and Wildlife Service (USFWS) initiated a restoration stocking program for paddlefish in Lake Texoma in 1999. Evaluation of the Lake Texoma paddlefish population conducted by Patterson (2010) estimated the population at 1,761 individuals in 2009. Natural reproduction could not be confirmed during this study. Paddlefish were found to generally utilize the upper portions of the reservoir. Growth rates were similar to other Oklahoma paddlefish populations.

**Alligator Gar**
Alligator gar (*Atractosteus spatula*) is a fishery resource of growing importance in the southeastern United States. Declining populations in portions of the species' range have caused many state and federal agencies to actively manage populations. Growing concerns about the vulnerability of spawning alligator gar in Lake Texoma led to the development of seasonal "no harvest" areas in the Big Mineral and upper Red River arm of the lake. Alligator gar are known to reach 100 or more pounds in Lake Texoma and the Red River. The current Oklahoma state record was caught in 2006 in the Red River upstream from the lake. It weighed 184 pounds and was 7 feet, 8 inches long.

## Fish Consumption Advisories

Fish consumption advisories are issued by the Oklahoma Department of Environmental Quality (ODEQ) and can be viewed at www.deq.state.ok.us. At the time of this document, no fish consumption advisories exist for Lake Texoma.

## Threats to the Fishery

### Siltation

The highly erodible soils within the Red and Washita River drainages contribute to turbidity and significant sedimentation in the upper reaches of Lake Texoma. Patton and Lyday (2007) have documented accretion of sediments above water level that has effectively resulted in surface area reduction, cove isolation, fragmentation of lacustrine habitats, morphometric changes, and establishment of terrestrial vegetation on newly deposited lands. Depositional bars have effectively isolated large embayments (i.e. Widow Moore, and Kansas Creek) greatly limiting boat access to these once popular fishing destinations.

Limited connectivity to the main lake and a decline in habitat quality has likely influenced the distinct fish communities found between isolated fragments and the main reservoir. Shorelines associated with isolated backwaters are generally monotypic and of low value to many species of desirable sportfish. These shorelines are characterized by reduced shoreline development values, lower shoreline gradient, and reduced habitat heterogeneity than main lake non-depositional shorelines. Future decades will pose numerous challenges and perhaps opportunities to resource managers as management will likely be altered in these wetland environments.

### Competing water uses

Current and projected demands for regional water have elevated concerns for adequate quality water for aquatic resources in future years and decades. Numerous projects and operational changes are being evaluated to make Red River and Lake Texoma water more readily available and desirable for municipal, industrial, and agricultural purposes. Unfortunately, there are concerns that changes to the chemical properties of water and additional removal from the system will have pronounced negative effects on aquatic organisms and water-based recreation in the region.

Efforts to remove naturally occurring chlorides from water draining the Red River watershed have been the focus of numerous studies over the past decades and appear to be regaining momentum. The construction of low-flow dams, pump stations, and diversion pipelines would potentially alter instream flows, the timing and magnitude of inflow events, and water chemistry. It is widely understood that chlorides are important properties entrained within water that bind to suspended clay particles and assist with flocculation, subsequently enhancing water clarity. This process is important for making the water within Lake Texoma aesthetically pleasing and attractive to water-based recreation. Additionally, primary productivity and lake carrying capacity are enhanced by adequate sunlight penetration. The relatively high salinity levels are an important factor for striped bass egg development and buoyancy. A reduction in salinity and a reduction in available flows may compromise this premier fishery.

Water storage reallocations pose additional threats to the current seasonal pool plan, optimal fish production and water-based recreational activities. Concern as to whether enough water is available within the Red River, its tributaries, and Lake Texoma to satisfy the "cumulative" water supply requirements is warranted.

**Aquatic Nuisance Species (ANS)**

Golden Alga

Golden alga (*Parmnesium parvum*) is a single-celled species capable of producing dense blooms and toxins. Golden alga was first observed within Lake Texoma during the winter of 2004 when fish kills were observed in several embayments of the upper Red River arm. Subsequent fish kills resulting from golden alga blooms were documented in 2006, 2007, and 2009. Each of these kills was contained within isolated embayments of the upper Red River arm. Toxins produced from this harmful species have the ability to harm or kill organisms within multiple trophic levels including other algal species, zooplankton, planktivores and piscivores. Conditions surrounding bloom and toxin formation are dynamic and not completely understood. High levels of nutrients, especially phosphorus, and relatively high salinity levels (>1.5 ppt) are conducive to increased toxicity levels (Hambright 2009). Golden alga densities are higher in the winter and in the Red River arm of the lake. While this species is observed lake wide, heavy blooms, toxic conditions, and associated fish kills have been limited to the Red River arm. The largest blooms have been observed in Lebanon Pool, a large backwater basin often disconnected from the main reservoir. Observed fish kills have occurred during years of lower than normal pool elevation which may further favor bloom conditions and limit the ability of fishes to escape near-shore areas or isolated embayment. The establishment of the University of Oklahoma Biological Station Plankton Ecology Lab has placed Oklahoma and specifically Lake Texoma at the forefront of *Prymnesium* research in the United States and abroad. Substantial monitoring and research is currently being conducted to better understand this harmful alga and attempt to provide management implications.

Zebra mussels

Zebra mussels (*Dreissena polymorpha*) were first detected in Lake Texoma in 2008. Water samples collected by the U.S. Fish and Wildlife Service near Highport Marina tested positive during PCR analysis. The first live adult zebra mussel was detected in April of 2009 near Eisenhower State Park. Since that time, adult zebra mussels have become widespread throughout Lake Texoma. Additional research is warranted to track the population increase and potential negative impacts of zebra mussels in Lake Texoma.

<u>Harris Mud Crabs</u>

Harris mud crabs (*Rhithropanopeus harrisii*) were first collected at Lake Texoma in September 2008. The first specimen was provided to ODWC by a scuba diver and a second specimen was collected by Southeastern Oklahoma State University (SOSU) during sampling to determine the abundance of Harris mud crabs in Lake Texoma. Both specimens were collected near the dock at Cross Point Methodist Camp. In 2009, additional sampling was conducted by SOSU to determine the distribution and abundance of Harris mud crabs in Lake Texoma. A total of 22 specimens were collected ranging from Buncombe Creek to the west and Willow Springs to the north and east. The Harris mud crab is believed to originate from the Gulf of Mexico and has established populations in at least five Texas freshwater reservoirs. Lake Nacona has an established Harris mud crab population and is upstream of Lake Texoma within the Red River watershed. The Lake Texoma population may be the result of downstream migration from Lake Nacona. Additional research is warranted to track the population increase and distribution of Harris mud crabs in Lake Texoma.

<u>Asian Carp</u>

Bighead (*Hypophthalmichthys nobilis*) and silver carp (*H. molitrix)* are invasive fish that feed on plankton and compete for food with larval fishes, shad, and mussels. Grass carp (*Ctenopharyngodon idella*) are herbivorous fish holding a reputation of ecological disruption often limiting desirable aquatic vegetation. Juvenile grass carp have been observed within the Red and Washita River arms of the reservoir, indicating successful reproduction within the watershed (Hargrave and Gido 2004). Bighead carp have been confirmed within the tailrace and unconfirmed reports of bighead carp have been reported within the lake. The long free flowing current offered in the Red and Washita Rivers provide a mechanism for successful hatching for their semi-buoyant eggs. Documenting Asian carp sightings will be critical to monitoring their expansion. It is suspected that the source of inter-basin spread is bait bucket introductions. A marketing campaign is needed to educate the public on identification of these species and measures to avoid their further spread.

<u>Hydrilla</u>

Hydrilla (*Hydrilla verticillata*) is an invasive and potentially damaging aquatic weed popular in the aquarium trade. It has the ability to form dense mats displacing native species, restricting water flow, and impairing recreational activities. Its many modes of reproduction, including fragmentation, allows for rapid spread and dispersal within and among water bodies. Although hydrilla has not been observed within Lake Texoma, several water bodies within its drainage host this species (Arbuckle and Murray Lakes). It is unknown how this species may impact Lake Texoma if established.

## Lake Texoma Fisheries Management Goal

To provide a diversified, high quality sport fishery commensurate with resource capabilities and public desires.

## Objectives and Strategies

**Objective 1.0 Maintain largemouth bass electrofishing catch rates at the following levels.**

A. Total catch rates - ≥ 65 fish per hour.
B. Catch rates for LMB ≥ 14 inches - ≥ 25 fish per hour.
C. Length at age – 14 inches at age 3.

Strategies

1. Conduct standardized sampling procedure (SSP) electrofishing every two years to evaluate catch rates.
2. Collect age and growth data once every five years.
3. Maintain current harvest regulations.

**Objective 2.0 Establish baseline dataset for smallmouth bass.**

Strategies

1. Collect smallmouth bass during SSP electrofishing every two years to evaluate catch rates by size groups and relative weights.
2. Conduct fall SSP electrofishing to evaluate catch rates by size groups and relative weights.
3. Evaluate spring versus fall electrofishing data and determine appropriate sampling protocol for Lake Texoma.
4. Collect age and growth data once every five years.
5. Monitor tournament data.
6. Establish target management objectives.

**Objective 3.0 Maintain striped bass gill-net catch rates, size structure, and growth at the following levels.**

A. Winter gillnet catch rates - ≥ 22 fish per net-night
B. Percentage of fish ≥ 20-inches - ≥ 20%
C. Length at age – 20-inches at age IV

Strategies

1. Conduct SSP gillnetting annually to evaluate catch rates by size groups and relative weights.
2. Collect age and growth data once every five years.
3. Maintain current harvest regulations.

**Objective 4.0 Evaluate summer electrofishing protocol for blue catfish and establish a baseline dataset.**

Strategies

1. Conduct summer electrofishing every three years utilizing random and non-random protocols for site selection.
2. Evaluate random versus non-random electrofishing data and determine appropriate sampling protocol for Lake Texoma with an emphasis on larger individuals (>30 inches).
3. Establish target management objectives.

**Objective 5.0 Establish baseline dataset for crappie.**

Strategies

1. Conduct SSP trap netting every three years to evaluate catch rates by size groups and relative weights.
2. Collect age and growth data during each survey year.
3. Establish target management objectives.

**Objective 6.0 Collect trend data on threadfin and gizzard shad populations and maintain densities appropriate for predator demand.**

Strategies

1. Conduct SSP gillnetting annually to evaluate catch rates by size groups.
2. Monitor potential interaction with zebra mussels.
3. Monitor effects of potential winter kill events.
4. Restock threadfin shad following severe winter kills if an acceptable source is available.

**Objective 7.0 Address aquatic nuisance species through monitoring efforts and public outreach.**

Strategies

1. Participate in Lake Texoma ANS committee and provide technical assistance towards applicable plans, monitoring efforts, and public outreach.
2. Conduct at least one media contact per year highlighting ANS issues and measures the public can use to prevent further spread.
3. Provide area dock managers and marina operators with information that will educate the public regarding aquatic nuisance species.

**Objective 8.0 Protect and enhance aquatic habitat to benefit important sportfish and their associated prey species.**

Strategies

1. Oppose habitat degradation and shoreline development that does not comply with the Lake Texoma Shoreline Management Plan and does not require adequate mitigation. ODWC will propose adequate and reasonable mitigation measures when necessary.
2. Maintain thirty (30) fishing attractors and visually mark their position with buoys. Brush piles made of natural materials will be refurbished once during the duration of this plan.
3. Provide GPS coordinates of all newly established habitat structures for public viewing on the ODWC website.
4. Establish additional shallow water habitat using methods and materials supported by USACOE.
5. Protect the seasonal pool plan which inundates terrestrial vegetation, providing spawning and nursery habitat.

**Objective 9.0 Provide technical assistance to public agencies and participate in related planning efforts**

Strategies

1. Collect forebay and tailrace water quality data during summer stratification period and advise the USACOE accordingly.
2. Monitor USACOE and ODEQ permits and provide comments on projects that could negatively impact the resource and/or public use.
3. Continue to serve as a member of the Lake Texoma Advisory Committee.
4. Meet annually with TPWD staff to facilitate data transfer and ensure regulation consistency.

**Objective 10.0 Provide improved angler access at selected sites**

Strategies

1. Utilize Sportfish Restoration Boating and Fishing access funds to improve existing sites and establish new sites pending suitable cooperators and funding.
2. Annually monitor existing boating and fishing access projects and supply cooperator with a compliance letter.
3. Work with USACOE to identify and develop high water level boat ramps and quality shoreline fishing access.

**Objective 11.0 Conduct public outreach**

Strategies

1. Conduct at least one media contact per year highlighting ODWC management efforts on Lake Texoma and fishing opportunities available to the public.
2. Provide support to the Lake Records program and area vendors.
3. Provide area dock managers and marina operators with information that will educate the public regarding regulations and aquatic nuisance species.

4. Provide information to the Lake Texoma Association as requested and attend related meetings as available.
5. Collect fish and/or tissue samples as requested to monitor contaminant levels in selected fishes.
6. Educate anglers and guides about proper fish handling and associated fishing mortality.
7. Publish case history of striped bass in Lake Texoma.

## Citations


Ashby, S. L., J. L. Myers, E. Laney, D. Honnell, and C. Owens. 1999. The effects of hydropower releases from Lake Texoma on downstream water quality. Journal of Freshwater Ecology Volume 4:103-112.

