

PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

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FEDERAL AID PROJECT F-30-R-35

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2009 Survey Report

Lake Palestine

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SURVEY AND MANAGEMENT SUMMARY

The Lake Palestine fish community was surveyed from June 2009 through May 2010 using electrofishing, gill netting, and trap netting. A vegetation survey was conducted in September 2009. A roving creel survey, conducted from June 2009 through May 2010, collected angler use and harvest information. This report summarizes results of these surveys and contains a management plan based on those findings.

- **Reservoir Description:** Lake Palestine is a 23,434-acre reservoir on the Neches River, Texas, built to provide water for municipal and industrial purposes. Boat access is adequate, but public bank angler access is limited to public boat ramps or at bridge crossings (where parking is limited). None of the public boat ramps have facilities marked as handicap-specific, but the courtesy pier nearest the dam has guard rails making wheelchair accessibility possible. Overall coverage of submersed aquatic vegetation remains below 5%.
- **Management History:** Important sport fish include sunfishes, largemouth bass, white bass, palmetto bass (white x striped bass), blue catfish, channel catfish, white crappie, and black crappie. Florida largemouth bass stockings were conducted in 2008 and 2009. The 12-inch length limit for white bass reverted to the statewide 10-inch limit in September 2003. Biennial monitoring of largemouth bass, temperate basses, and catfishes was conducted. Palmetto bass were stocked in 2007, 2008, and 2009 at a reduced rate due to limited hatchery production. Vegetation surveys identified water hyacinth and giant salvinia in the system; mechanical control of both species was successful.
- **Fish Community**
 - **Prey species:** Threadfin shad and gizzard shad are still present in the reservoir but electrofishing catch rates were lower than in previous surveys. Redear and bluegill sunfishes ≤ 4 inches also exhibited lower electrofishing catch rates than previous surveys but continue to provide adequate prey for sport fishes.
 - **Catfishes:** Channel catfish size distribution and growth (Ott and Bister 2002) were poor. Blue catfish size distribution was better than channel catfish and these two species account for the majority of directed angler effort.
 - **Temperate basses:** Abundance of white bass continued to be low. Gill net catch rate of palmetto bass was low and reflect low stocking rate. Angler effort has declined and may be related to low target-fish abundance.
 - **Largemouth bass:** Largemouth bass size distribution was better than previous surveys and reflects a strong 2007 year class. Body condition and growth rate were good. Directed angler effort for largemouth bass has declined but angler success has improved.
 - **Crappie:** White and black crappie trap net catch rates continue to be low but body condition is good. Crappie is the second most sought after species group and angler catch rate has increased.
- **Management Strategies:** Conduct fall electrofishing in 2011 to assess largemouth bass population parameters and Florida largemouth bass genetics. Consider modifications to catfish harvest regulations; conduct additional gill netting in 2012 to monitor catfish population dynamics. Promote Lake Palestine angling opportunities by way of news releases. Continue requesting palmetto bass stocking annually. Continue soliciting partners or funding for a Lake Palestine aquatic habitat enhancement program. Continue monitoring invasive exotic species as necessary.

INTRODUCTION

This document is a summary of fisheries data collected from Lake Palestine from June 2009 through May 2010. The purpose of this document is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other species of fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2009-2010 data for comparison where appropriate.

Reservoir Description

Lake Palestine is a 23,434-acre reservoir constructed in 1962 (enlarged to present size in 1971) on the Neches River, Texas, to supply water for municipal and industrial purposes. The reservoir is located in Cherokee, Anderson, Henderson, and Smith Counties and is operated and controlled by the Upper Neches Municipal River Authority. Lake Palestine is hypereutrophic with a mean TSI *chl-a* of 61.1, which was higher than previous samples (Texas Commission on Environmental Quality 2008). The littoral zone consists of a variety of physical habitat types (Ott and Bister 2002). The majority of the shoreline is featureless (55%), while combinations consisting of bulkhead, eroded shoreline, rocky shoreline, and boat docks make up the remainder. Previous habitat surveys have documented numerous aquatic vegetation species; however, vegetation presently occupies approximately <5% of the total surface area. Native submersed and emergent species are present, but the exotic species hydrilla (*Hydrilla verticillata*) is the most abundant. Other non-native species include Alligator weed (*Althernanthera philoxeroides*) and water hyacinth (*Eichornia crassipes*). Standing timber is present throughout the reservoir but is in decline due to decomposition at the water line. Other descriptive characteristics for Lake Palestine are found in (Table 1).

Boat access is adequate, but bank angler access is limited. Boats can be launched from 16 boat ramps surrounding the lake, of which seven are designated as public access. There are no handicap-specific facilities, but most are accessible.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Beck and Ott 2006) included:

1. Evaluate largemouth bass (*Micropterus salmoides*) allele frequencies in fall of 2007. Additional stockings may be recommended pending analysis.
Action: Electrofishing was conducted in 2007 and 2009, and genetic analysis was conducted in 2007. Stocking was conducted in 2008 and 2009.
2. Continue monitoring size distribution and growth of channel and blue catfish (*Ictalurus punctatus* and *I. furcatus*) in spring 2008; if the trend in poor growth continues, modifications to length limits may again be recommended.
Action: Gill netting was conducted in spring 2008 and size distribution had improved. Changes in harvest regulations were postponed pending development of a statewide catfish management plan and results of a blue catfish slot-length limit evaluation on select reservoirs in Texas.
3. Provide news releases to area anglers encouraging harvest of catfish species, and inform them of alternative methods to possibly increase chances of catching trophy blue catfish.
Action: News releases promoting the Lake Palestine catfish fishery have been supplied to the media. An assessment of slot-size regulations to promote trophy blue catfish has been initiated on several other reservoirs and may be pertinent to Lake Palestine. A new water body record blue catfish (64.62 lbs, 46.5 in) was submitted in March 2010.
4. Continue building and maintaining working relationships with the Upper Neches River Municipal Water Authority and discuss strategies for increasing bank access.
Action: Discussions with the controlling authority have not resulted in construction of new bank access but have emphasized exotic vegetation such as water hyacinth (*Eichhornia crassipes*) and giant salvinia (*Salvinia molesta*) control to maintain access at ramp areas.

5. A research pre-proposal for assessing alternate year stocking of palmetto bass has been approved.

Action: Project has not progressed to the data collection phase.

Harvest regulation history: Sport fishes in Lake Palestine are currently managed with statewide regulations (Table 2). An experimental 12-inch length limit was established on September 1, 1992, and at that time, Lake Palestine was defined (for law enforcement purposes) as being in Anderson, Cherokee, Henderson, and Smith Counties. The following year (1993), the same four counties and the Neches River (Smith, Henderson, and Van Zandt Counties), Kickapoo Creek (Henderson County), and Flat Creek (Henderson County), were included in the 12-inch minimum-length limit. The experimental regulation was removed and Lake Palestine reverted to the statewide 10-inch minimum-length limit for white bass on September 1, 2003. No additional changes in harvest regulations have been made since the last report in 2006.

Stocking history: Palmetto bass (*Morone saxatilis* x *M. chrysops*) and Florida largemouth bass (*M.s. floridanus*) (FLMB) have been the most frequently stocked species at Lake Palestine. Palmetto bass fingerlings were first stocked in 1987. Stocking continues to maintain the fishery. Largemouth bass were stocked in 1971, and the population has been self-sustaining since. FLMB bass were initially stocked in 1981 and have been stocked strategically since then to enhance the trophy potential of the fishery. Lake Palestine was initially stocked with channel and blue catfish in 1971. Supplemental stockings of blue catfish were conducted in the late 1970s and mid 1980s; however, the population is currently self-sustaining. Walleye (*Sitiosedion vitreum*) were stocked in the mid 1970's, but the population did not persist and additional stockings were not conducted. Threadfin shad (*Dorsoma petenense*) were stocked as adults (1984) and have not required supplemental stocking. A complete stocking history is found in Table 3.

Vegetation/habitat history: The aquatic vegetation community has historically been low in diversity and limited in distribution. Native emergent species were present along the perimeter of the reservoir but occupied little total area. In 2001, the emergent vegetation occupied 46 miles of shoreline; 34% of the total perimeter (Ott and Bister 2002). Submersed vegetation present in Lake Palestine was sparse, and was reported to cover less than the desired 20% of the littoral zone in 2001 (Ott and Bister 2002). The majority of the submersed vegetation present was the exotic aquatic invasive species hydrilla, and was concentrated in the Kickapoo arm located at the north end of the reservoir. Other non-native invasive species present included alligator weed, water hyacinth, and elephant ear (*Colocasia spp.*) Giant salvinia was detected and removed in 2008 and 2009; mechanical control of water hyacinth is on-going. Additional shoreline development has slowed (Table 4).

Local interest groups have established restoration and habitat improvement projects. The Palestine Cypress Project began in 1996 and continues to date. Approximately 3,500 bald cypress (*Taxodium distichum*) trees have been planted in the upper end of the reservoir to replace the native fallen timber. A funding proposal was prepared and submitted through the Southeastern Aquatic Resources Partnership for a habitat enhancement program on the reservoir; however, the proposal was not funded.

METHODS

Fishes were collected by electrofishing (2 hours at 24, 5-min stations), gill netting (15 net nights at 15 stations), and trap netting (15 net nights at 15 stations). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing and, for gill- and trap-netting, as the number of fish per net night (fish/nn). A vegetation survey was conducted in September 2009. Roving creel surveys were conducted from June 2009 through May 2010. Surveys consisted of 9 creel days per quarter (4 weekdays and 5 weekend days). All survey dates were randomly selected and all surveys were conducted during daylight hours according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2009).

Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution

(PSD), as defined by Guy et al. (2007)], and condition indices [relative weights (W_r)] were calculated for target fishes according to Anderson and Neumann (1996). Index of vulnerability (IOV) was calculated for gizzard shad (DiCenzo et al. 1996). Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE statistics and for creel statistics and SE was calculated for structural indices and IOV. For white bass, ages were determined using otoliths from 11 specimens with lengths ranging from 9.2-10.8 inches; for palmetto bass ages were determined using otoliths from 10 specimens with lengths ranging from 17.1-18.7 inches, for largemouth bass, ages were determined using otoliths from 13 specimens with lengths ranging from 13.2-14.8 inches. Microsatellite DNA analysis was conducted on a 30-fish sample of age-0 fish in 2007 to determine largemouth bass genetic composition. Prior to 2005, genetic analysis was done by electrophoresis. Water level data were obtained from the United States Geological Survey web site (USGS 2009).

RESULTS AND DISCUSSION

Habitat: A comprehensive vegetation survey of the littoral zone was conducted in September 2009 (Table 4). Hydrilla continued to be the most abundant submersed species present but occupied <4% of the reservoir and was confined to a shallow bay in the Kickapoo Creek arm above the SH 315 bridge. American pondweed (*Potamogeton nodosus*), fanwort (*Cabomba caroliniana*), and muskgrass (*Chara vulgaris*) were also present in this area but at much lower abundance. Native floating species: duckweed (*Lemna minor*) and frog's-bit (*Limnobium spongia*) occupied approximately 620 acres in the same general area as the hydrilla. Non-native water hyacinth occupied approximately 1 acre in the Hisaw/Ledbetter arm of the reservoir and in a canal north of Flat Creek where it is under mechanical control. Native and non-native emergent species were present in a scattered distribution along the perimeter of the shoreline. Water primrose (*Ludwigia spp.*) was the only species that occupied a substantial area (~330 acres). Other native species present included: American lotus (*Nelumbo lutea*), arrowhead (*Sagittaria spp.*), cattail (*Typha spp.*), giant cutgrass (*Zizaniopsis miliacea*), maidencane (*Panicum hemitomons*), unnamed *Panicum (P. spp.)*, smartweed (*Polygonum pensylvanicum*), spatterdock (*Nuphar lutea*), and water willow (*Justicia americana*). Non-native emergent species included alligatorweed and elephant ear.

Creel: Total annual angling effort was 223,497 hours in 2009/2010 and had declined approximately 30% from the previous estimate of 313,766 hours in 2005/2005 but was similar to 227,768 hours of effort in 2001/2002 (Table 6). Annual estimate of direct angler expenditures (\$1,079,536) declined in proportion to decreased effort. Directed angling effort was highest for catfish (42.6%) followed by crappie (18.8%) and black basses (17.4 %); (Table 5). The proportion of directed effort for temperate basses has declined from 9.1% in 2001/2002 to only 2.7 % in 2009/2010 and likely reflects reduced availability of palmetto bass.

Prey species: Total catch rate of most prey species declined in 2009 compared to 2007. The 2007 electrofishing catch rates were unusually high, most likely due to high sustained water level (Figure 1) and inundated terrestrial vegetation during summer in that year. Electrofishing catch rate of gizzard shad (*D. cepedianum*) was low (45/h) in 2009, and had declined since 2007 (157/h) and 2005 (183/h); (Figure 2). Although catch rate was low, Index of Vulnerability for gizzard shad was 59, indicating almost 60% were available as prey (Figure 2). Electrofishing catch rate of threadfin shad was 39/h (Appendix A); down from 1,191/h in 2007 (unpublished data) and 723/h in 2005 (Beck and Ott 2006). Electrofishing catch rate of sunfishes <4 inches in length was also lower than in 2007. Electrofishing catch rate of bluegill (*Lepomis macrochirus*) (136.5/h); (Figure 2) was lower than 2007 (276.5/h) but similar to 2005 (145.0/h). Redear sunfish (*L. microlophus*) catch rate (29.0/h); (Figure 3) was higher than 2007 (13.5/h) but lower than 2005 (43.5/h). It is likely that low abundance of aquatic vegetation limits reproduction and recruitment of sunfishes. Mean W_r for bluegill and redbreast sunfish was >90 indicating good body condition. Sunfishes accounted for approximately 1% of the directed angler effort in 2009/2010 (Table 7) and most anglers reported targeting sunfish as bait for other species. However, bluegill up to 8 inches in length were observed in the creel (Figure 5) and it is likely these were retained for human consumption.

Catfish: Catfish accounted for an estimated 95,132 angler-hours of directed effort (4.1 h/acre) during the 2009/2010 creel period (Table 8) and the proportion of angler effort directed toward catfish is higher than in the two previous creel surveys (Table 5). Angler catch rate of channel and blue catfish combined was high (2.3/h) in 2009/2010, and overall harvest was an estimated 121,174 fish (Table 9). However, anglers released an estimated 128,172 fish below legal length (more than were harvested) and <10% of the harvested fish were 16 inches or greater in length (Figure 8).

Lake Palestine has historically supported a high-density channel catfish population with a sub-optimal size distribution that has precipitated angler complaints about few legal-length individuals (Ott and Bister 2002). Following a species specific fish kill in summer 2005 (Beck and Ott 2006) channel catfish catch rates in gill nets declined by approximately 50% and size distribution temporarily improved. Gill net catch rate of channel catfish in 2010 (17.1/nn) was similar to 2008 (16.3/nn) but approximately 25% higher than 2006 (13.9/nn); (Figure 7). The ratio of legal-length to all-size fish has declined somewhat from the past two surveys and likely contributes to the high angler release rate. Only approximately a third of the channel catfish collected by gill net in 2010 were of legal length or longer compared to approximately half legal length and longer in the previous survey. Although the present size distribution does provide a fishery, anglers interviewed during the present creel survey again expressed their frustration at the high release-to-retention ratio. This situation will need to be monitored for relapse of the poor size distribution of the mid 1990s. Relative weight was still ≥ 90 for most size classes but was not as good as the ≥ 100 exhibited in 2006.

Gill net catch rate of blue catfish (10.7/nn) was not as high as channel catfish but size distribution was more desirable (Figure 6). Few blue catfish less than legal length were collected and fish up to 25 inches in length were more common than channel catfish; specimens as long as 40 inches in length were collected. Relative weights of blue catfish were generally better than channel catfish. Lake Palestine is also capable of providing a "trophy" blue catfish fishery, and a new lake record (64.62 lb, 46.5 inch) was submitted to the angler recognition program in March 2010. This specimen was determined to be from the 1987 year class based on sectioned otoliths.

Temperate basses: Angling effort directed toward temperate bass has declined as the stocking rate of palmetto bass has decreased. Throughout the 1990s, stocking rate ranged from 10 -15 fingerlings/acre (Table 3) and directed effort for temperate bass was 20,726 h in 2001/2002 (Table 5). Following a decrease in annual stocking rate to ≤ 5 /acre beginning in 2003, directed effort declined to 6,107 h in 2009/2010. Angler catch rate of temperate bass was 1.0/h in 2009/2010 (Table 7) and total estimated harvest was at its lowest level, 1,574 fish. No harvest of palmetto bass was documented in the current creel survey (Table 9, Figure 11); however, survey design was not specific to temperate basses.

The gill net catch rate of white bass was 2.0/nn in 2010 (Figure 9) similar to 2008 (2.0/nn) and 2006 (1.4/nn). Gill net catch rate of white bass peaked in 2002 at 7.1/nn (Ott and Bister 2002) and has remained low but stable since then. Ott and Bister (2002) suggested high catch rates in 2002 may have been related to high spring flows in the Neches river in 2001; however, this trend was not observed in 2008 following high flows and reservoir elevation in spring 2007 (Figure 1). Despite low relative abundance, size distribution of white bass is good with the majority of specimens collected by gill nets at or above the minimum length limit. Relative weight (W_t) for most size classes was ≤ 100 and indicative of adequate prey availability. The average age of white bass at 10 inches (range = 9.2 to 10.8 inches) was 1.0 year (N=11; all were age 1).

Gill net catch rate of palmetto bass was 2.2/nn in 2010 (Figure 10) and was within the recent historical range of 2.7/nn in 2006 and 1.2/nn in 2008. Gill net catch rates for the last three surveys are only 0.14 to 0.33 of the historical high in 1998 (8.4/nn), (Beck and Ott 2006), and are likely related to reduction in annual stocking rate. In 2010, gill net size distribution was bi-modal with one peak at the 17-inch group (corresponding to the 2008 stocking). A second peak was present at the 23-inch group (presumably corresponding to the 2007 stocking); the 2009 year class was not well represented. Growth however is excellent, average age of palmetto bass at 18 inches (range = 17.1 to 18.7 inches) was 2.0 years (N=10).

Largemouth bass: The proportion and magnitude of overall angling effort directed toward largemouth

bass has declined over the past decade. In 2009/2010, fishing effort for largemouth bass represented only 17.4% of total effort (1.7 hr/acre) (Tables 5, 10). Although directed effort has declined, angler catch rate has increased from 0.5/h (2001/2002) to 1.1/h in 2009/2010 (Table 10). In 2009/2010 anglers released 70% of the legal-length largemouth bass caught (Table 10). However, 83% of the fish in possession by anglers during surveys were tournament-retained (TR) and were reportedly to be released following weighing (Fig 13).

Total electrofishing catch rate (37.5 fish/h) declined compared to 2007 (63.0 fish/h) but was similar to 2005 (39.0 fish/h) (Figure 12). The greatest reduction in catch rate compared to 2007 was in sub-stock size fish; catch rate of stock-size fish was the same as 2007 (26.0 fish/h) and higher than 2005 (14.0 fish/h). It is likely that the high catch rate of sub-stock size fish in 2007 was a function of high recruitment resulting from abundant rainfall and flooded terrestrial vegetation in summer of that year (Figure 1). That strong year-class resulted in greater abundance of two-year-old fish in 2009. Proportional size distribution (PSD) and PSD-14 are improved over previous surveys and indicate a well balanced population. Increased abundance of fish ≥ 14 inches in 2009 is also likely due to the strong 2007 year-class. Average age of largemouth bass at 14 inches (range = 13.2 to 14.8 inches) was 1.8 years (N=13, range = 1-2), and mean W_r for most inch classes was ≥ 95 . Rapid growth and good body condition are indicative of adequate prey availability despite the low prey catch rates documented for some species in electrofishing. Genetic analysis of largemouth bass was not conducted in 2009 because FLMB were stocked that year. However, of the 30 age-0 fish collected for microsatellite DNA analysis in 2007, 50% expressed FLMB alleles and no pure FLMB were collected (Table 11).

Crappie: Crappie moved from the third to the second most sought after sport fish group at Lake Palestine (surpassing largemouth bass in 2009-2010) accounting for 18.8% (1.8 h/acre) of total directed effort (Table 5, 12). Angler catch rate of crappie (2.2/h) was higher than in 2001/2002 (1.4/h) or 2005/2006 (1.7/h). Anglers harvested an estimated 45,273 crappie (species combined) but harvest was still relatively low (1.9/acre). Although most (63%) of the crappie harvested were less than 12 inches length, individual specimens of black crappie up to 16 inches in length and white crappie 18 inches in length were harvested (Figure 16).

Trap net catch rates of both white crappie (0.4 fish/nn) and black crappie (0.5/fish nn) were low in 2009. Both species have exhibited a general declining trend in trap net catch rate compared to previous surveys (Figures 14 and 15). Although size distribution (PSD and PSD-10) is within the target range for both species, the low sample size makes any meaningful conclusions doubtful. Body condition (W_r) of both species is above 95 for most size classes and suggests adequate prey availability. Age-and-growth information was not collected for either species in 2009 due to low sample sizes. However, previous surveys have indicated white crappie grow to legal length by age 2 and black crappie by age 3 (Beck and Ott, 2006).

Fisheries management plan for Lake Palestine, Texas

Prepared – July 2010

ISSUE 1: Florida Largemouth bass (FLMB) fingerlings were stocked at 21 fish/acre in 2008 and 28 fish/acre in 2009 therefore no genetic analysis was conducted in fall 2009. Previous genetic analysis conducted in fall 2007 indicated over 50% of the young-of-the-year carried FLMB alleles. Although Lake Palestine has never produced a ShareLunker (largemouth bass catch weighing ≥ 13 pounds), it has come close. The lake record is 12.51 pounds and was caught in 1991 and a 12.33-pound fish was caught in spring 2010.

MANAGEMENT STRATEGY

1. Conduct optional electrofishing in fall of 2011; assess largemouth bass allele frequencies to evaluate success of prior stockings. Prepare stocking request for FLMB fingerlings at 25/acre in FY 2012 to maintain potential to produce trophy (≥ 8 pounds) specimens.

ISSUE 2: Palmetto bass stockings have not met requested level since 2002, resulting in inconsistent angler interest.

MANAGEMENT STRATEGIES

1. Request palmetto bass fingerlings at a stocking rate of 15/acre annually until procedures for stocking duration research project are finalized, then modify requests as necessary.