Hambright, K. D. 2009. Invasive and toxic golden algae in Lake Texoma: Research to identify practical management measures for regulation of toxicity and prevention of blooms. July 1, 2008 to June 30, 2009. Federal Aid Project F-61-R, Job No. 3. Oklahoma Department of Wildlife Conservation. Oklahoma City, OK.

Hargrave, C.W. and K.B. Gido. 2004. Evidence of reproduction by exotic grass carp in the Red and Washita Rivers, Oklahoma. Southwestern Naturalist 49:89-93.

Harper, J. L. and H. E. Namminga. 1986. Fish population trends in Lake Texoma reservoir following establishment of striped bass. Pages 156-165 *in* G. E. Hall and M J. Van Den Avyle, editors. Reservoir Fisheries Management: Strategies for the 80's. Reservoir Committee, Southern Division, American Fisheries Society, Bethesda, MD.

Hunt, K. M. and R. B. Ditton. 1998. Characteristics of anglers and guides at Lake Texoma, their fishing participation patterns, and attitudes towards management of the recreational fishery. Human Dimensions of Fisheries Research Laboratory. Texas A&M University, College Station.

Hysmith, B. T., J. H. Moczygemba, and T. R. Robinson. 2000. Statewide freshwater fisheries monitoring and management program: Survey report for Lake Texoma, 1999. Texas Parks and Wildlife Department, Performance Report, Federal Aid Project F-30-R, Austin.

Hysmith, B. T., J. H. Moczygemba, and G. R. Wilde. 1992. Hooking morality of striped bass in Lake Texoma, Texas-Oklahoma. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 46:413-420.

Kuklinski, K. 2008. Size at harvest and growth of blue catfish in Oklahoma reservoirs. May 1, 2006 to December 31, 2007. Federal Aid Project F-50-R, Job No. 24. Oklahoma Department of Wildlife Conservation. Oklahoma City, OK.

Kuklinski, K. 2010. Evaluation of striped bass recruitment in the Washita River and Red River arms of Lake Texoma. March 1, 2005 to December 31, 2009. Federal Aid Project F-50-R, Job No. 20. Oklahoma Department of Wildlife Conservation. Oklahoma City, OK.

Mauck, P. E. 1986. Striped bass research study: Population trends (Texoma Reservoir) March 1, 1981 to February 29, 1986. Federal Aid Project F-29-R, Job No. 3. Oklahoma Department of Wildlife Conservation, Oklahoma City, OK.

Mauck, P. and J. Boxrucker. 2004. Abundance, Growth, and Mortality of the Lake Texoma Blue

Catfish Population: Implications for Management. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 58:57-65.

Moczygemba, J. H. and B. T. Hysmith. 1994. Evaluation of reduced striped bass bag limit, Lake Texoma, Texas and Oklahoma. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 48:433-440.

Moczygemba, J. H., B. T. Hysmith, and J.W. Schlechte. 2005. Comparison of guided and unguided fishing trips from two Texas reservoirs. Texas Chapter, American Fisheries Society Annual Proceedings, Volume 27:17-30.

Patton, T., and C. Lyday. 2008. Ecological succession and fragmentation in a reservoir: effects of sedimentation on habitats and fish communities. American Fisheries Society Symposium 62.

Schoor, M. S., J. Sah, D. F. Schreiner, M. R. Meador, and L. G. Hill. 1995. Regional economic impact of the Lake Texoma (Oklahoma-Texas) striped bass fishery. Fisheries 20(5):14-18.

Table 1. Physical and chemical characteristics of Lake Texoma

| | | |
|---|---|---|
| Operating Agencies: | | |
| Hydropower | Southwestern Power Administration | |
| Flood Control | U.S. Army Corps of Engineers | |
| Impoundment Date | 1944 | |
| Watershed | 39,719 square miles | |
| Surface Area | 88,000 acres | |
| Capacity | 2,643,000 acre-feet | |
| Shoreline | 580 miles | |
| Shoreline Development Ratio | 13.9 | |
| Mean Depth | 30.6 ft. | |
| Maximum Depth | 98.4 ft. | |
| Water Exchange Rate | 6.06 | |
| | Lower Lake | Upper Lake |
| Secchi Disk | 51 in. | 13 in. |
| pH Range | 7.27 – 8.42 | 7.84 – 8.65 |
| Conductivity Range | 887.6 – 1301 μS/cm | 1364 – 3062 μS/cm |
| Salinity Range | 0.46 – 0.70 ppt | 0.70 – 1.70 ppt |
| Average Turbidity Value | 5 NTU | 59 NTU |
| Trophic State Index (chlorophyll a) | 51 | 63 |
| Trophic Class | Mesotrophic | Hypereutrophic |

Table 2. Species, number and size of fish stocked by Oklahoma and Texas in Lake Texoma from 1965 to 2010.

| DATE | SPECIES | NUMBER | SIZE |
|---|---|---|---|
| 1965 | Striped bass | 138 | Adults |
| 1967 | Striped bass | 200,000 | Fry |
| 1968 | Striped bass | 5,000 | Fingerlings |
| 1968 | Walleye | 50,400 | Fry |
| 1969 | Walleye | 500,000 | Fry |
| 1969 | Striped bass | 284,614 | Fingerlings |
| 1970 | Striped bass | 77,640 | Fingerlings |
| 1971 | Striped bass | 96,839 | Fingerlings |
| 1972 | Striped bass | 208,340 | Fingerlings |
| 1973 | Striped bass | 141,612 | Fingerlings |
| 1974 | Florida bass | 10,000 | Fry |
| 1974 | Striped bass | 548,898 | Fingerlings |
| 1974 | Largemouth bass | 57,225 | Fry |
| 1975 | Walleye | 4,750,000 | Fry |
| 1975 | Florida bass | 200,000 | Fry |
| 1975 | Hybrid largemouth bass | 80,000 | Fry |
| 1976 | Walleye | 25,000 | Fry |
| 1977 | Walleye | 2,261,000 | Fry |
| 1977 | Florida bass | 23,748 | Fingerlings |
| 1977 | Striped bass | 1,600 | Fingerlings |
| 1979 | Threadfin shad | 31,181 | Adults |
| 1981 | Smallmouth bass | 576,655 | Fingerlings |
| 1982 | Threadfin shad | 1,500 | Adults |
| 1982 | Smallmouth bass | 452,372 | Fingerlings |
| 1983 | Smallmouth bass | 48,104 | Fingerlings |
| 1984 | Threadfin shad | 33,744 | Adults |
| 1984 | Striped bass | 490 | Fingerlings |
| 1985 | Threadfin shad | 38,920 | Adults |
| 1985 | Florida bass | 237,589 | Fingerlings |
| 1985 | Striped bass | 550 | Fry |
| 1986 | Florida bass | 231,850 | Fingerlings |
| 1987 | Smallmouth bass | 6,800 | Fingerlings |
| 1991 | Smallmouth bass | 10,641 | Fingerlings |
| 1991 | Channel catfish | 15,170 | Fingerlings |
| 1992 | Channel catfish | 59 | Growouts |
| 1995 | Florida bass | 100,000 | Fingerlings |
| 1996 | Smallmouth bass | 16,100 | Fingerlings |
| 1996 | Smallmouth bass | 3,900 | Fingerlings |
| 1996 | Florida bass | 51,420 | Fingerlings |
| 1996 | Florida bass | 48,880 | Fingerlings |
| 1996 | Florida bass | 100,300 | Fingerlings |
| 1997 | Florida bass | 109,950 | Fingerlings |

Table 2. Continued.

| DATE | SPECIES | NUMBER | SIZE |
|---|---|---|---|
| 1997 | Florida bass | 100,090 | Fingerlings |
| 1998 | Smallmouth bass | 27,694 | Fingerlings |
| 1998 | Florida bass | 110,500 | Fingerlings |
| 1999 | Smallmouth bass | 20,085 | Fingerlings |
| 1999 | Florida bass | 327,191 | Fingerlings |
| 1999 | Paddle fish | 5,862 | Fingerlings |
| 2000 | Paddle fish | 20,568 | Fingerlings |
| 2001 | Paddle fish | 770 | Fingerlings |
| 2001 | Threadfin shad | 11,300 | Adults |
| 2002 | C. Florida bass | 678,403 | Fingerlings |
| 2004 | C. Florida bass | 234,537 | Fingerlings |
| 2005 | Paddlefish | 31,478 | Fingerlings |
| 2007 | Paddlefish | 2,029 | Fingerlings |
| 2010 | Threadfin shad | 39,252 | Adults |
| 2010 | C. Florida bass | 34,357 | Fingerlings |

Table 3. Lake Texoma Tournament Results. Ranking of lakes statewide from which 10 or more tournament reports were received. Ranked according to quality fishing indicators. Lake Texoma ranking listed in parentheses.

| Year | Number of Reports | Total Number Of Anglers | Number of Bass Caught | Number of Bass Weighed In per 8-Hour Day | | Bass/ Tourn | Bass Weighed In/Angler | Percent Successful Anglers | | Average Weight per Bass (lbs.) | | Number of Bass Weighing In Over 5 lbs. | Angler-Hours per Bass Weighing In Over 5 lbs. | Number of Bass Weighing In Over 8 lbs. | Avg. Big Bass | Avg. 1st Place Weight (lbs.) | | Overall Rank |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1994 | 19 | 659 | 1121 | 1.7 | (# 5) | 59.0 | 1.7 | 81 | (# 1) | 2.3 | (# 14) | 1.0 | (#11) | 0 | 6.8 | 15.8 | (# 4) | 4 |
| 1995 | 21 | 898 | 1320 | 1.1 | (# 18) | 62.9 | 1.5 | 79 | (# 3) | 2.25 | (# 11) | 0.9 | (#18) | 0 | 6.6 | 14.3 | (# 5) | 8 |
| 1996 | 25 | 1303 | 2048 | 1.4 | (# 8) | 81.9 | 1.6 | 79 | (# 1) | 2.05 | (# 14) | 1.5 | (#14) | 0 | 7.8 | 14.7 | (# 4) | 7 |
| 1997 | 26 | 1778 | 2335 | 0.9 | (# 17) | 89.8 | 1.3 | 69 | (# 5) | 2.34 | (# 15) | 1.8 | (#15) | 0.04 | 9.4 | 15.7 | (# 3) | 10 |
| 1998 | 26 | 1508 | 2177 | 1.0 | (# 16) | 83.7 | 1.4 | 76 | (# 2) | 2.17 | (# 16) | 1.0 | (#16) | 0 | 7.4 | 15.4 | (# 2) | 7 |
| 1999 | 31 | 2152 | 2177 | 0.9 | (# 18) | 70.2 | 1.0 | 72 | (# 6) | 2.14 | (# 16) | 0.9 | (#17) | 0.03 | 8.3 | 13.7 | (# 9) | 15 |
| 2000 | 16 | 667 | 856 | 1.2 | (# 11) | 53.5 | 1.3 | 82 | (# 3) | 2.15 | (# 15) | 0.9 | (#14) | 0.19 | 9.0 | 15.6 | (# 6) | 8 |
| 2001 | 13 | 427 | 547 | 1.0 | (# 13) | 42.1 | 1.3 | 76 | (# 2) | 2.08 | (# 11) | 0.2 | (#18) | 0 | 5.7 | 13.4 | (# 4) | 10 |
| 2002 | 18 | 870 | 820 | 0.7 | (# 14) | 45.6 | 0.9 | 70 | (# 5) | 2.00 | (# 15) | 0.4 | (#16) | 0 | 6.7 | 12.7 | (# 3) | 10 |
| 2003 | 21 | 1150 | 1771 | 1.4 | (# 7) | 84.3 | 1.5 | 75 | (# 5) | 2.18 | (# 13) | 0.7 | (#20) | 0 | 6.9 | 13.9 | (# 4) | 4 |
| 2004 | 24 | 1459 | 1826 | 1.0 | (# 13) | 76.1 | 1.3 | 71 | (# 7) | 2.03 | (# 16) | 0.8 | (#20) | 0.04 | 8.3 | 14.1 | (# 5) | 12 |
| 2005 | 30 | 1705 | 1831 | 1.4 | (# 14) | 61.0 | 1.1 | 71 | (# 9) | 2.18 | (# 12) | 0.5 | (#21) | 0 | 6.9 | 13.3 | (# 6) | 9 |
| 2006 | 28 | 1157 | 1749 | 1.9 | (# 6) | 62.5 | 1.5 | 76 | (# 6) | 2.07 | (# 16) | 0.4 | (#16) | 0 | 4.7 | 14.5 | (# 4) | 8 |
| 2007 | 20 | 575 | 1421 | 2.8 | (# 6) | 71.1 | 2.8 | 82 | (# 4) | 2.12 | (# 15) | 1.1 | (#14) | 0.1 | 5.2 | 15.8 | (# 4) | 6 |
| 2008 | 17 | 1082 | 1574 | 1.2 | (#18) | 92.0 | 1.2 | 72 | (#8) | 2.09 | (#13) | 0.8 | (#18) | 0 | 5.3 | 14.7 | (#8) | 18 |
| 2009 | 15 | 818 | 1711 | 1.8 | (#7) | 112 | 1.8 | 83 | (#7) | 2.13 | (#14) | 1.3 | (#17) | 0 | 5.6 | 16.4 | (#11) | 13 |
| **Avg** | **22** | **1138** | **1580** | **1.3** | **12** | **71.7** | **1.5** | **76** | **4.6** | **2.1** | **14** | **0.9** | **16.6** | **0.03** | **6.9** | **14.6** | **5.1** | **9.3** |