ISSUE 3: Historically, the channel catfish population has exhibited poor growth (presumably due to extremely high population densities resulting in intraspecific competition for food. An increase in harvest and a fish kill in the summer of 2005 (Beck and Ott, 2006) may have temporarily benefitted population dynamics. Current sampling indicated a slight reduction in the ratio of legal length to sub-legal length fish with a relatively low PSD. Changes in harvest regulations may be necessary to modify size distribution and growth.

MANAGEMENT STRATEGIES

1. Consider regulation options that liberalize harvest of small catfish.
2. Continue monitoring size distribution with optional gill netting in spring 2012.

ISSUE 4: Blue catfish continue to be under-utilized compared to channel catfish at Lake Palestine. Although some anglers target blue catfish and a trophy blue catfish fishery is developing (a new lake record [64.62 lb; 46.5 inch] was established in March 2010), this fishery could benefit from additional promotion.

MANAGEMENT STRATEGIES

1. Continue providing news releases to local media encouraging utilization of this species. Inform anglers of alternative methods to increase chances of catching trophy blue catfish.
2. Consider regulation options that promote blue catfish trophy potential.

ISSUE 5: Bank access is inadequate and limits fishing opportunities for area anglers. The Upper Neches River Municipal Water Authority (UNRMWA) has expressed interest in acquiring land to build fishing piers.

MANAGEMENT STRATEGIES

1. Continue maintaining working relationships with UNRMWA and discuss strategies to increase bank fishing access on Lake Palestine.

ISSUE 6: Aquatic vegetation is locally abundant above the SH 315 Bridge on the Kickapoo Creek arm of Lake Palestine, but the plant community is dominated by hydrilla and is relatively low in species diversity. Some emergent species are present along the shoreline of the

remainder of the reservoir but submersed vegetation is scarce. A proposal was prepared and submitted through the Southeastern Aquatic Resources Partnership for a habitat enhancement program on the reservoir; however, the proposal was not funded.

MANAGEMENT STRATEGIES

1. Continue soliciting funding for a fish-habitat enhancement program.

ISSUE 7: Water hyacinth and giant salvinia have been detected and are currently under mechanical control to prevent spread.

MANAGEMENT STRATEGIES

1. Continue reconnaissance surveys as necessary to monitor existing infestations and detect new infestations as they occur; offer technical support and discuss treatment options with the controlling authority to prevent spread.

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule includes additional electrofishing in 2011, additional gill netting in 2012, and mandatory monitoring in 2013/2014 (Table 13). The additional electrofishing survey in 2011 is necessary to provide fish for genetic analysis in an effort to evaluate stockings of FLMB. Optional gill netting in the spring of 2012 will provide additional trend data on the catfish fishery and specific growth data for blue and channel catfish.

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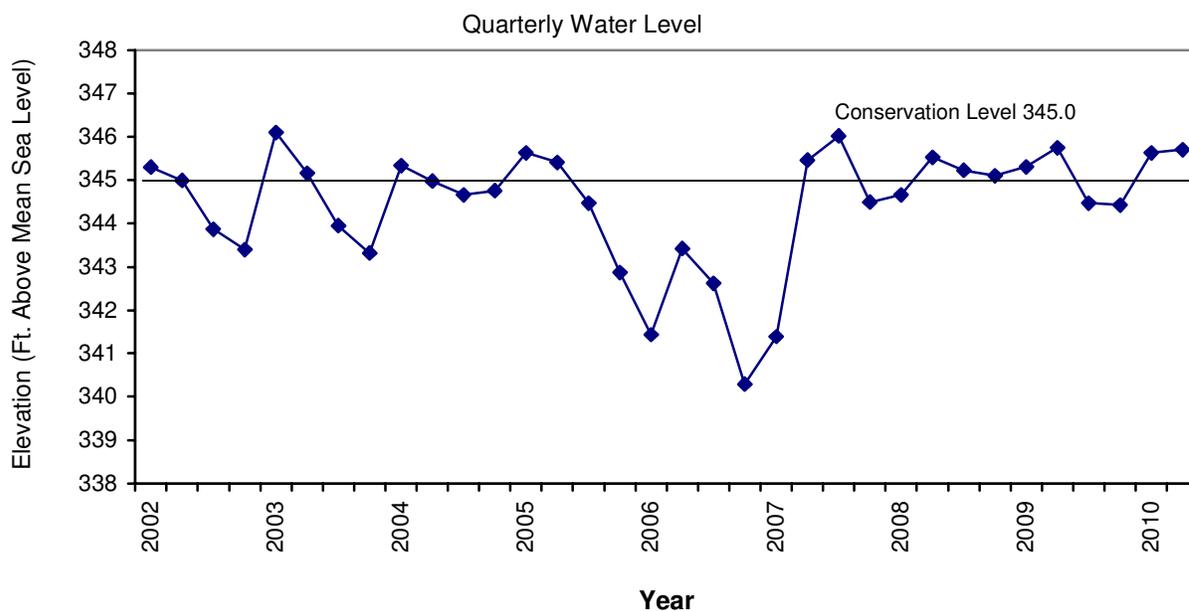


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Lake Palestine, Texas.

Table 1. Characteristics of Lake Palestine, Texas.

Characteristic	Description
Year constructed	1962, enlarged to present size in 1971
Controlling authority	Upper Neches River Municipal Water Authority
Counties	Cherokee (dam), Anderson, Henderson, and Smith
Reservoir type	Mainstream
Shoreline Development Index (SDI)	6.1
Conductivity	150 umhos/cm

Table 2. Harvest regulations for Lake Palestine, Texas.

Species	Bag Limit	Minimum-maximum length (inches)
Catfish: channel and blue, their hybrids and subspecies	25 (in any combination)	12-No limit
Catfish, flathead	5	18-No limit
Bass, white	25	10-No limit
Bass, palmetto	5	18-No limit
Bass, spotted	5	No limit
Bass, largemouth	(in any combination)	14-No limit
Crappie: white and black, their hybrids and subspecies	25 (in any combination)	10-No limit

Table 3. Stocking history of Lake Palestine, Texas. Size Categories are: FRY =<1 inch; FGL = 1-3 inches; AFGL = 8 inches, and ADL = adults.

Species	Year	Number	Size
Threadfin shad	1984	<u>2,500</u>	ADL
		2,500	
Blue catfish	1971	35,960	FGL
	1978	5,400	FGL
	1979	7,830	FGL
	1986	<u>250,140</u>	FGL
		299,330	
Channel catfish	1971	154,746	FGL
	1972	45,000	FGL
	1973	<u>126,940</u>	FGL
		326,686	
Palmetto bass	1978	139,615	FGL
	1979	227,800	FGL
	1982	295,035	FGL
	1991	257,270	FGL
	1992	390,867	FGL
	1993	1,093,700	FGL & FRY
	1994	385,747	FGL
	1995	385,400	FGL
	1996	281,670	FGL
	1997	255,021	FGL
	1998	255,217	FGL
	2002	191,250	FGL
	2003	58,530	FGL
	2004	122,131	FGL
	2005	101,117	FGL
	2007	1,195,830	FRY
2007	100,000	FGL	
2008	143,907	FGL	
2009	<u>100,937</u>	FGL	
		5,993,712	
Largemouth bass	1971	<u>1,600,000</u>	FGL
		1,600,000	
Florida largemouth bass	1981	21,410	FGL
	1982	19,000	FGL
	1983	25,500	FGL
	1984	292,310	FGL
	1997	255,500	FGL
	1998	256,518	FGL
	1999	255,000	FGL
	2000	255,472	FGL
	2004	441,191	FGL
	2005	589,360	FGL
	2008	499,961	FGL
2009	651,015	FGL	

		1.4	
		<u>3,577,445</u>	
Walleye	1974	2,580,000	FRY
	1975	2,250,000	FRY
	1976	<u>1,000,000</u>	FRY
		5,830,000	

Table 4. Structural habitat survey was conducted in 2000 (Ott and Bister 2001). Vegetation survey was conducted in 2009. A linear shoreline distance (miles) was recorded for each habitat type found. Surface area (acres) and percent of reservoir surface area was determined for each type of aquatic vegetation found.

Shoreline habitat type	Shoreline Distance		Surface Area	
	Miles	Percent of total	Acres	Percent of reservoir surface area
Bulkhead ¹	0.4	0.3		
Bulkhead and boat dock ¹	19.8	14.7		
Concrete ¹	2.8	2.1		
Eroded shoreline ¹	15.5	11.5		
Eroded shoreline & boat docks ¹	1.3	0.9		
Rip rap ¹	0.7	0.5		
Rocky shoreline ¹	3.4	2.5		
Featureless ¹	74.8	55.4		
Featureless and boat dock ¹	16.3	12.1		
Native submerged vegetation				
American pondweed			1	<0.1
Fanwort			10	<0.1
Muskgrass			tr.	tr.
Native emergent vegetation				
American lotus			10	<0.1
Arrowhead			tr.	tr.
Cattail			2	<0.1
Giant cutgrass			7	<0.1
Maidencane			7	<0.1
Panicum			27	0.1
Smartweed			1	<0.1
Spatterdock			7	<0.1
Water primrose			329*	1.4
Water willow			2	<0.1
Native floating				
Duckweed			616*	na
Frogbit			8*	na
Non-Native				
Alligatorweed			41	0.2
Hydrilla			821	3.5
Elephant ear			1	<0.1
Water hyacinth			1	<0.1
Giant salvinia			unk	unk

¹ Structural habitat features.

* Growing in combination with other species and do not represent discrete colonies.

^{unk} Identified and removed, no current infestation.

Table 5. Percent directed angler effort by species for Lake Palestine, Texas, June 2001 through May 2002, June 2005 through May 2006, and June 2009 through May 2010.

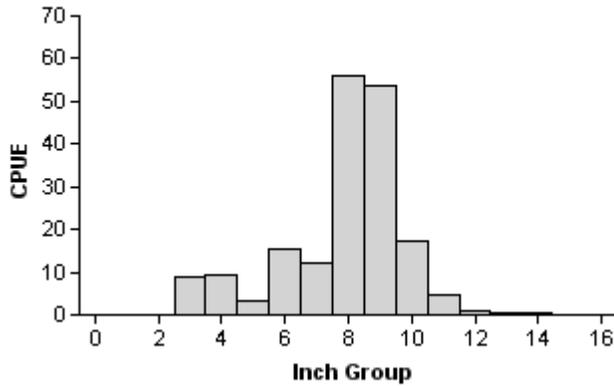
Species	Year	Year	Year
	2001/2002	2005/2006	2009/2010
Catfish spp.	37.9	35.7	42.6
Temperate basses	9.1	7.7	2.7
Sunfishes	1.7	2.3	0.9
Black basses	23.7	21.4	17.4
Crappie spp.	11.4	17.5	18.8
Anything	16.1	15.4	17.6

Table 6. Total fishing effort (h) for all species and total directed expenditures at Lake Palestine, Texas, June 2001 through May 2002, June 2005 through May 2006, and June 2009 through May 2010.

Creel Statistic	Year	Year	Year
	2001/2002	2005/2006	2009/2010
Total fishing effort	227,768	313,766	223,497
Total directed expenditures	\$763,875	\$1,590,899	\$1,079,536

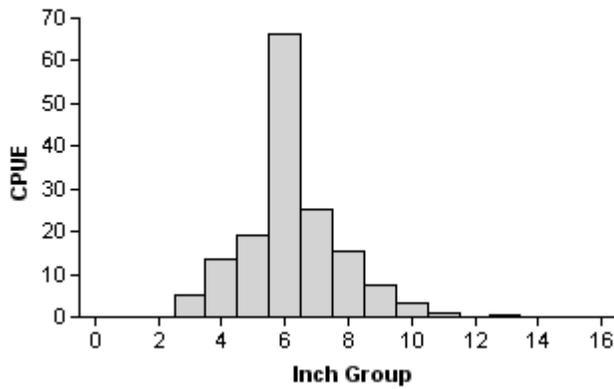
Gizzard shad

2005



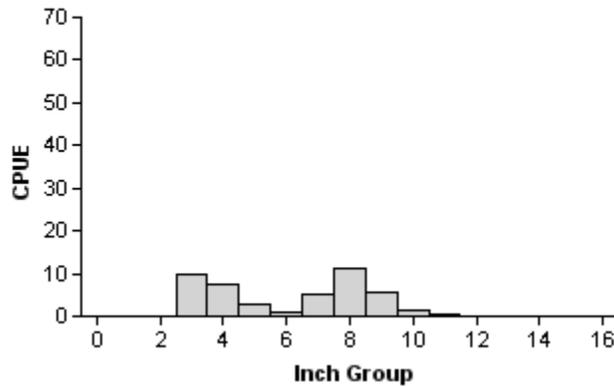
Effort = 2.0
 Total CPUE = 183.0 (16; 366)
 Stock CPUE = 145.5 (19; 291)
 IOV = 27 (5.1)

2007



Effort = 2.0
 Total CPUE = 157.0 (22; 314)
 Stock CPUE = 53.0 (26; 106)
 IOV = 82 (4.0)

2009



Effort = 2.0
 Total CPUE = 45.0 (34; 90)
 Stock CPUE = 23.5 (25; 47)
 IOV = 59 (14.2)

Figure 2. Number of gizzard shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Lake Palestine, Texas, 2005, 2007, and 2009.

Bluegill

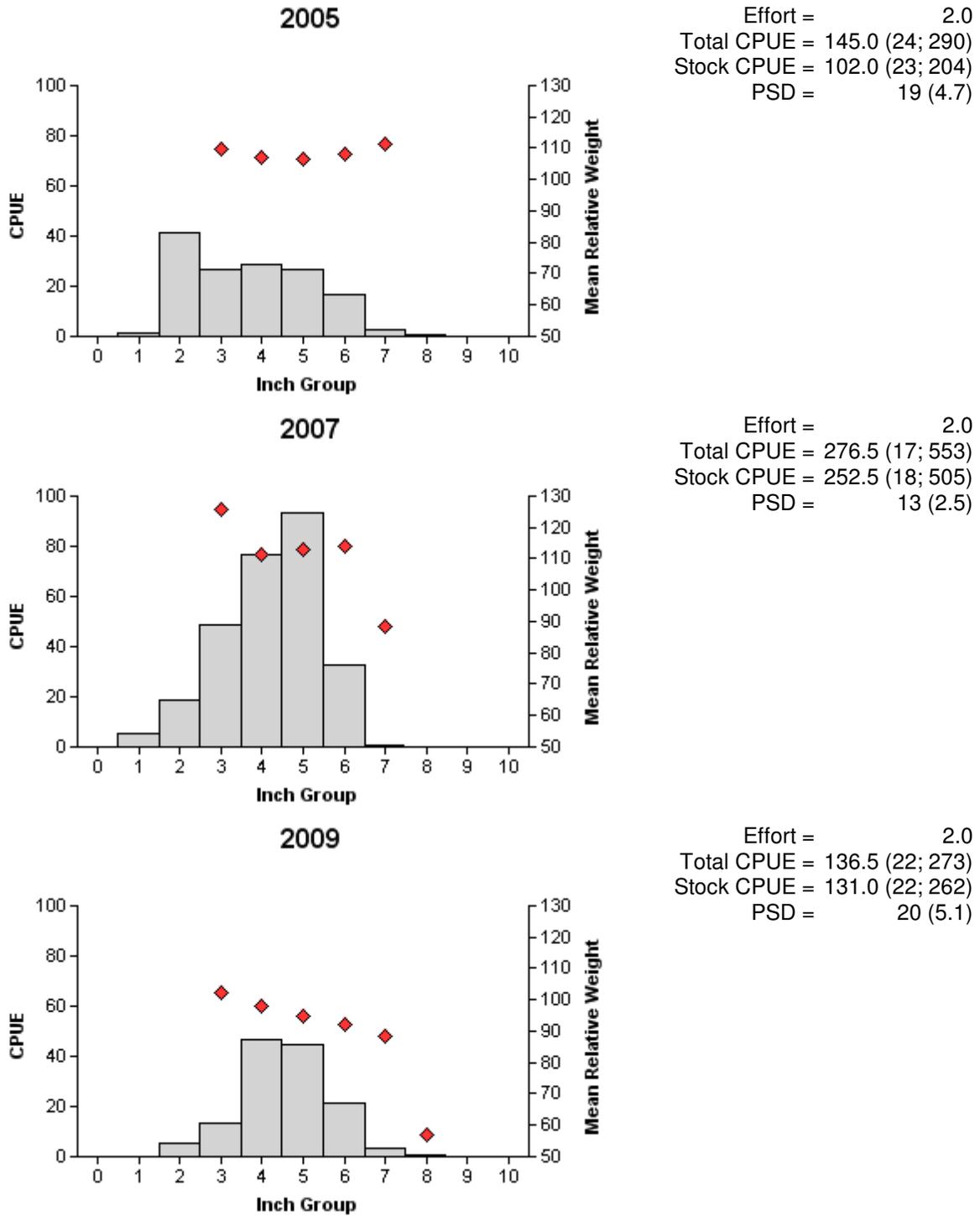
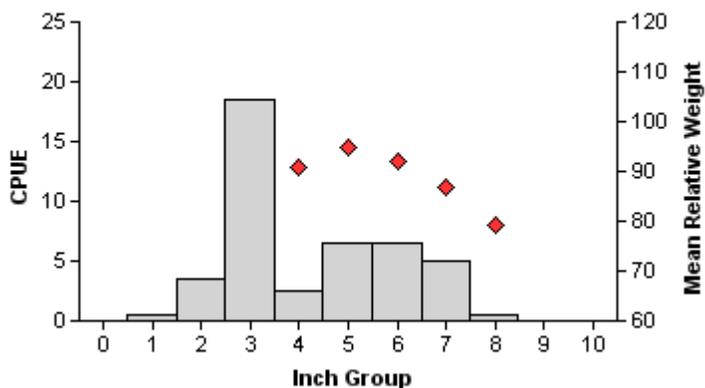


Figure 3. Number of bluegill caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE are in parentheses) for fall electrofishing surveys, Lake Palestine, Texas, 2005, 2007, and 2009.

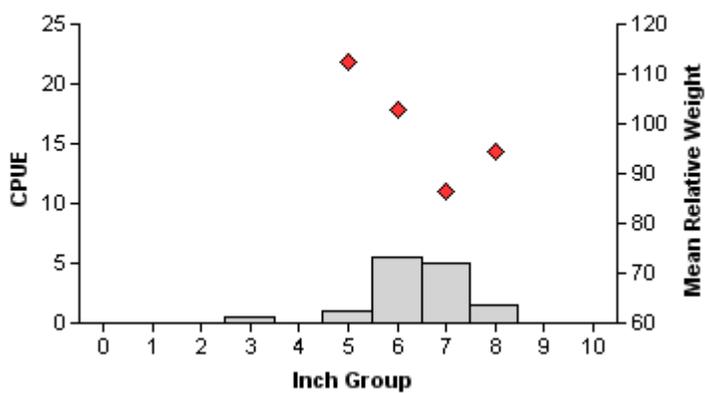
Redear sunfish

2005



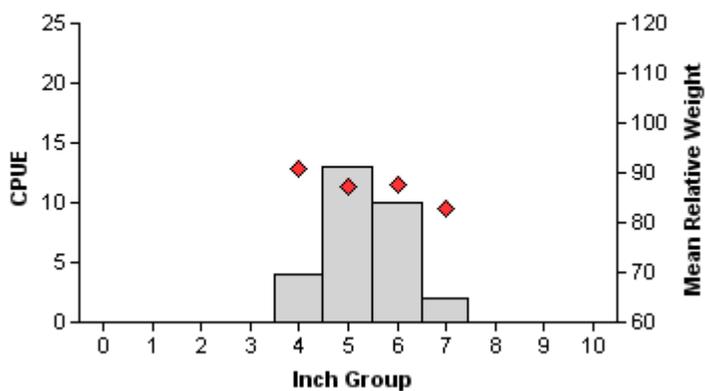
Effort = 2.0
 Total CPUE = 43.5 (30; 87)
 Stock CPUE = 21.0 (28; 42)
 PSD = 26 (12)

2007



Effort = 2.0
 Total CPUE = 13.5 (33; 27)
 Stock CPUE = 13.0 (34; 26)
 PSD = 50 (9.6)

2009



Effort = 2.0
 Total CPUE = 29.0 (42; 58)
 Stock CPUE = 29.0 (42; 58)
 PSD = 7 (2.8)

Figure 4. Number of redeer sunfish caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE are in parentheses) for fall electrofishing surveys, Lake Palestine, Texas, 2005, 2007, and 2009.

Sunfish

Table 7. Creel survey statistics for sunfish at Lake Palestine, Texas June 2001 through May 2002, June 2005 through May 2006, and June 2009 through May 2010 where total catch per hour is for anglers targeting all sunfish, and total harvest is the estimated number of sunfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year	Year	Year
	2001/2002	2005/2006	2009/2010
Directed effort (h)	3,802 (55.9)	7,282 (57.0)	1,977 (72.8)
Directed effort/acre	0.2 (55.9)	0.3 (57.0)	0.1 (72.8)
Total catch per hour	5.6 (47.3)	2.9 (45.3)	1.2 (100.0)
Total harvest	14,241 (86.4)	4,174 (123.3)	14,482 (160.0)
Bluegill	13,612 (61.12)	4,174 (123.3)	12,075 (105.6)
Redear	629 (642.8)	0	2,407 (435.0)
Harvest/acre	0.61 (86.4)	0.2 (123.3)	0.6 (160.0)
Bluegill	0.58 (61.12)	0	0.6 (105.6)
Redear	0.03 (642.8)	0	<0.1 (435.0)
Percent legal released	26	89	36

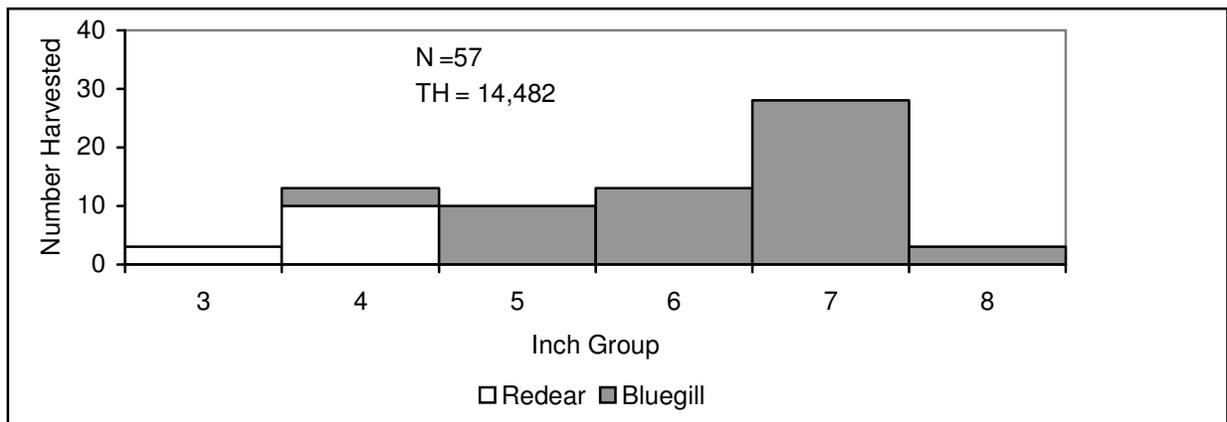


Figure 5. Length frequency of harvested bluegill and redear sunfish observed during creel surveys at Lake Palestine, Texas, June 2009 through May 2010 all anglers combined. N is the total number of sunfish observed during the angler creel survey. TH is the estimated number of harvested sunfish.