Table 4. Total number (No.), catch rates (C/f), and relative weights ($W_r$) by size groups of largemouth bass collected by spring electrofishing from Lake Texoma. Numbers in parentheses represent acceptable values for a quality fishery. Acceptable $W_r$ values are $\geq$90.

| Total ($\geq$40) | | | <8 in. (15-45) | | 8–12 in. (15-30) | | $\geq$12 in. ($\geq$15) | | $\geq$14 in. ($\geq$10) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | No. | C/f | C/f | $W_r$ | C/f | $W_r$ | C/f | $W_r$ | C/f | $W_r$ |
| 1982 | 147 | 21.0 | 9.0 | 101 | 6.3 | 95 | 3.9 | 91 | 1.9 | 93 |
| 1983 | 338 | 22.9 | 8.5 | 100 | 7.2 | 98 | 7.2 | 90 | 2.8 | 90 |
| 1984 | 337 | 32.1 | 16.3 | 99 | 9.4 | 97 | 6.4 | 89 | 1.4 | 88 |
| 1985 | 320 | 26.1 | 7.5 | 90 | 11.7 | 85 | 6.9 | 92 | 2.6 | 83 |
| 1986 | 218 | 45.9 | 11.4 | 89 | 14.1 | 97 | 20.4 | 90 | 10.3 | 90 |
| 1987 | 189 | 29.8 | 6.9 | 95 | 13.1 | 102 | 9.8 | 91 | 5.3 | 95 |
| 1988 | 255 | 42.5 | 11.8 | 90 | 15.7 | 95 | 15.0 | 99 | 8.5 | 104 |
| 1989 | 279 | 58.7 | 5.1 | 91 | 33.9 | 101 | 19.8 | 101 | 10.9 | 103 |
| 1990 | 201 | 80.4 | 26.8 | 107 | 24.8 | 103 | 28.8 | 95 | 11.2 | 96 |
| 1991 | 275 | 84.6 | 5.2 | 111 | 37.8 | 94 | 41.5 | 96 | 24.6 | 96 |
| 1992 | 254 | 84.7 | 14.6 | 117 | 23.0 | 106 | 47.0 | 100 | 28.3 | 93 |
| 1993 | 279 | 69.8 | 8.5 | 94 | 17.8 | 102 | 43.5 | 98 | 25.0 | 98 |
| 1994 | 258 | 103.0 | 11.2 | 85 | 20.8 | 92 | 71.2 | 95 | 49.2 | 93 |
| 1996 | 257 | 114.0 | 21.3 | 94 | 24.4 | 94 | 68.4 | 97 | 55.1 | 97 |
| 1998 | 263 | 105.0 | 20.4 | 85 | 25.2 | 89 | 59.6 | 96 | 45.2 | 95 |
| 1999 | 248 | 76.3 | 4.9 | 98 | 13.8 | 98 | 57.6 | 91 | 38.2 | 92 |
| 2000 | 247 | 82.3 | 19.7 | 95 | 23.0 | 100 | 39.7 | 96 | 29.0 | 94 |
| 2002 | 235 | 78.3 | 17.3 | 89 | 22.7 | 90 | 38.3 | 91 | 19.3 | 90 |
| 2006* | 366 | 61.0 | 13.5 | 112 | 26.3 | 100 | 21.2 | 90 | 10.0 | 88 |
| 2010 | 447 | 66.2 | 5.2 | 86 | - | - | - | - | 38.8 | 92 |

* Denotes changed electrofishing protocol – Minimum of 6 hrs of effort required.

Table 5.  Total number (No.), catch rates (C/f), and relative weights ($W_r$) by size groups of spotted bass collected by spring electrofishing from Lake Texoma.  Numbers in parentheses represent acceptable values for a quality fishery.  Acceptable $W_r$ values are ≥90.

| | Total (≥ 40) | | < 8 inches (15-45) | | 8-12 inches (15-30) | | ≥ 14 inches (≥ 10) | |
|---|---|---|---|---|---|---|---|---|
| Year | No. | C/f | C/f | $W_r$ | C/f | $W_r$ | C/f | $W_r$ |
| 1987 | 26 | 4.2 | 2.4 | 86 | 1.1 | 78 | - | - |
| 1988 | 29 | 4.8 | 0.7 | 77 | 1.5 | 85 | 0.67 | 93 |
| 1989 | 44 | 9.3 | 5.3 | 89 | 1.9 | 82 | 0.63 | 121 |
| 1990 | 55 | 22.0 | 7.6 | - | 8.8 | 91 | 2.4 | 95 |
| 1991 | 71 | 21.8 | 6.5 | 75 | 12.3 | 85 | 0.9 | 96 |
| 1992 | 47 | 15.7 | 5.7 | - | 6.0 | 97 | 2.3 | 97 |
| 1993 | 118 | 29.5 | 3.5 | 97 | 8.0 | 89 | 5.3 | 92 |
| 1994 | 63 | 25.2 | 3.2 | - | 10.4 | 83 | 6.0 | 91 |
| 1996 | 60 | 26.7 | 0.9 | 91 | 2.7 | 90 | 11.5 | 94 |
| 1998 | 36 | 14.4 | 4.0 | - | 5.6 | 86 | 1.2 | 93 |
| 1999 | 46 | 14.2 | 1.8 | 109 | 4.9 | 94 | 1.8 | 89 |
| 2000 | 82 | 27.3 | 3.3 | 88 | 7.7 | 101 | 3.7 | 97 |
| 2002 | 154 | 51.3 | 12.3 | 95 | 18.0 | 97 | 6.7 | 86 |
| 2006* | 86 | 14.3 | 4.5 | 111 | 5.2 | 100 | 1.3 | 89 |
| 2010 | 96 | 14.2 | 4.1 | 113 | - | - | 1.9 | 89 |

*2006 started a new minimum of 6 hours Electrofishing on Texoma Reservoir.

Table 6. Total number (No.), fish per net night (C/f), and relative weights (Wr) by size groups of white bass collected by combined OK-TX winter gill netting from Lake Texoma.

| | Total | | < 8 in. | | 8 – 12 in. | | ≥ 12 in. | |
|---|---|---|---|---|---|---|---|---|
| Year | No. | C/f | C/f | Wr | C/f | Wr | C/f | Wr |
| 1982 | 34 | 1.0 | 0.5 | 89 | 0.5 | 90 | 0.2 | 87 |
| 1983 | 73 | 3.6 | 0.5 | 92 | 1.4 | 93 | 1.7 | 90 |
| 1984 | 9 | 0.5 | 0.05 | 102 | 0.2 | 95 | 0.2 | 85 |
| 1985 | 39 | 1.9 | 0.2 | 72 | 0.5 | 76 | 1.4 | 83 |
| 1986 | 7 | 0.5 | 0.1 | 77 | 0.05 | 79 | 0.1 | 75 |
| 1987 | 17 | 1.0 | 0.1 | 83 | 0.2 | 86 | 0.5 | 83 |
| 1988 | 2 | 0.1 | - | - | - | - | 0.1 | 73 |
| 1989 | 169 | 8.4 | 1.2 | 84 | 6.0 | 88 | 1.4 | 93 |
| 1990 | 6 | 0.2 | 0.05 | 89 | 0.2 | 111 | 0.05 | 78 |
| 1991 | 74 | 3.8 | 0.7 | 83 | 1.7 | 87 | 1.2 | 90 |
| 1992 | 98 | 5.0 | 0.2 | 59 | 2.4 | 85 | 2.6 | 86 |
| *1993 | 257 | 9.8 | 1.2 | - | 3.6 | - | 5.0 | - |
| 1994 | 183 | 7.0 | 1.4 | - | 1.9 | - | 3.6 | - |
| 1995 | 97 | 3.8 | 0.2 | - | 1.9 | - | 1.4 | - |
| 1996 | 331 | 13.2 | 1.9 | - | 4.3 | - | 6.7 | - |
| 1997 | 79 | 2.9 | 0.1 | - | 1.7 | - | 1.2 | - |
| 1998 | 310 | 12.2 | 2.6 | - | 5.0 | - | 4.6 | - |
| 1999 | 65 | 2.4 | 0.5 | - | 1.2 | - | 0.7 | - |
| 2000 | 202 | 7.9 | 1.0 | - | 2.4 | - | 4.6 | - |
| 2001 | 72 | 2.9 | 1.0 | - | 1.2 | - | 0.7 | - |
| 2002 | 56 | 2.2 | 0.2 | - | 0.5 | - | 0.5 | - |
| 2003 | 152 | 5.5 | 1.7 | - | 1.9 | - | 1.9 | - |
| 2004 | 25 | 0.7 | 0.02 | - | 0.1 | - | 0.7 | - |
| 2005 | 135 | 5.0 | 0.7 | - | 3.8 | - | 0.5 | - |
| 2006 | 78 | 2.9 | 0.1 | - | 1.2 | - | 1.4 | - |

Table 6. Continued.

| | Total | | < 8 in. | | 8 – 12 in. | | ≥ 12 in. | |
|---|---|---|---|---|---|---|---|---|
| Year | No. | C/f | C/f | Wr | C/f | Wr | C/f | Wr |
| 2007 | 123 | 4.6 | 0.5 | - | 3.1 | - | 1.0 | - |
| 2008 | 187 | 6.7 | 1.0 | 86 | 2.4 | 91 | 3.3 | 100 |
| 2009 | 158 | 5.4 | 1.3 | 84 | 1.9 | 87 | 2.2 | 97 |
| 2010 | 125 | 4.6 | 0.6 | 86 | 1.8 | 90 | 2.1 | 97 |

* Winter gill netting began in 1993.

Table 7. Total number (No.), fish per net night (C/f), and relative weights (Wr) by size groups of striped bass collected by combined OK-TX winter gill netting from Lake Texoma.

| Total | | | < 12 in. | | 12 – 20 in. | | ≥ 20 in. | |
|---|---|---|---|---|---|---|---|---|
| Year | No. | C/f | C/f | Wr | C/f | Wr | C/f | Wr |
| 1982 | 290 | 8.6 | 1.4 | 86 | 7.0 | 74 | 2.9 | 68 |
| 1983 | 211 | 10.6 | 5.8 | 93 | 4.6 | 91 | 0.5 | 85 |
| 1984 | 141 | 7.2 | 0.7 | 98 | 4.8 | 74 | 1.9 | 74 |
| 1985 | 152 | 7.7 | 1.2 | 71 | 4.8 | 83 | 1.7 | 78 |
| 1986 | 223 | 11.5 | 3.8 | 81 | 7.4 | 79 | 0.5 | 86 |
| 1987 | 102 | 5.0 | 2.2 | 85 | 2.9 | 85 | 0.1 | 85 |
| 1988 | 48 | 2.4 | 2.6 | 78 | 2.4 | 92 | 0.5 | 105 |
| 1989 | 244 | 12.2 | 8.6 | 79 | 3.1 | 85 | 0.5 | 71 |
| 1990 | 100 | 5.3 | 0.5 | 130 | 4.1 | 84 | 0.7 | 73 |
| 1991 | 320 | 16.1 | 6.5 | 82 | 8.9 | 88 | 0.7 | 79 |
| 1992 | 363 | 19.0 | 6.5 | 73 | 11.0 | 97 | 1.4 | 84 |
| *1993 | 484 | 18.2 | 3.8 | - | 9.4 | - | 5.0 | - |
| 1994 | 569 | 21.6 | 3.4 | - | 13.7 | - | 4.6 | - |
| 1995 | 334 | 13.2 | 2.4 | - | 7.9 | - | 2.9 | - |
| 1996 | 374 | 14.9 | 3.4 | - | 7.9 | - | 3.6 | - |
| 1997 | 531 | 19.9 | 2.4 | - | 11.8 | - | 5.8 | - |
| 1998 | 580 | 23.0 | 7.9 | - | 11.0 | - | 4.1 | - |
| 1999 | 546 | 21.1 | 4.1 | - | 14.2 | - | 3.1 | - |
| 2000 | 567 | 22.3 | 3.1 | - | 15.1 | - | 4.1 | - |
| 2001 | 747 | 30.2 | 2.6 | - | 19.0 | - | 8.6 | - |
| 2002 | 580 | 21.8 | 3.4 | - | 16.6 | - | 2.2 | - |
| 2003 | 650 | 23.5 | 1.9 | - | 15.6 | - | 6.0 | - |
| 2004 | 732 | 24.0 | 1.4 | - | 18.0 | - | 7.0 | - |
| 2005 | 669 | 24.7 | 5.8 | - | 9.4 | - | 9.4 | - |
| 2006 | 758 | 28.3 | 5.8 | - | 15.4 | - | 7.2 | - |

Table 7. Continued.

| | Total | | < 12 in. | | 12 – 20 in. | | ≥ 20 in. | |
|---|---|---|---|---|---|---|---|---|
| Year | No. | C/f | C/f | Wr | C/f | Wr | C/f | Wr |
| 2007 | 674 | 25.2 | 5.8 | - | 13.9 | - | 5.5 | - |
| 2008 | 597 | 21.6 | 2.9 | 88 | 12.8 | - | 5.9 | 98 |
| 2009 | 704 | 24.1 | 6.6 | 86 | 11.6 | - | 5.9 | 92 |
| 2010 | 580 | 20.3 | 1.0 | 84 | - | - | 5.2 | 84 |

* Winter gill netting began in 1993.

Table 8. Mean length at age of blue catfish from Lake Texoma. Samples collected by summer boat electrofishing during 2003.

| Age | Number | Length (in) |
|---|---|---|
| 1 | 30 | 6.8 |
| 2 | 21 | 10.0 |
| 3 | 23 | 12.4 |
| 4 | 42 | 14.6 |
| 5 | 32 | 15.8 |
| 6 | 35 | 17.3 |
| 7 | 19 | 18.1 |
| 8 | 47 | 19.5 |
| 9 | 26 | 21.1 |
| 10 | 17 | 23.0 |
| 11 | 18 | 22.6 |
| 12 | 11 | 26.7 |
| 13 | 4 | 37.6 |
| 14 | 1 | 27.4 |
| 15 | 3 | 31.7 |
| 16 | 4 | 36.7 |

Table 9. Total number (No.), and catch rate (C/f) by size groups of blue catfish collected by summer boat electrofishing from Lake Texoma.

| | Total | | < 12 in. | ≥ 12 in. | ≥ 20 in. | ≥ 30 in. |
|---|---|---|---|---|---|---|
| Year | No. | C/f | C/f | C/f | C/f | C/f |
| 1993 | 116 | 148.7 | 53.6 | 94.5 | 42.1 | 3.8 |
| 1994 | 261 | 261 | 77.0 | 184.0 | 46.0 | 4.0 |
| 1995 | 285 | 180 | 45.5 | 134.5 | 32.2 | 2.5 |
| 1999 | 660 | 330 | 76.5 | 253.5 | 40.0 | 6.5 |
| 2002 | 185 | 185 | 1.0 | 184.0 | 40.0 | 8.0 |
| 2003 | 450 | 225 | 44.2 | 180.8 | 32.5 | 3.0 |
| 2009* | 483 | 322 | 295.3 | 26.7 | 8.7 | 2.7 |

* Denotes changed electrofishing protocol – Minimum of 1.5 hrs of effort required and sites randomly selected within the upper 50% of the reservoir.

Table 10. Total number (No.), fish per net night (C/f), and relative weights (Wr) by size groups of channel catfish collected by combined OK-TX winter gill netting from Lake Texoma.

| | Total | | < 12 in. | | ≥ 12 in. | | ≥ 16 in. | |
|---|---|---|---|---|---|---|---|---|
| Year | No. | C/f | C/f | Wr | C/f | Wr | C/f | Wr |
| 1982 | 69 | 2.2 | 0.7 | 91 | 1.2 | 91 | 0.7 | 95 |
| 1983 | 37 | 1.9 | 0.7 | 97 | 1.2 | 91 | 0.5 | 97 |
| 1984 | 39 | 1.9 | 0.7 | 88 | 1.2 | 89 | 0.5 | 98 |
| 1985 | 36 | 1.9 | 0.7 | 79 | 1.0 | 91 | 0.5 | 96 |
| 1986 | 34 | 1.7 | 1.0 | 72 | 0.7 | 78 | 0.1 | 96 |
| 1987 | 32 | 1.7 | 0.7 | 81 | 0.7 | 91 | 0.5 | 89 |
| 1988 | 30 | 1.7 | 0.7 | 79 | 1.0 | 84 | 0.5 | 85 |
| 1989 | 35 | 1.7 | 1.2 | 79 | 0.7 | 84 | 0.5 | 90 |
| 1990 | 23 | 1.2 | 0.7 | 96 | 0.5 | 79 | 0.2 | 85 |
| 1991 | 12 | 0.7 | 0.2 | 89 | 0.5 | 87 | 0.1 | 103 |
| 1992 | 23 | 1.2 | 0.7 | 81 | 0.5 | 92 | 0.2 | 93 |
| *1993 | 48 | 1.9 | 0.7 | - | 1.0 | - | 0.5 | - |
| 1994 | 34 | 1.2 | 0.7 | - | 0.7 | - | 0.1 | - |
| 1995 | 64 | 2.6 | 1.7 | - | 1.0 | - | 0.2 | - |
| 1996 | 34 | 1.2 | 0.2 | - | 1.0 | - | 0.5 | - |
| 1997 | 22 | 0.7 | 0.5 | - | 0.5 | - | 0.1 | - |
| 1998 | 33 | 1.2 | 0.5 | - | 0.7 | - | 0.2 | - |
| 1999 | 53 | 1.9 | 1.7 | - | 1.7 | - | 0.7 | - |
| 2000 | 20 | 0.7 | 0.1 | - | 0.7 | - | 0.1 | - |
| 2001 | 67 | 2.6 | 1.4 | - | 1.2 | - | 0.5 | - |
| 2002 | 47 | 1.7 | 0.5 | - | 1.2 | - | 0.7 | - |
| 2003 | 58 | 2.2 | 1.2 | - | 0.7 | - | 0.5 | - |
| 2004 | 53 | 1.9 | 1.2 | - | 0.7 | - | 0.5 | - |
| 2005 | 50 | 1.7 | 0.7 | - | 1.2 | - | 0.2 | - |

Table 10. Continued.

| | Total | | < 12 in. | | ≥ 12 in. | | ≥ 16 in. | |
|---|---|---|---|---|---|---|---|---|
| Year | No. | C/f | C/f | Wr | C/f | Wr | C/f | Wr |
| 2006 | 58 | 2.2 | 1.2 | - | 1.2 | - | 0.5 | - |
| 2007 | 38 | 1.4 | 0.5 | - | 0.7 | - | 0.5 | - |
| 2008 | 63 | 2.3 | 0.8 | 82 | 1.5 | 88 | 1.1 | 89 |
| 2009 | 72 | 2.5 | 1.5 | 94 | 1.0 | 94 | 0.6 | 98 |
| 2010 | 38 | 1.3 | 0.5 | 93 | 0.8 | 88 | 0.3 | 93 |

* Winter gill netting began in 1993.

Table 11. Total number (No.), fish per net night (C/f), and relative weights (Wr) by size groups of all crappie collected by trap netting from Lake Texoma. Numbers in parentheses represent acceptable C/f values for a quality fishery.

| | Total (≥25) | | <5 in. (≥5) | | ≥5 in. (10-40) | | ≥8 in. (≥10) | | ≥10 in. (≥4) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | No. | C/f | C/f | Wr | C/f | Wr | C/f | Wr | C/f | Wr |
| 1992 | 94 | 8.4 | 1.8 | 60 | 6.2 | 99 | 5.0 | 101 | 1.6 | 100 |
| 1994 | 345 | 7.4 | 3.4 | 112 | 4.3 | 99 | 3.6 | 100 | 1.9 | 102 |
| 1995 | 192 | 7.3 | 0.5 | 86 | 6.7 | 93 | 6.2 | 95 | 3.5 | 97 |
| 1999 | 171 | 7.4 | 2.9 | 102 | 4.5 | 98 | 4.4 | 98 | 3.8 | 99 |
| 2001 | 184 | 7.2 | 4.6 | 75 | 2.6 | 91 | 2.2 | 96 | 1.7 | 98 |

Table 12. Mean length at age of crappie collected by trap netting from Lake Texoma. Numbers in parentheses represent values for acceptable growth rates.

| | Age 1 | Age 2 | Age 3 | Age 4 |
|---|---|---|---|---|
| Year | (≥ 6.3 in.) | (≥ 7.9 in.) | (≥ 8.9 in.) | (≥ 9.8 in.) |
| 1992 | 7.3 | 8.9 | 10.2 | 12.6 |
| 1994 | 8.7 | 11.5 | 12.4 | 12.8 |
| 1995 | 9.6 | 10.8 | 13.4 | 12.6 |
| 1998 | 8.2 | 10.2 | 11.1 | 12.6 |
| 1999 | 8.6 | 11.7 | 12.7 | 12.6 |
| 2001 | 6.8 | 10.7 | 12.7 | - |

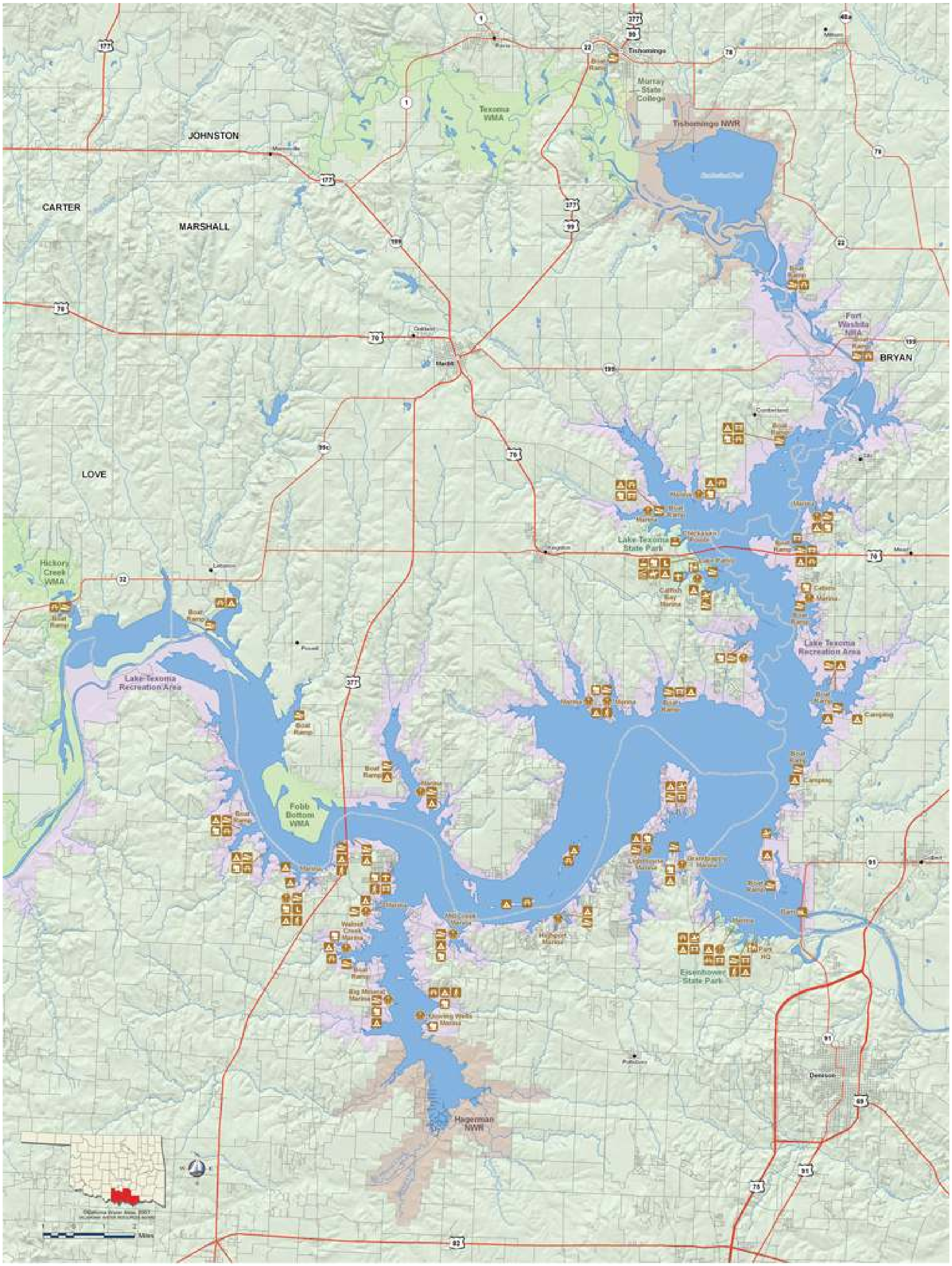


Figure 1. Map of Lake Texoma and vicinity.