Blue catfish

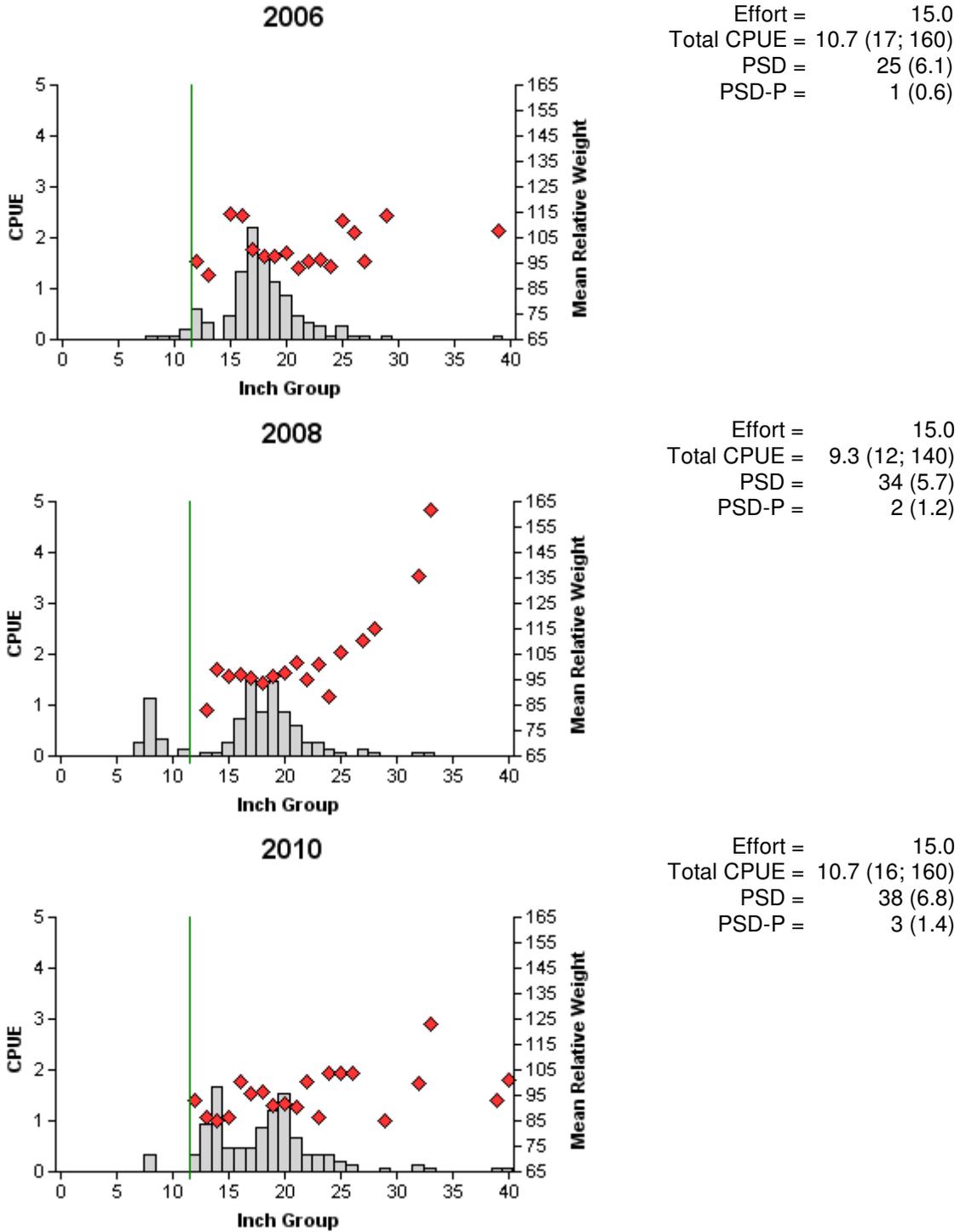


Figure 6. Number of blue catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Palestine, Texas, 2006, 2008, and 2010. Vertical lines represent length limit.

Channel catfish

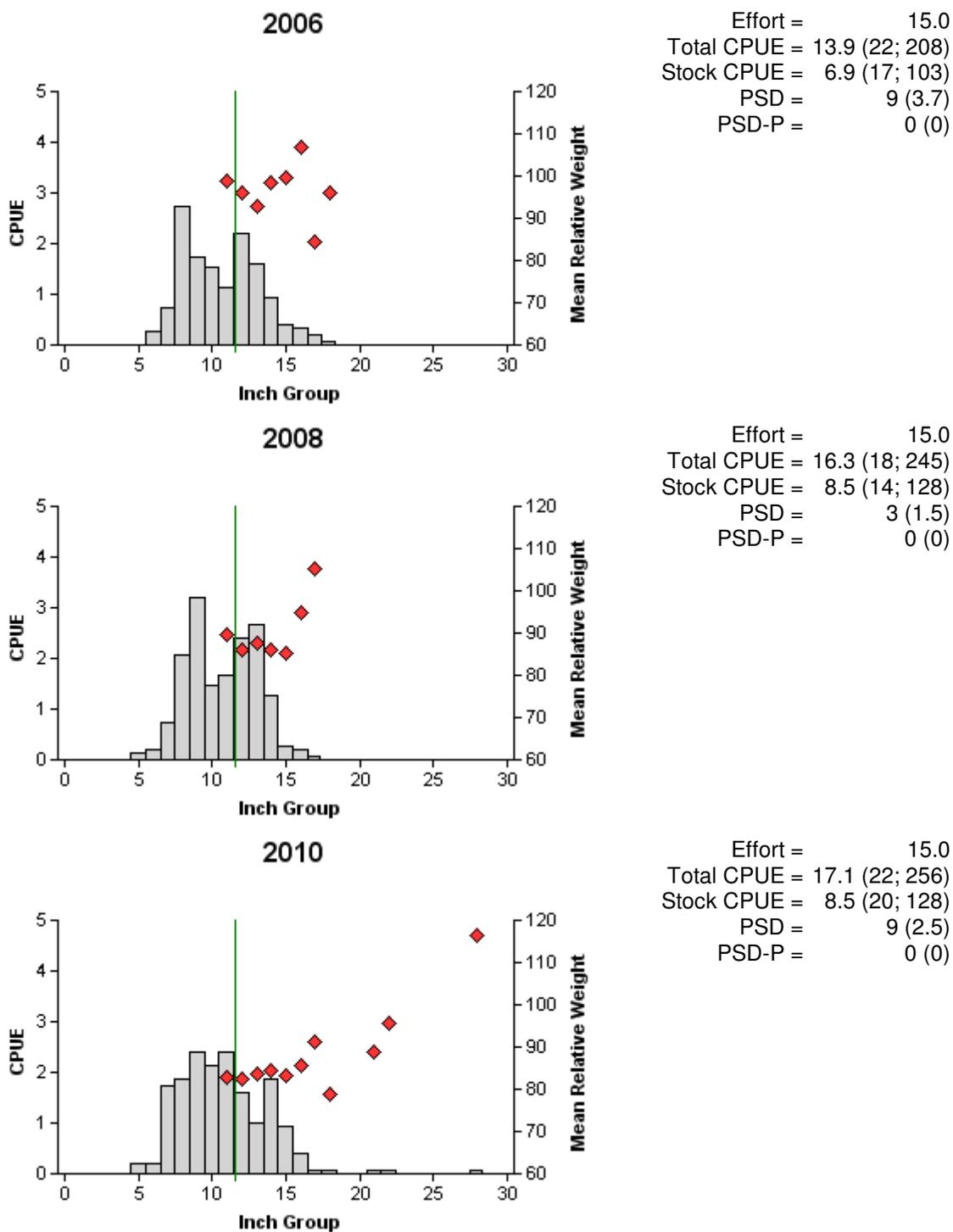


Figure 7. Number of channel catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Palestine, Texas, 2006, 2008, and 2010. Vertical lines represent length limit.

Catfish

Table 8. Creel survey statistics for catfish at Lake Palestine, Texas June 2001 through May 2002, June 2005 through May 2006, and June 2009 through May 2010, where total catch per hour is for anglers targeting catfish and total harvest is the estimated number of catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year	Year	Year
	2001/2002	2005/2006	2009/2010
Directed effort (h)	86,245 (18.4)	112,037(16.0)	95,132 (18.1)
Directed effort/acre	3.6 (18.4)	4.8 (16.0)	4.1 (18.1)
Total catch per hour	2.1 (41.0)	1.4 (43.1)	2.3 (39.1)
Total harvest	62,337 (52.2)	184,315 (28.7)	121,174 (29.3)
Blue	44,728 (32.9)	36,288 (43.3)	32,246 (38.4)
Channel	17,609 (44.1)	148,027 (26.03)	88,927 (46.2)
Harvest/acre	2.7 (52.2)	7.9 (28.7)	5.2 (29.3)
Blue	1.9 (32.9)	1.5 (43.3)	1.4 (38.4)
Channel	0.8 (44.1)	6.3 (26.0)	3.8 (46.2)
Percent legal released	17	9	5

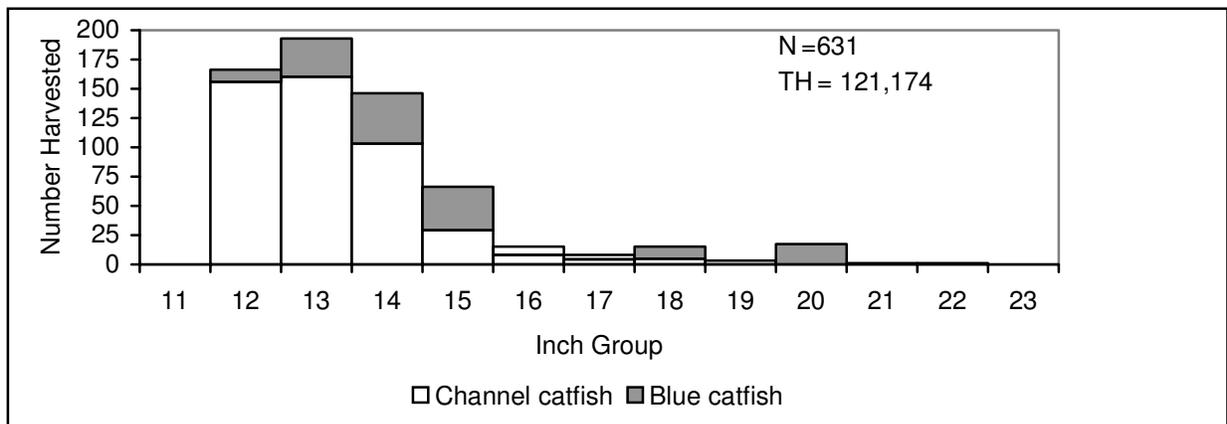


Figure 8. Length frequency of harvested catfish observed during creel surveys at Lake Palestine, Texas, June 2009 through May 2010, all anglers combined. N is the number of harvested catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