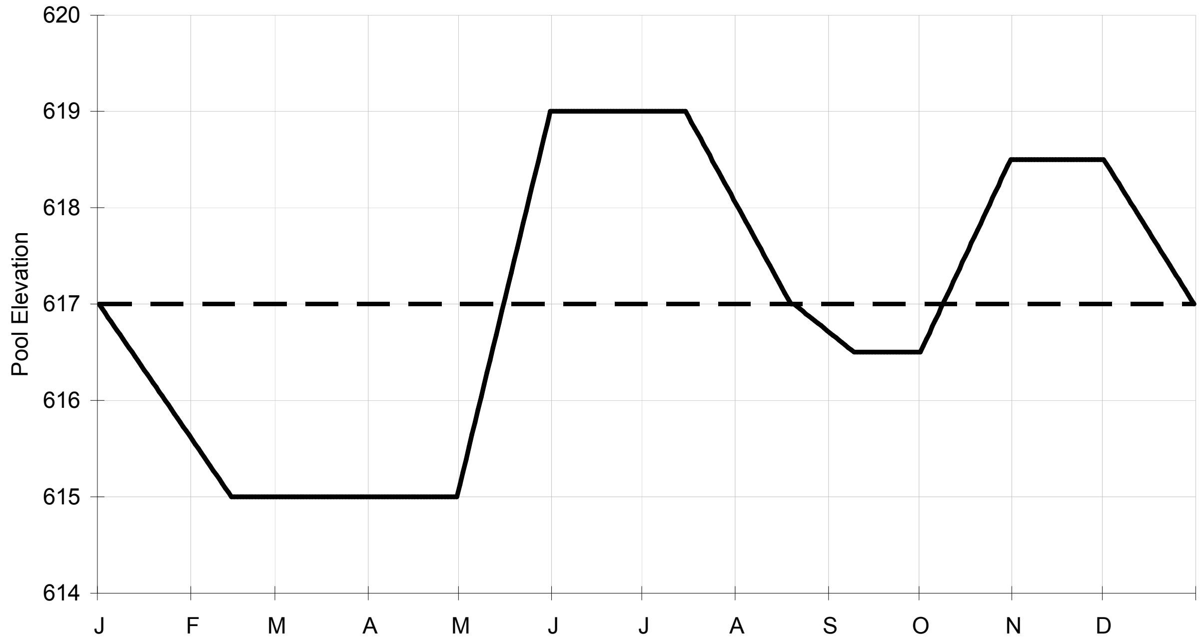


Figure 2. Target elevations (solid line) and conservation pool (dotted line) for Lake Texoma.

Dates and elevations for seasonal pool plan.
Jan 1 – Elevation 617 and dropping to 615 feet msl
Feb 15 – Elevation 615 feet msl
May 1 – Raise elevation from 615 to 619 feet msl
June 1 – Elevation 619 feet msl
July 15 – Lower elevation from 619 to 616.5 feet msl
Sept 10 – Elevation 616.5 feet msl
Oct 1 – Raise elevation from 616.5 to 618.5 feet msl
Nov 1 – Elevation 618.5 feet msl
Dec 1 – Lower elevation from 618.5 to 617 feet msl

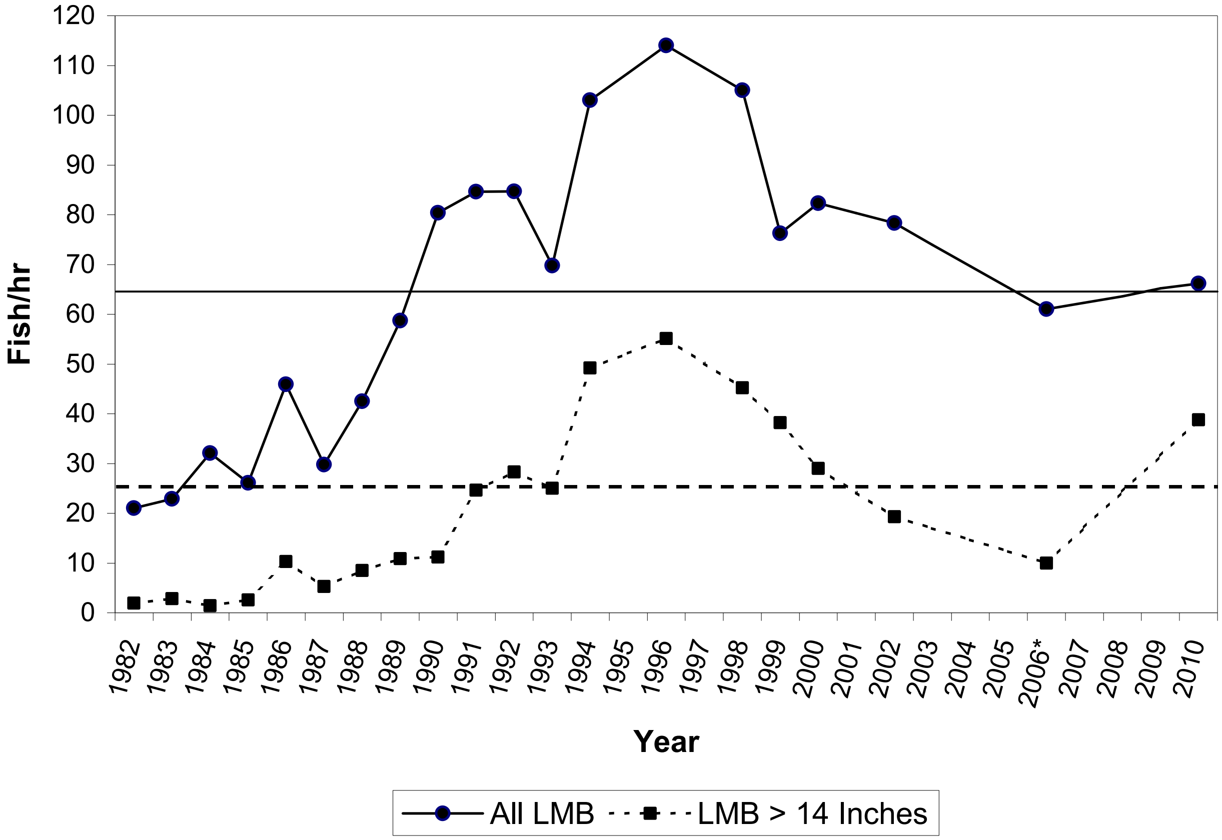


Figure 3. Total catch rates of largemouth bass and catch rates of largemouth bass > 14 inches collected by spring electrofishing. Solid horizontal line (65 fish/hr) and dotted horizontal line (25 fish/hr) designate target levels for All LMB and LMB > 14 inches, respectively.

* Denotes changed electrofishing protocol – Minimum of 6 hrs of effort required.

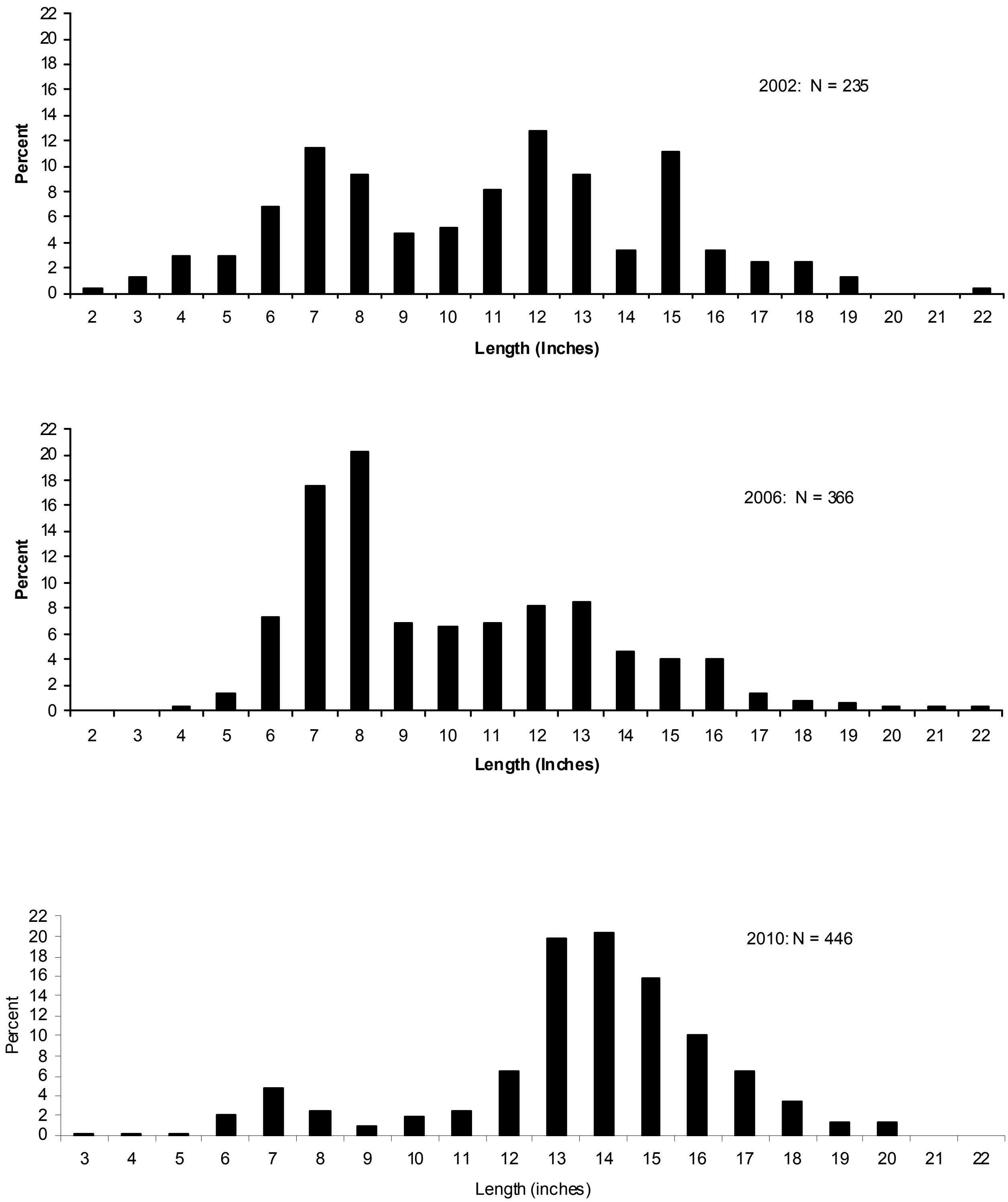


Figure 4. 2002, 2006, and 2010 length frequency distribution for largemouth bass collected by spring electrofishing at Lake Texoma.

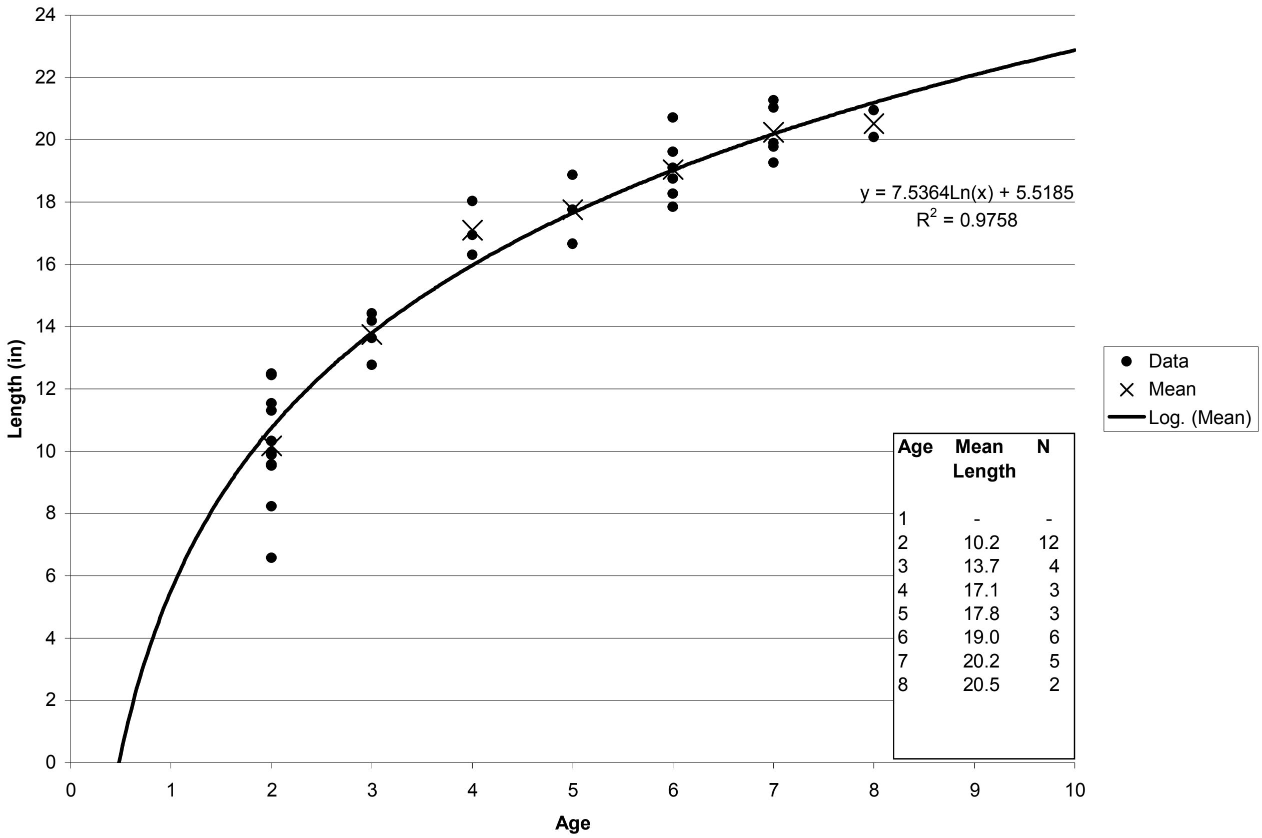


Figure 5. 2010 Length at age data for largemouth bass collected from Lake Texoma by spring electrofishing. N = 124