White bass

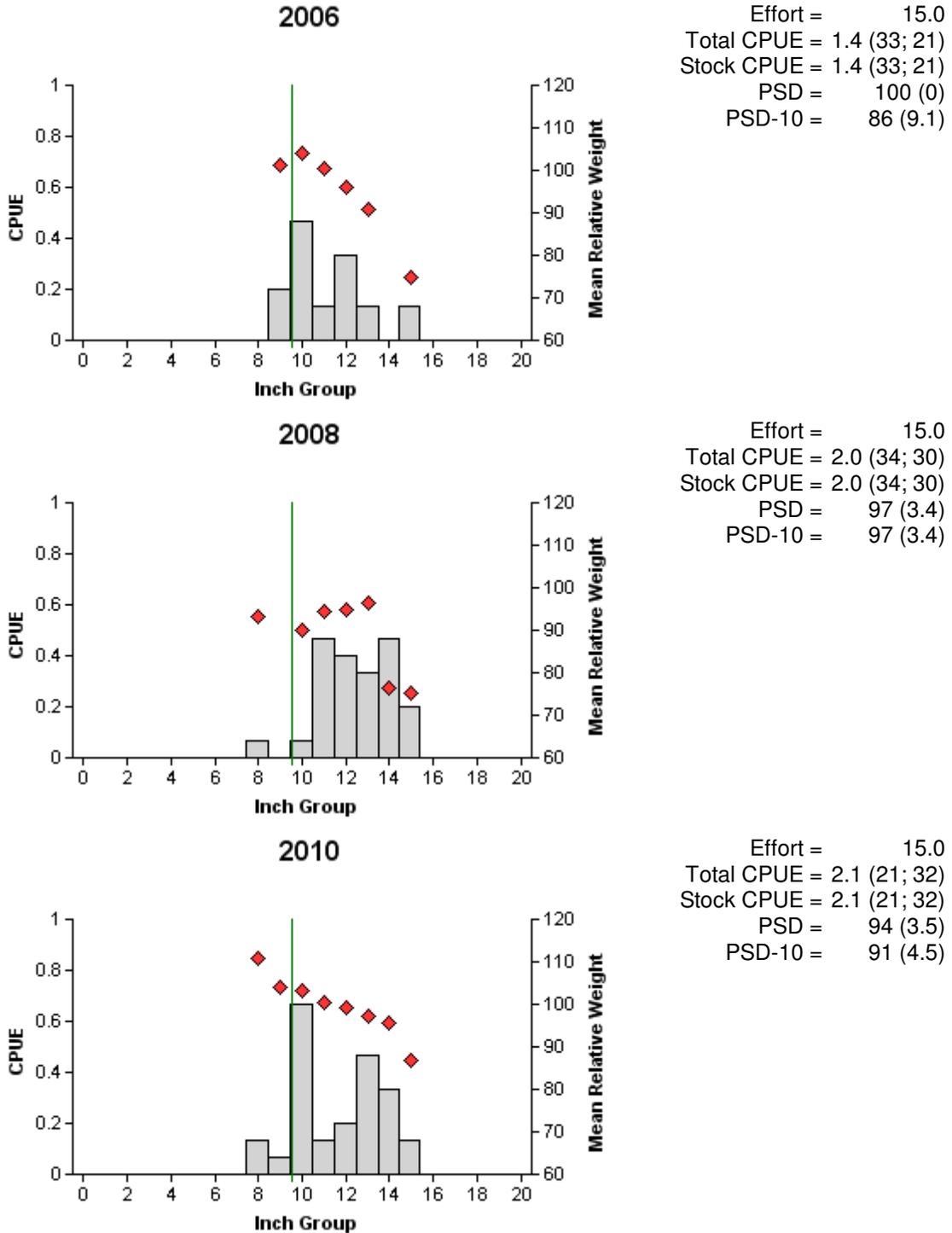
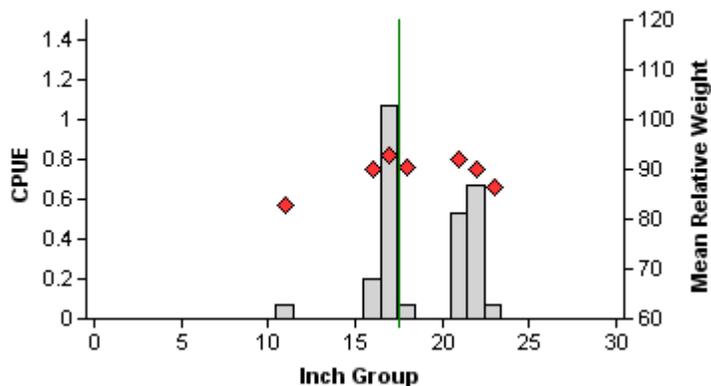
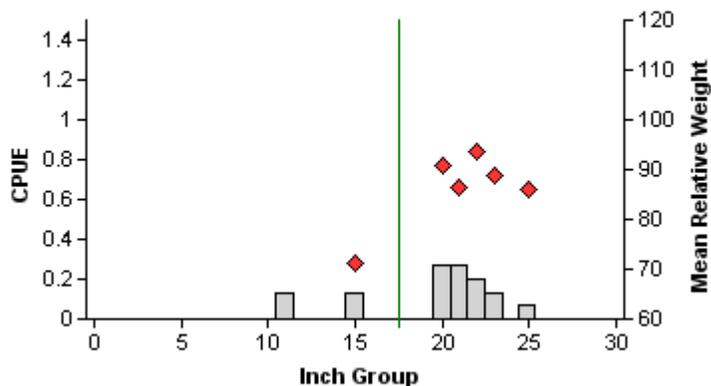


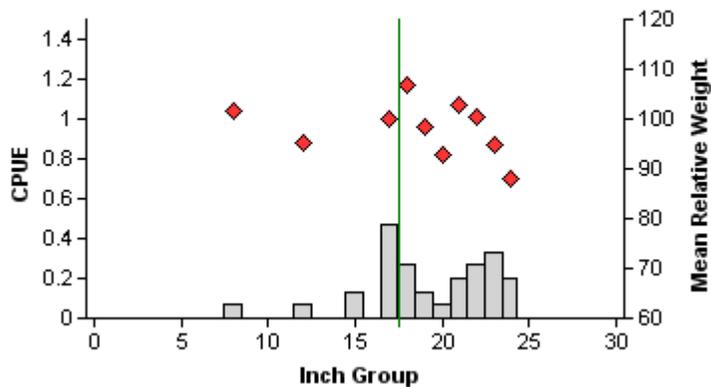
Figure 9. Number of white bass caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Palestine, Texas, 2006, 2008, and 2010. Vertical lines represent length limit.

Palmetto bass**2006**

Effort = 15.0
 Total CPUE = 2.7 (27; 40)
 Stock CPUE = 2.7 (27; 40)
 PSD = 98 (2.6)
 PSD-18 = 52 (7.7)

2008

Effort = 15.0
 Total CPUE = 1.2 (33; 18)
 Stock CPUE = 1.2 (33; 18)
 PSD = 89 (8.1)
 PSD-18 = 78 (10.8)

2010

Effort = 15.0
 Total CPUE = 2.2 (58; 33)
 Stock CPUE = 2.2 (58; 33)
 PSD = 97 (3.3)
 PSD-18 = 67 (9.9)

Figure 10. Number of palmetto bass caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Palestine, Texas, 2006, 2008 and, 2010. Vertical lines represent length limit.

Temperate bass

Table 9. Creel survey statistics for temperate bass at Lake Palestine, Texas June 2001 through May 2002, June 2005 through May 2006, and June 2009 through May 2010, where total catch per hour is for anglers targeting temperate bass, and total harvest is the estimated number of white and palmetto bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year	Year	Year
	2001/2002	2005/2006	2009/2010
Directed effort (h)	20,726 (43.2)	24,028 (27.6)	6,107 (39.8)
Directed effort/acre	0.9 (43.2)	1.0 (27.6)	0.3 (39.8)
Total catch per hour	0.5 (45.8)	1.2 (40.1)	1.0 (47.2)
Total harvest	6,396 (115.1)	32,212 (76.6)	1,574 (314.9)
White bass	5,373 (109.5)	24,489 (76.1)	1,574 (314.9)
Palmetto bass	1,023 (144.9)	7,723 (78.4)	0.0 (na)
Harvest/acre	0.3 (115.1)	1.4 (76.6)	<0.1 (314.9)
White bass	0.2 (109.5)	0.3 (78.4)	<0.1 (314.9)
Palmetto bass	0.04 (144.9)	0.3 (78.4)	0.0 (na)
Percent legal released	71	78	54

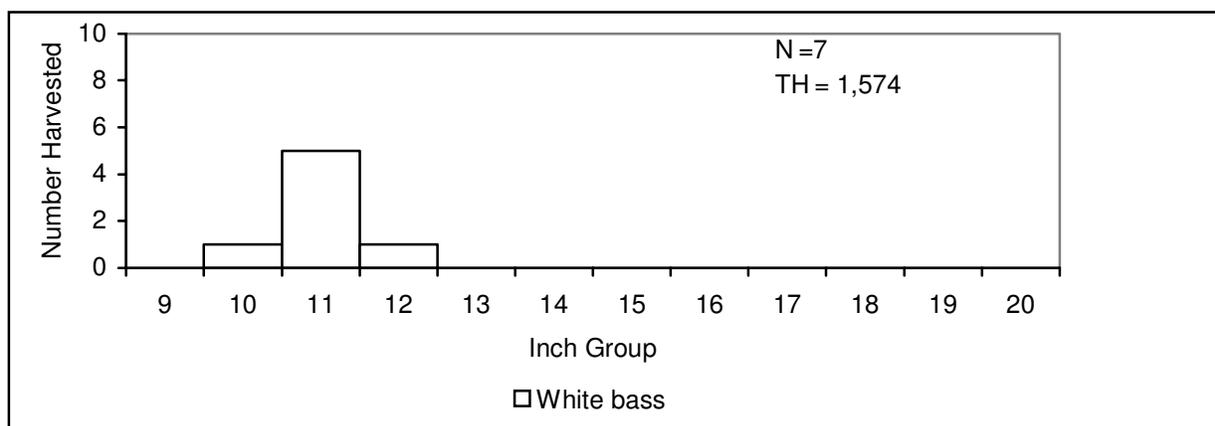
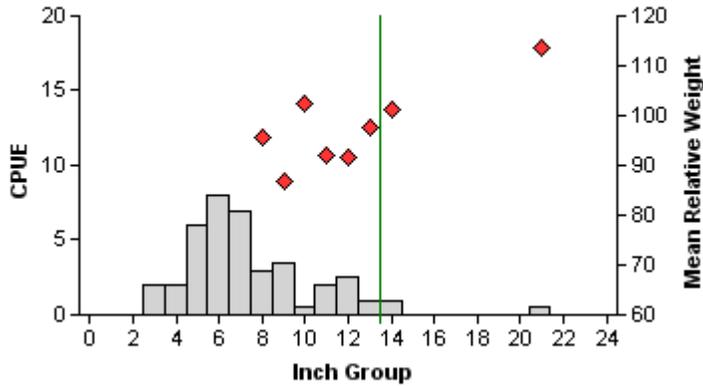


Figure 11. Length frequency of harvested temperate bass observed during creel surveys at Lake Palestine, Texas, June 2009 through May 2010, all anglers combined. N is the total number of temperate bass observed during the angler creel survey. TH is the estimated number of harvested temperate bass. *No harvested palmetto bass were observed during 2009/2010 creel survey.*

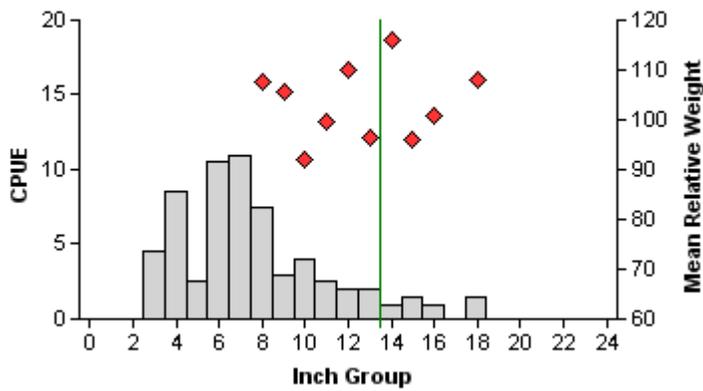
Largemouth bass

2005



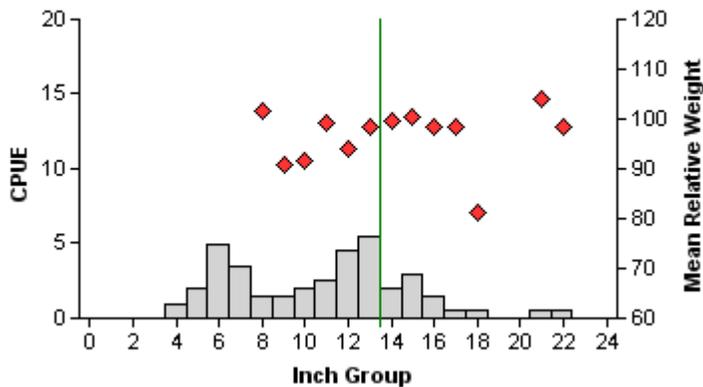
Effort = 2.0
 Total CPUE = 39.0 (20; 78)
 Stock CPUE = 14.0 (16; 28)
 PSD = 36 (9)
 PSD-14 = 11 (5.6)

2007



Effort = 2.0
 Total CPUE = 63.0 (22; 126)
 Stock CPUE = 26.0 (24; 52)
 PSD = 35 (7.6)
 PSD-14 = 19 (4.8)

2009



Effort = 2.0
 Total CPUE = 37.5 (20; 75)
 Stock CPUE = 26.0 (23; 52)
 PSD = 71 (6.3)
 PSD-14 = 33 (8.5)

Figure 12. Number of largemouth bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE are in parentheses) for fall electrofishing surveys, Lake Palestine, Texas, 2005, 2007, and 2009. Vertical lines represent length limit.

Largemouth bass

Table 10. Creel survey statistics for largemouth bass at Lake Palestine, Texas June 2001 through May 2002, June 2005 through May 2006, and June 2009 through May 2010, where total catch per hour is for anglers targeting all black basses, and total harvest is the estimated number of largemouth bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year		
	2001/2002	2005/2006	2009/2010
Directed effort (h)	54,137 (22.3)	67,288 (17.3)	38,979 (22.6)
Directed effort/acre	2.3 (22.4)	2.9 (17.3)	1.7 (22.6)
Total catch per hour	0.5 (56.6)	0.8 (38.0)	1.1 (43.6)
Total harvest	4,606 (96.0)	13,453 (88.2)	6,595 (100.5)
Traditional harvest			1,137 (100.5)
Tournament retained			5,458 (100.5)
Percent harvest tournament-retained			83
Harvest/acre	0.2 (96.0)	0.6 (88.2)	0.3 (100.5)
Percent legal released	21	60	70

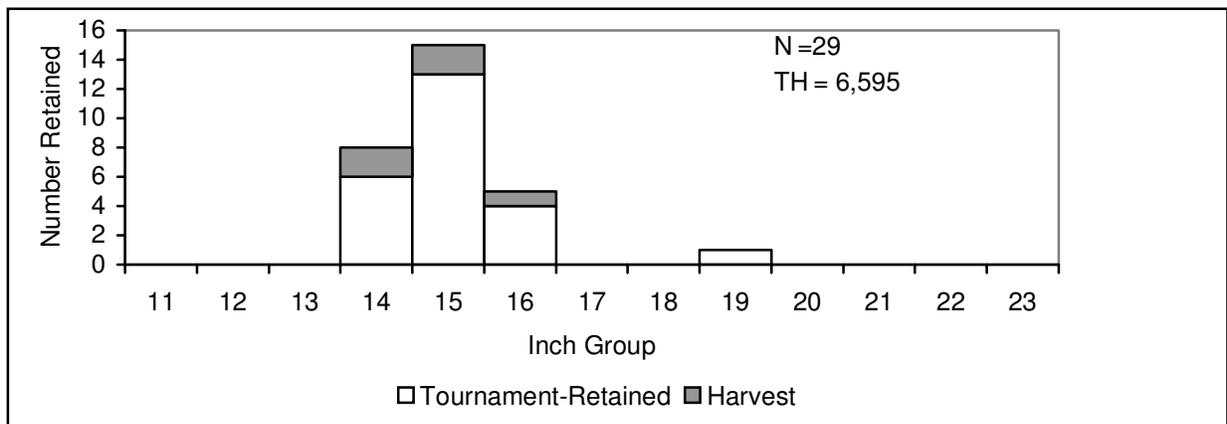
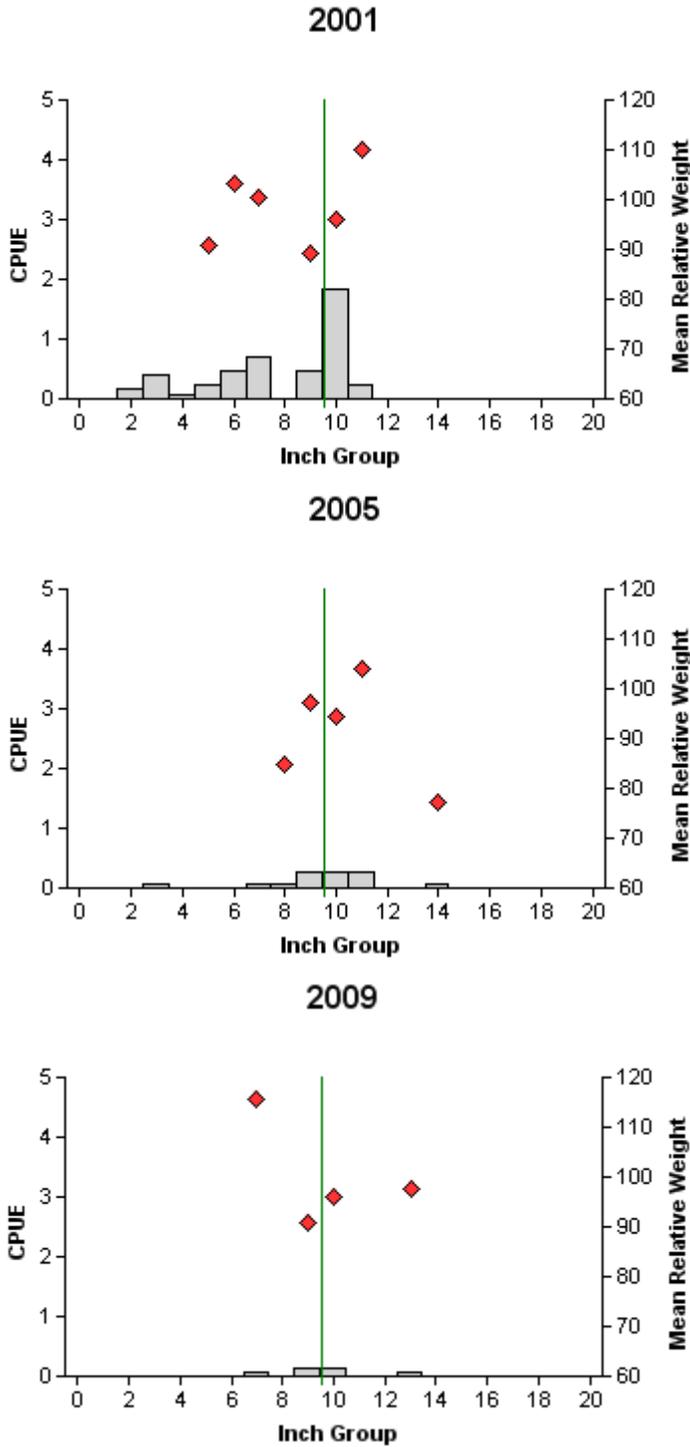


Figure 13. Length frequency of harvested largemouth bass (white = tournament-retained; grey = harvested) observed during creel surveys at Lake Palestine, Texas, June 2009 through May 2010, all anglers combined. N is the number of harvested largemouth bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

Table 11. Results of genetic analysis of largemouth bass collected by fall electrofishing at Lake Palestine, Texas, 1994, 1995, 1996, 1997, 2001, 2003, and 2007. FLMB=Florida largemouth bass, NLMB=Northern largemouth bass, integrade is a hybrid between a FLMB and a NLMB. Samples collected between 1999 and 2004 were analyzed by electrophoresis. *Genetic analysis was not conducted in 2009 due to fingerling stocking in the same year.*

Year	Sample size	FLMB	Integrade	NLMB	% FLMB alleles	% pure FLMB
1994	59	4	42	13	42	6.8
1995	30	2	32	6	42	6.9
1996	30	1	17	12	31	3.3
1997	32	0	26	6	32	0.0
2001	24	1	21	2	38	4.1
2003	30	5	19	5	42	14.3
2007	30	0	30	0	50	0.0

White Crappie



Effort = 13.0
 Total CPUE = 4.5 (29; 59)
 Stock CPUE = 3.9 (32; 51)
 PSD = 65 (6.9)
 PSD-10 = 53 (3.6)

Effort = 15.0
 Total CPUE = 1.1 (55; 16)
 Stock CPUE = 1.0 (57; 15)
 PSD = 93 (6.9)
 PSD-10 = 60 (15.2)

Effort = 15.0
 Total CPUE = 0.4 (84; 6)
 Stock CPUE = 0.4 (84; 6)
 PSD = 83 (20.5)
 PSD-10 = 50 (12.2)

Figure 14. Number of white crappie caught per net night (CPUE, bars), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap net surveys, Lake Palestine, Texas, 2001, 2005, and 2009. Vertical lines represent length limit at time of survey.