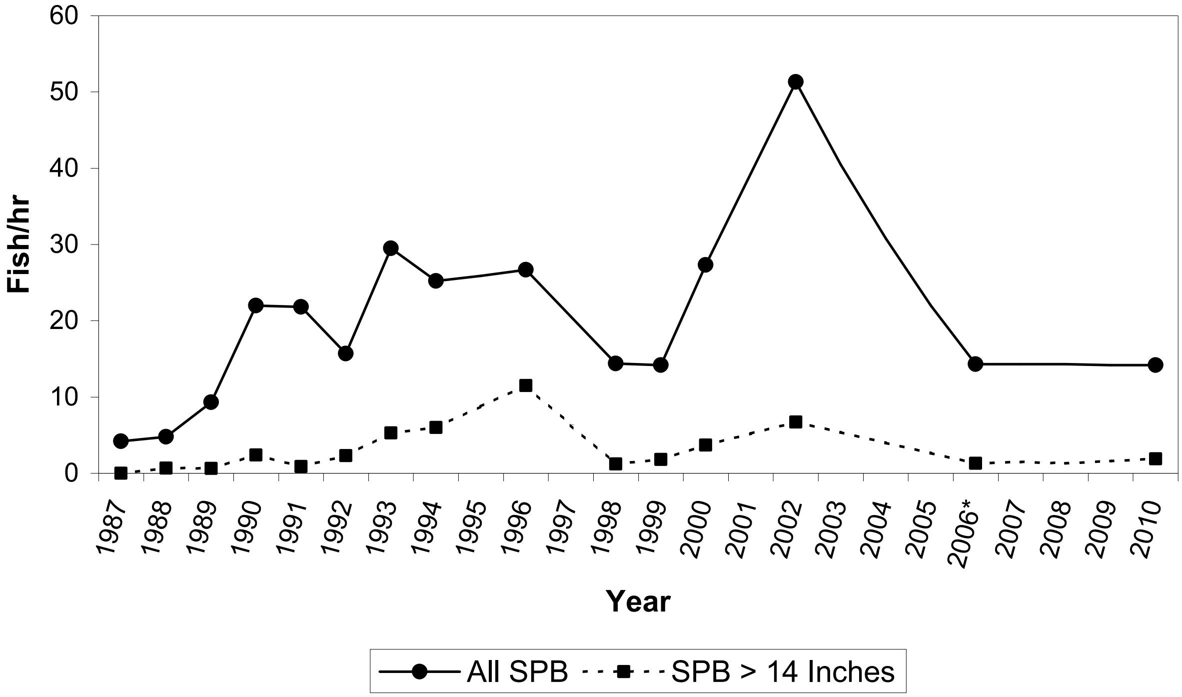


Figure 6. Total catch rates of spotted bass and catch rates of spotted bass > 14 inches collected by spring electrofishing.

* Denotes changed electrofishing protocol – Minimum of 6 hrs of effort required.

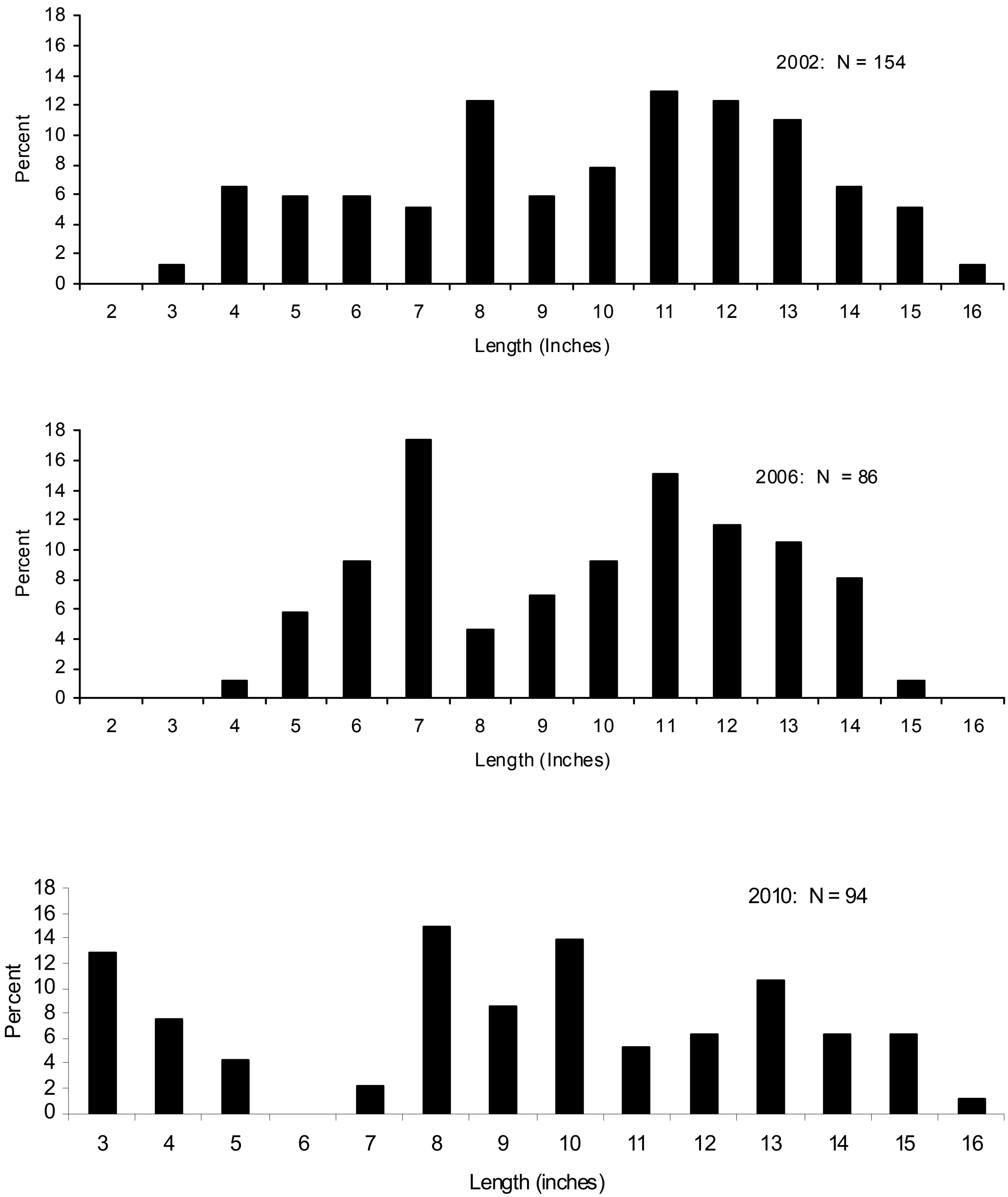


Figure 7. 2002, 2006, and 2010 length frequency distribution for spotted bass collected by spring electrofishing at Lake Texoma.

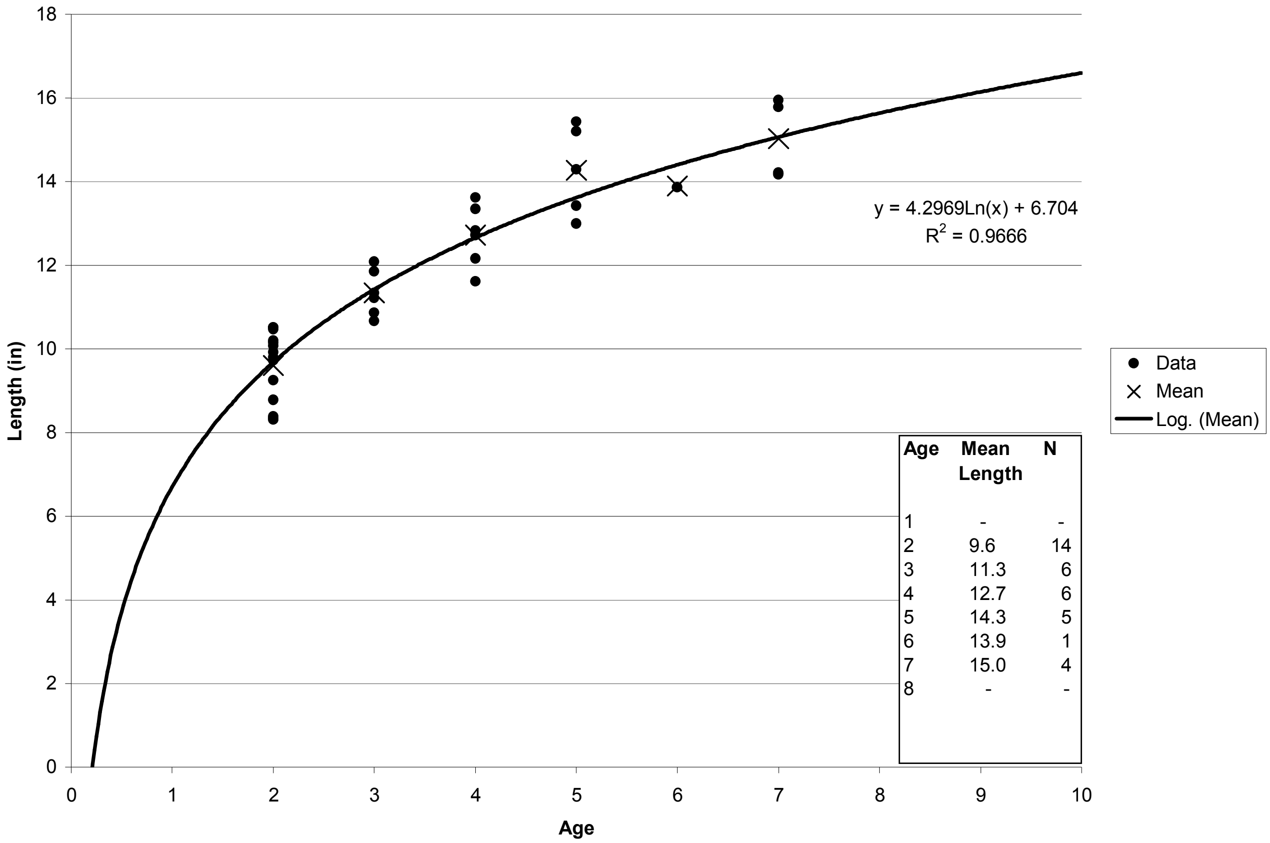


Figure 8. 2010 Length at age data for spotted bass collected from Lake Texoma by spring electrofishing. N = 36

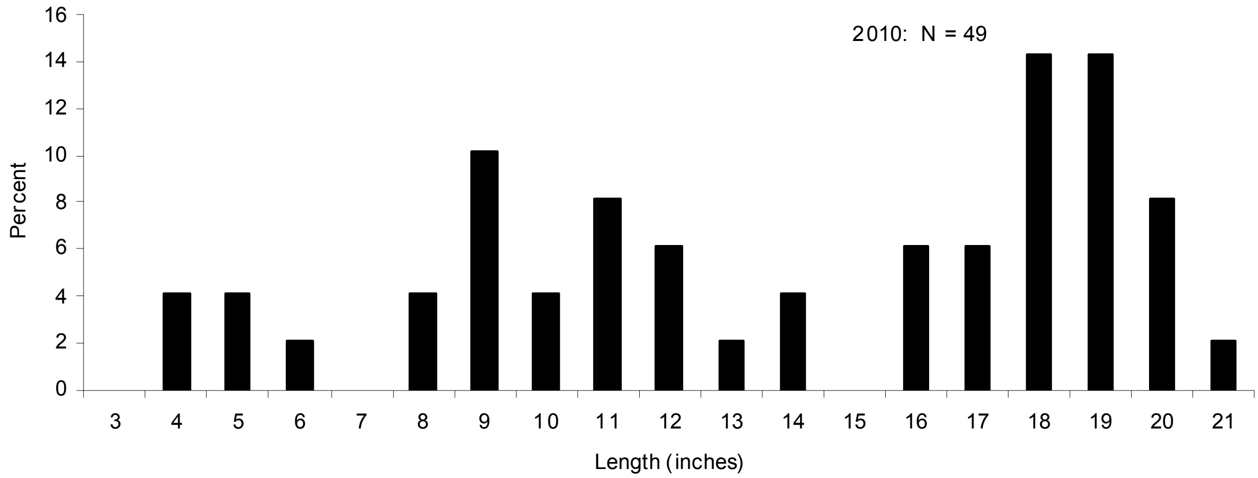


Figure 9. 2010 length frequency distribution for smallmouth bass collected by spring electrofishing at Lake Texoma.

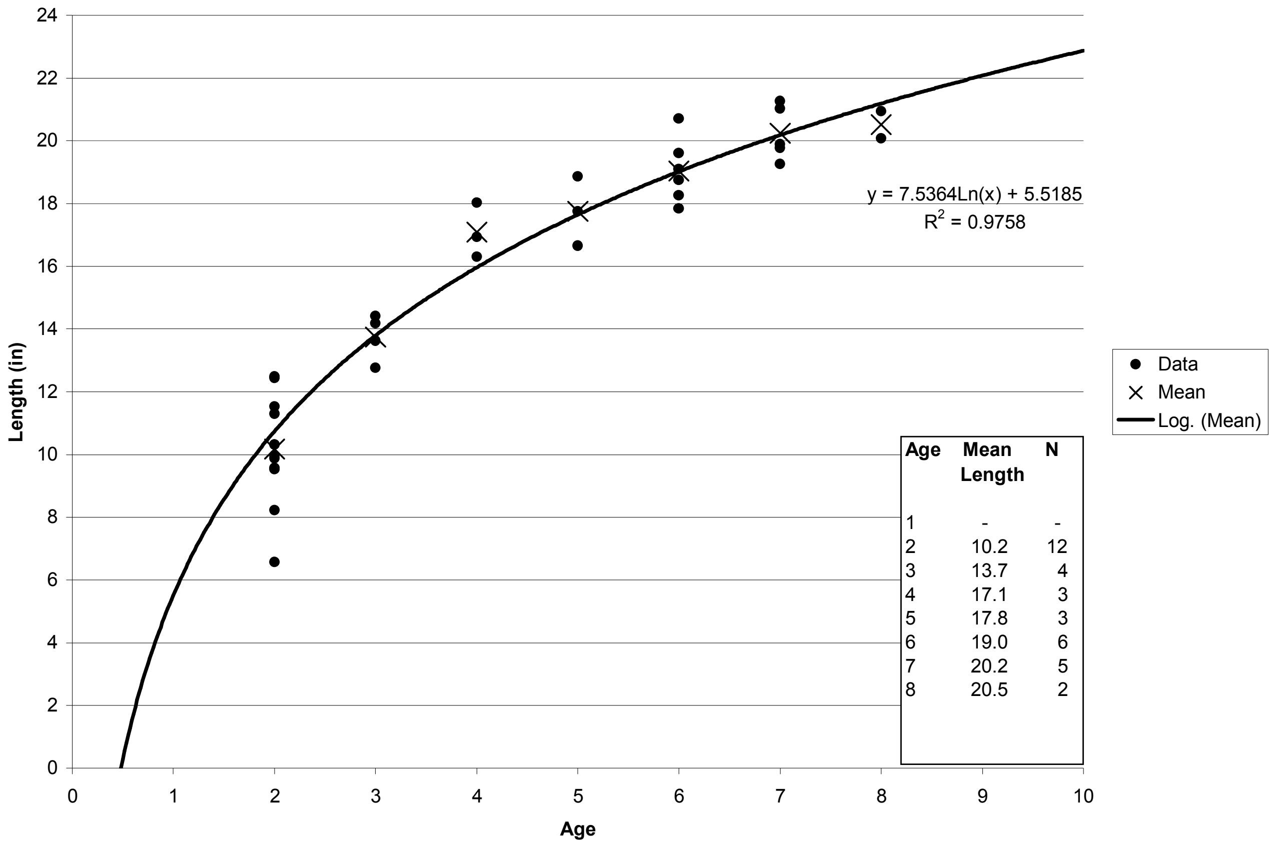


Figure 10. 2010 Length at age data for smallmouth bass collected from Lake Texoma by spring electrofishing. N = 35

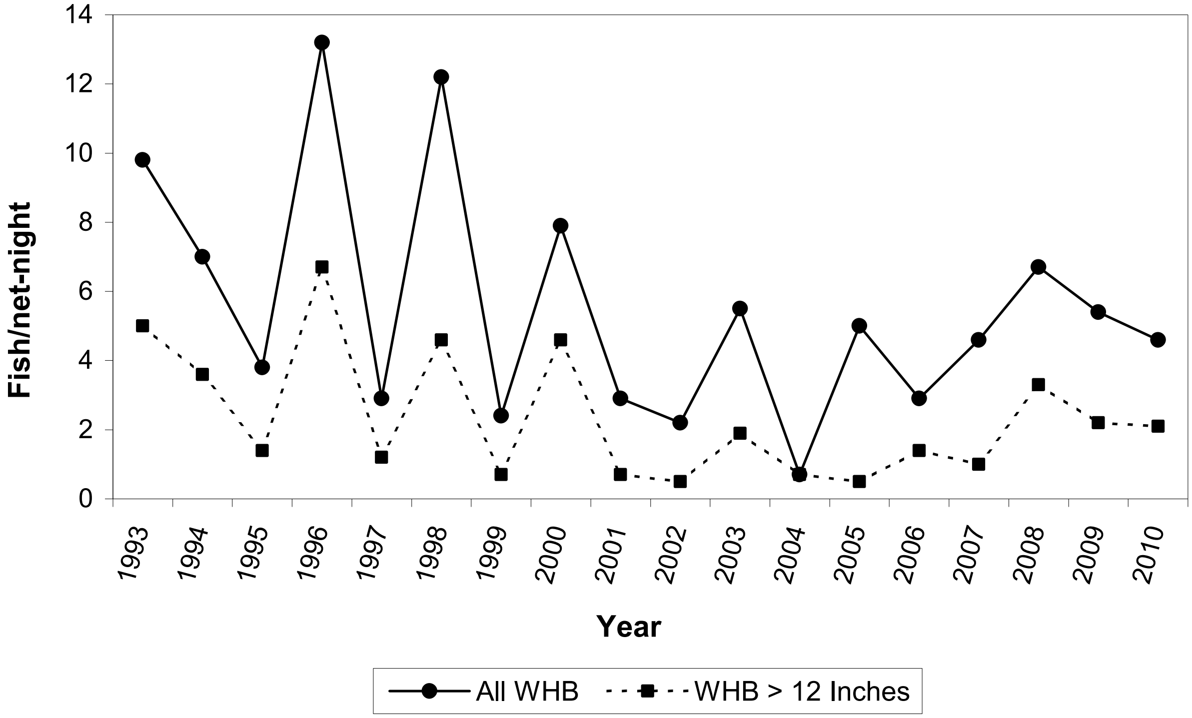


Figure 11. 1993 to 2010 catch rates for all white bass and white bass > 12 inches collected by combined OK-TX winter gillnetting at Lake Texoma.

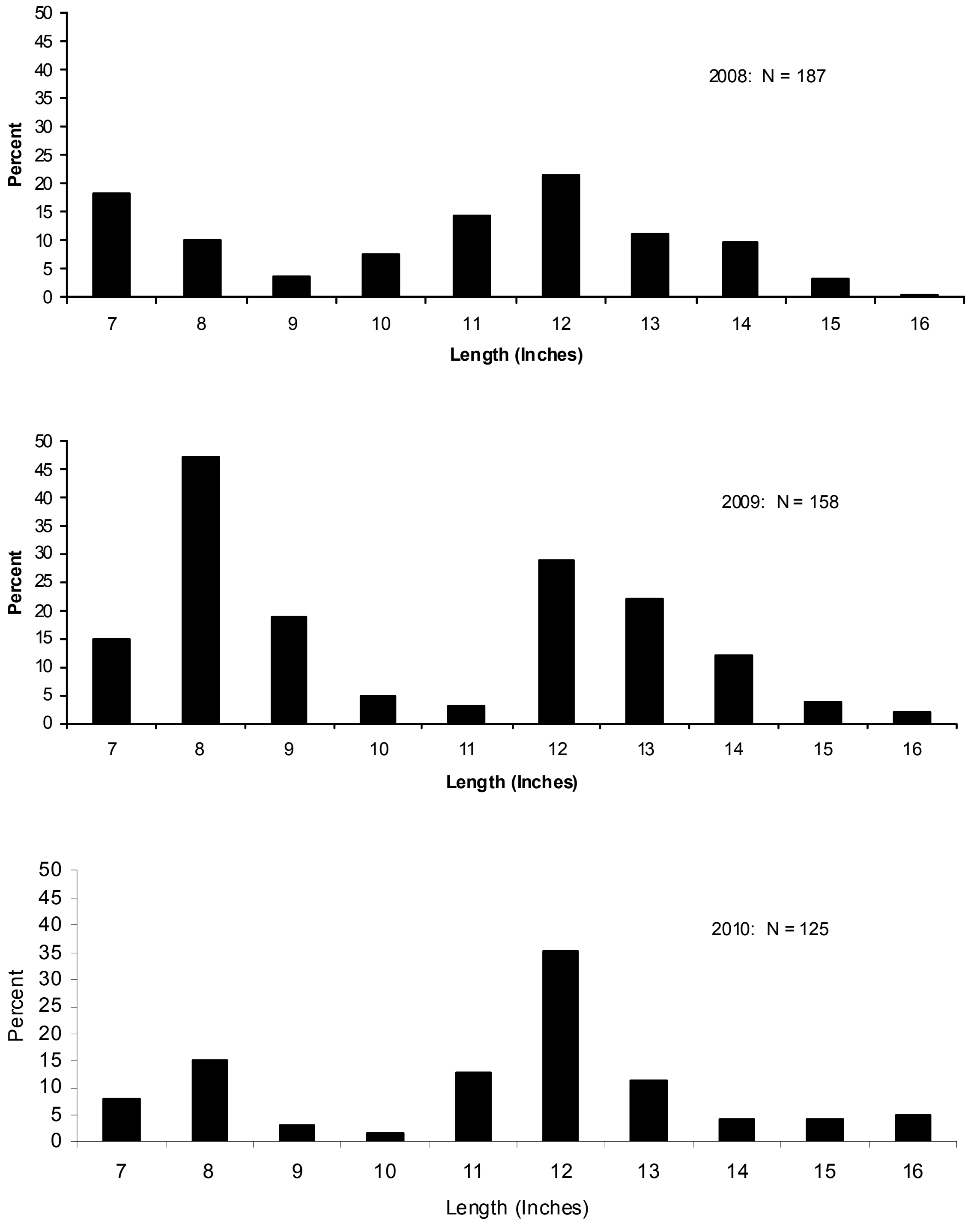


Figure 12. 2008 to 2010 length frequency distribution for white bass collected by combined OK-TX winter gillnetting at Lake Texoma.

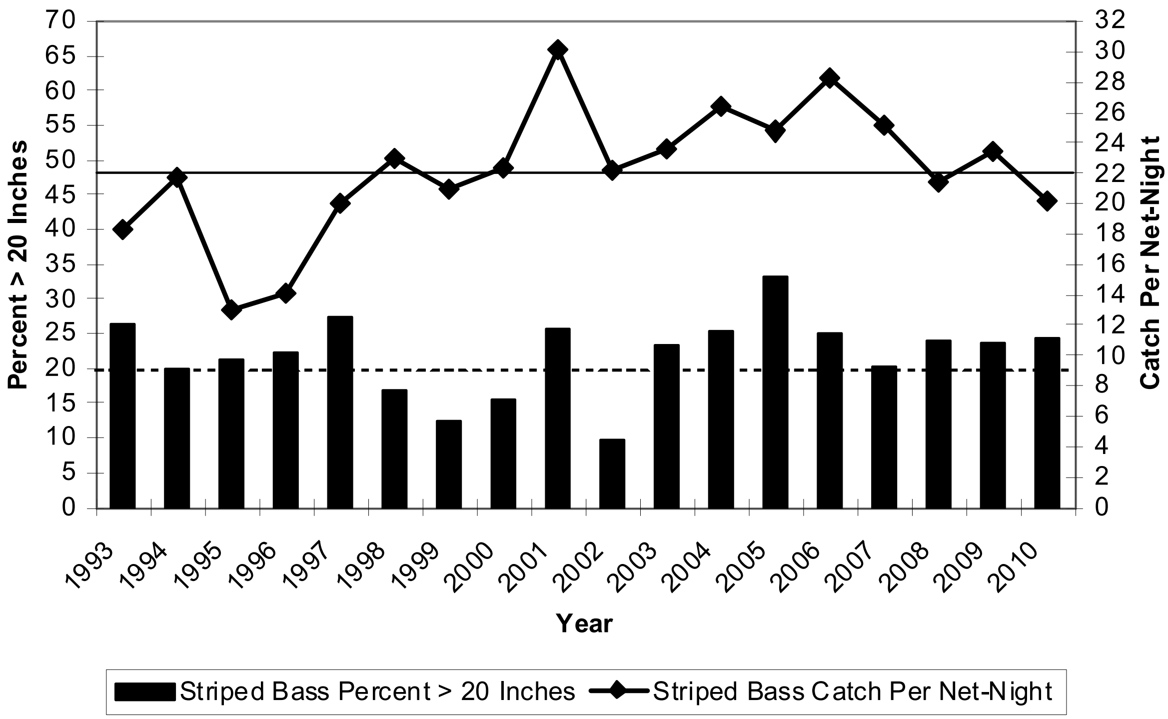


Figure 13. 1993 to 2010 catch per net-night and percent of catch > 20 inches for striped bass collected by combined OK-TX winter gillnetting at Lake Texoma. The solid horizontal line (22 fish/net-night) and dotted horizontal line (20% > 20 inches) designate target levels.