Black Crappie

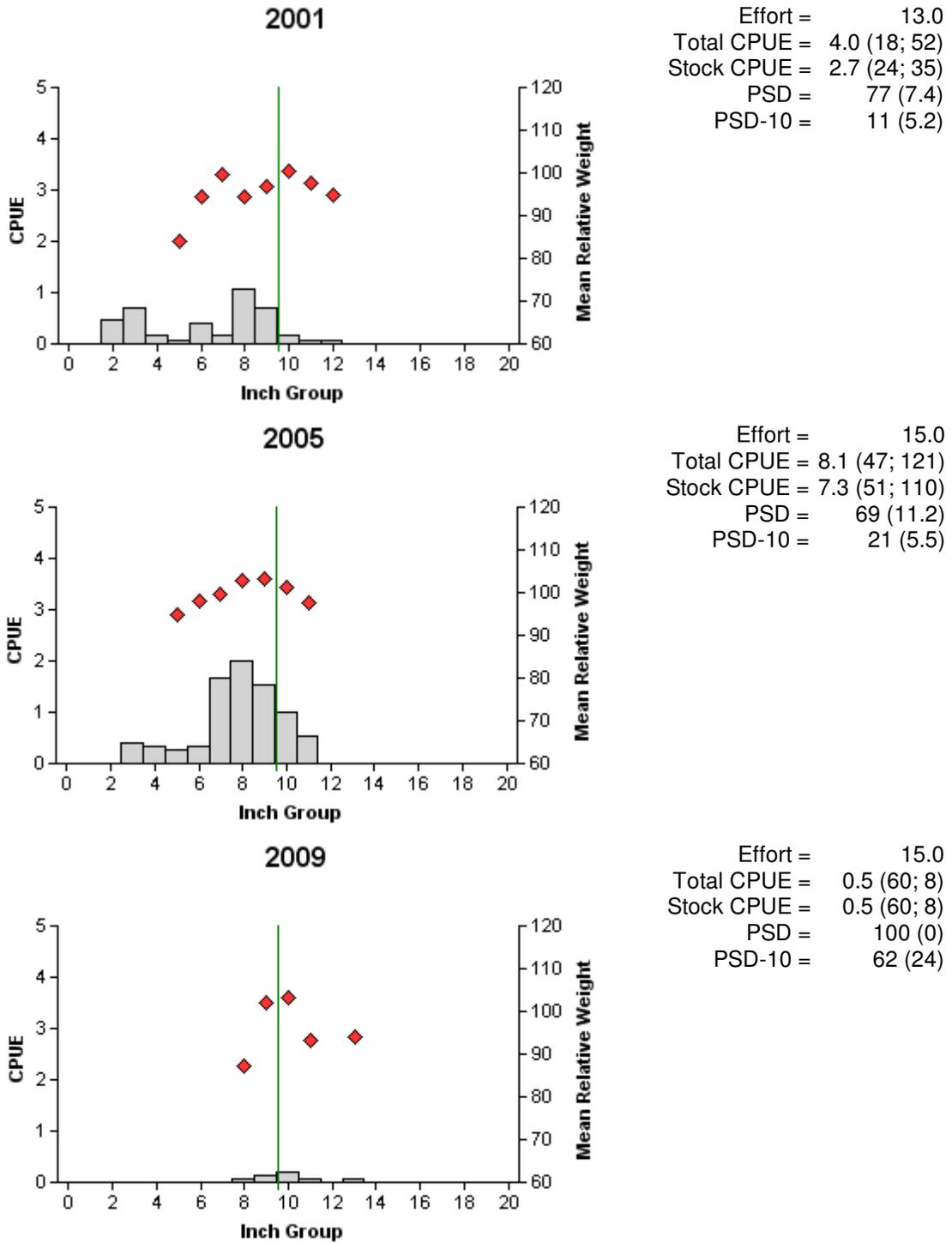


Figure 15. Number of black crappie caught per net night (CPUE, bars), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap net surveys, Lake Palestine, Texas, 2001, 2005, and 2009. Vertical lines represent length limit at time of survey.

Crappie

Table 12. Creel survey statistics for crappie at Lake Palestine, Texas June 2001 through May 2002, June 2005 through May 2006, and June 2009 through May 2010, where total catch per hour is for anglers targeting crappie and total harvest is the estimated number of crappie harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year	Year	Year
	2001/2002	2005/2006	2009/2010
Directed effort (h)	25,992 (22.9)	54,889 (18.0)	42,009 (18.1)
Directed effort/acre	1.1 (22.9)	2.3 (18.0)	1.8 (18.1)
Total catch per hour	1.4 (46.0)	1.7 (48.6)	2.2 (33.4)
Total harvest	23,772 (66.7)	84,459 (43.7)	45,273 (61.0)
White	16,827 (54.1)	41,062 (43.3)	30,627 (33.0)
Black	6,945 (97.6)	43,397 (44.2)	14,646 (58.6)
Harvest/acre	1.0 (66.7)	3.6 (43.7)	1.9 (50.6)
White	0.7 (54.1)	1.8 (43.3)	1.3 (33.0)
Black	0.3 (97.6)	1.8 (44.2)	0.6 (58.6)
Percent legal released	1	2	4

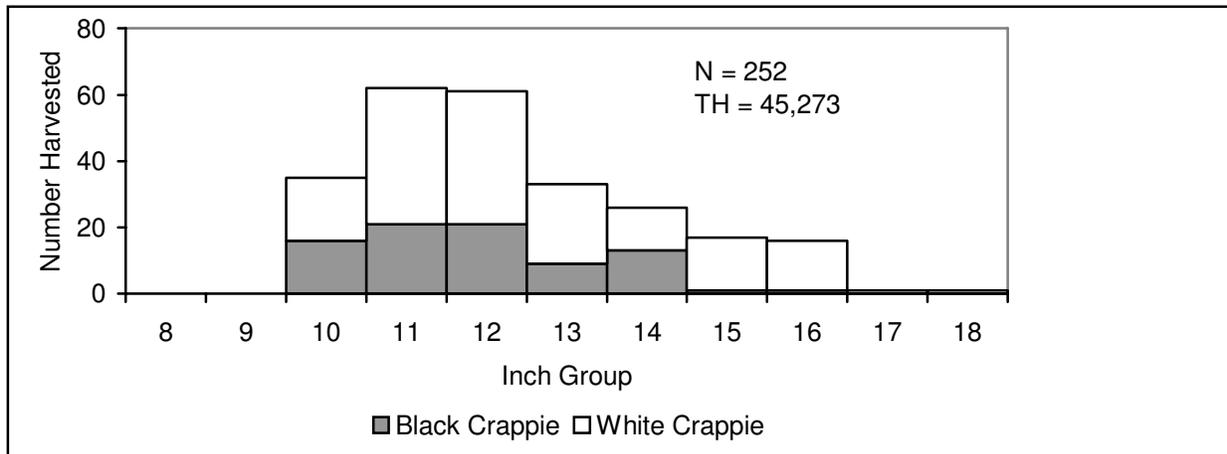


Figure 16. Length frequency of harvested crappie observed during creel surveys at Lake Palestine, Texas, June 2009 through May 2010, all anglers combined. N is the number of harvested crappie observed during creel surveys, and TH is the total estimated harvest for the creel period.

Table 13. Proposed sampling schedule for Lake Palestine, Texas. Gill netting surveys are conducted in the spring, while electrofishing and trap netting surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

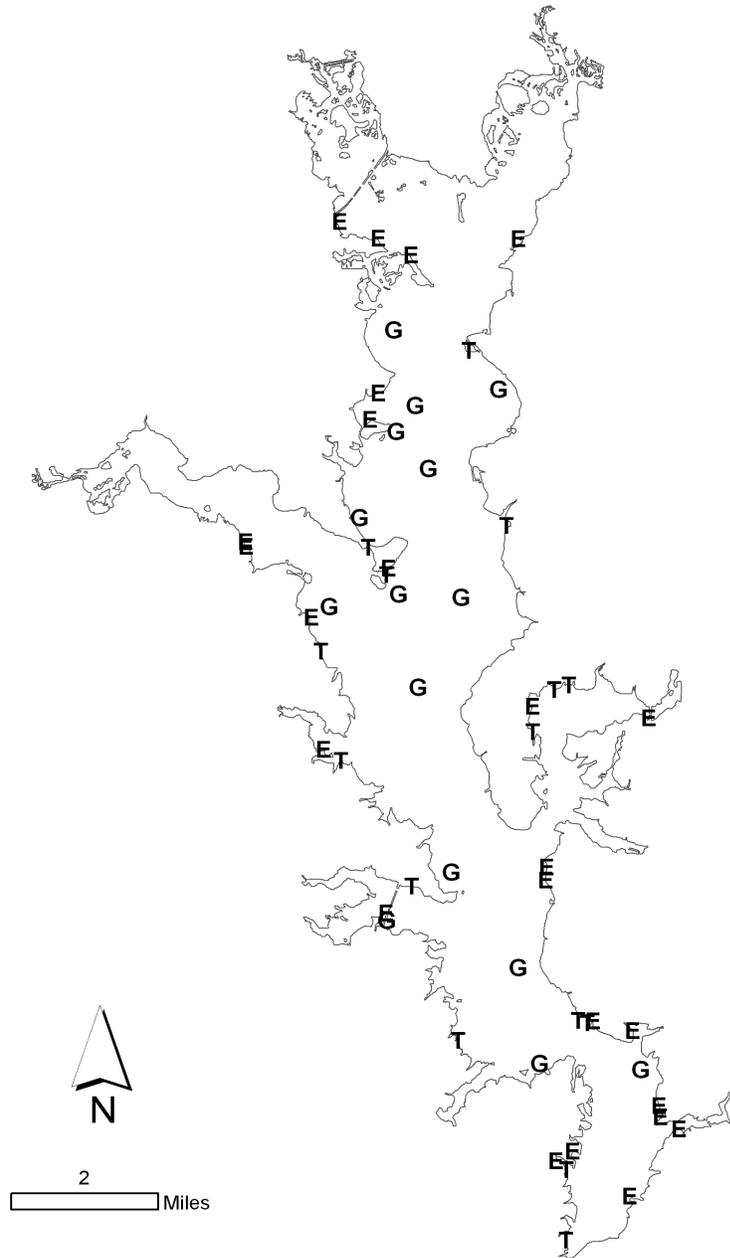
Survey Year	Electrofishing	Trap Net	Gill Net	Habitat	Creel	Report
2010-2011						
2011-2012	A		A			
2012-2013						
2013-2014	S	A	S	S	A	S

APPENDIX A

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Lake Palestine, Texas, 2009-2010.

Species	Gill netting		Trap netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Gizzard shad					90	45.0
Threadfin shad					78	39.0
Blue catfish	160	10.7				
Channel catfish	256	17.1				
White bass	32	2.1				
Palmetto bass	33	2.2				
Redbreast sunfish					64	32.0
Green sunfish					23	11.5
Warmouth					1	0.5
Bluegill					273	136.5
Longear sunfish					16	8.0
Redear sunfish					58	29.0
Spotted sunfish					31	15.5
Largemouth bass					75	37.5
White crappie			6	0.4	6	0.4
Black crappie			8	0.5	8	0.5

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APPENDIX B



Location of sampling sites, Lake Palestine, Texas, 2009-2010. Trap netting, gill netting, and electrofishing stations are indicated by T, G, and E, respectively.