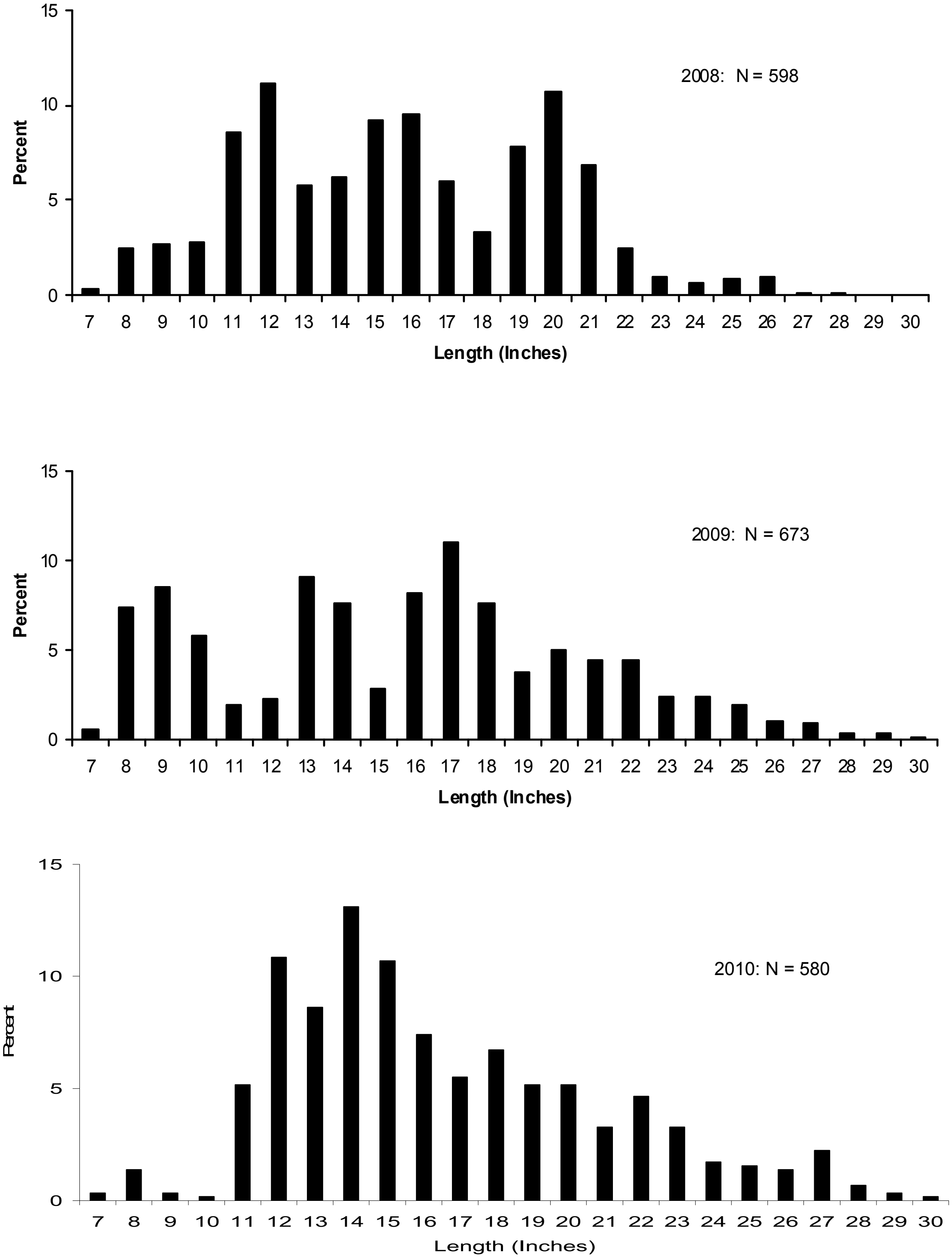


Figure 14. 2008 to 2010 length frequency distribution for striped bass collected by combined OK-TX winter gillnetting at Lake Texoma.

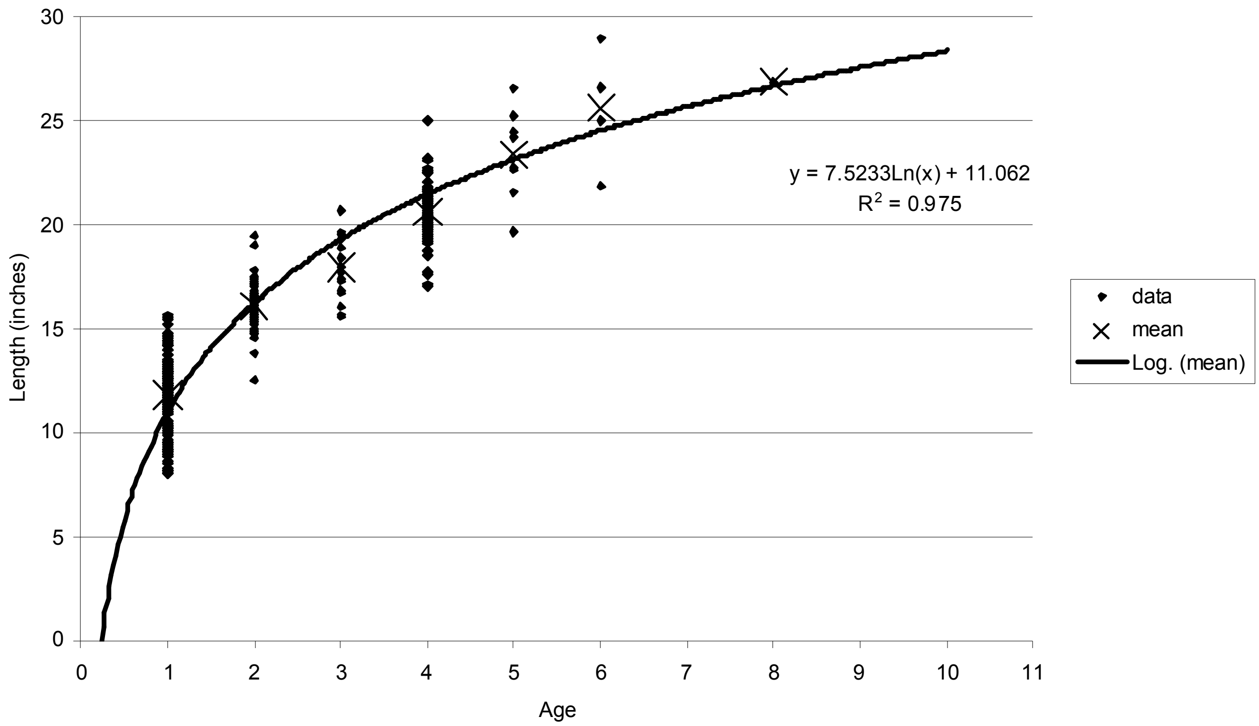


Figure 15. 2008 Length at age data for striped bass collected by gillnetting at Lake Texoma. N = 398.

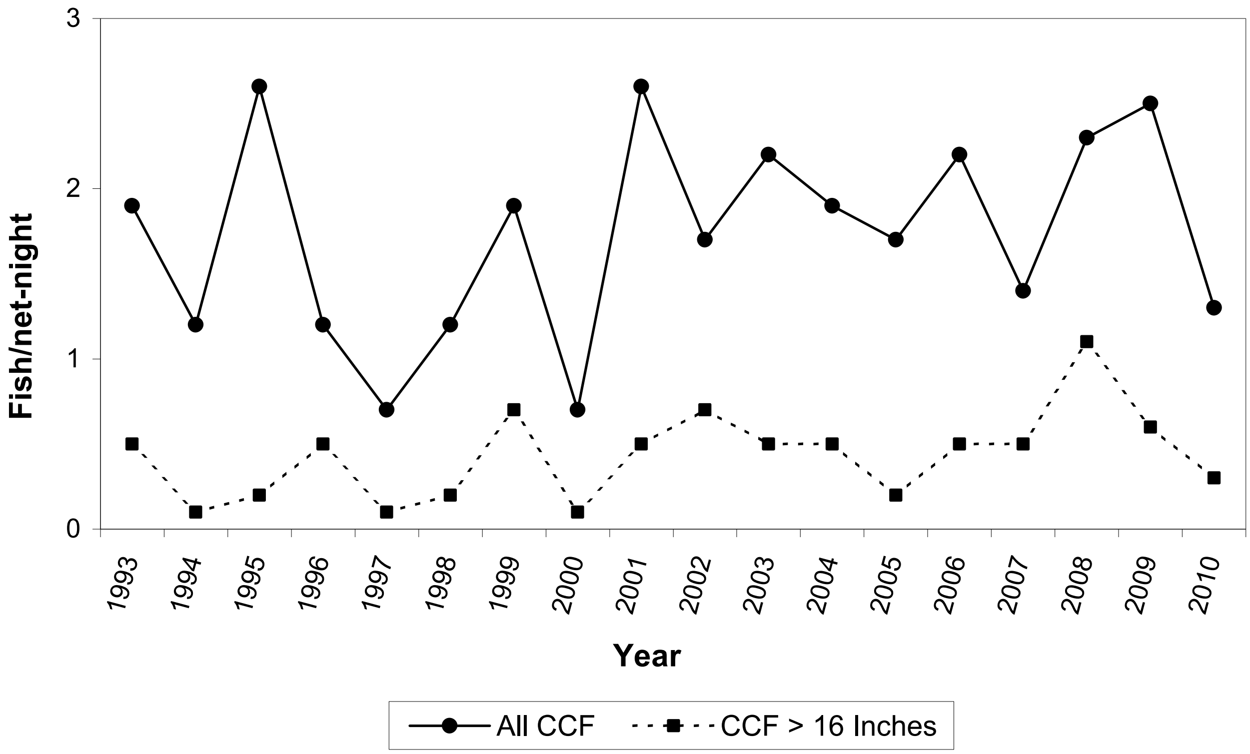


Figure 16. 1993 to 2010 catch rates for all channel catfish and channel catfish > 16 inches collected by combined OK-TX winter gillnetting at Lake Texoma.

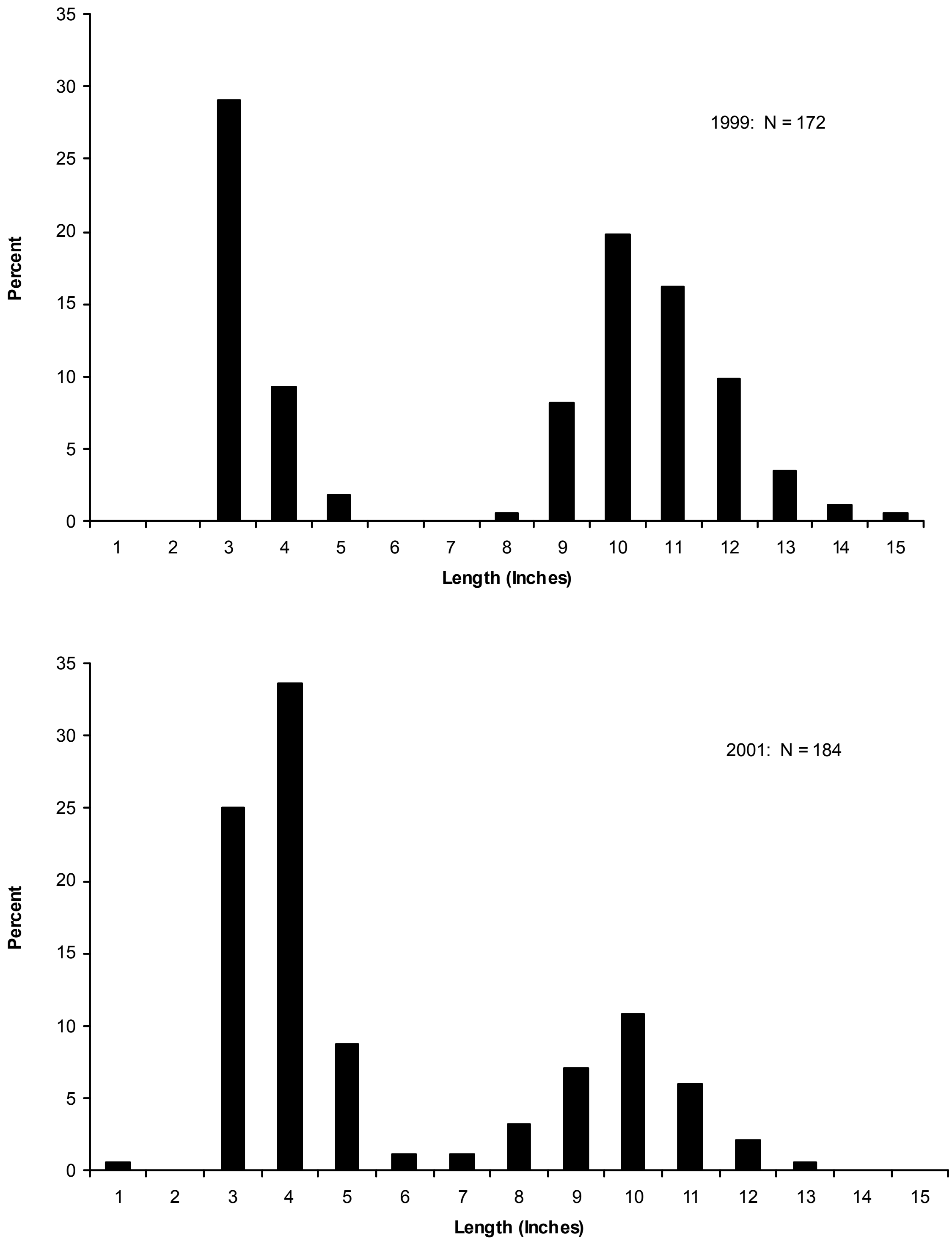


Figure 17. 1999 to 2001 length frequency distribution for all crappie collected by trap netting at Lake Texoma.