

PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

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FEDERAL AID PROJECT F-30-R-31

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2005 Survey Report

Lake Palestine

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SURVEY AND MANAGEMENT SUMMARY

The Lake Palestine fish community was surveyed from June 2005 - May 2006 using electrofishing, gill nets, and trap nets. A habitat and vegetation survey was conducted in August 2005. A roving-creel survey conducted from June 1, 2005-May 31, 2006 collected angler use and harvest information. This report summarizes results of the 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 at which 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. The reservoir contains a diversity of littoral habitat types. Although submersed aquatic vegetation is locally abundant above the Hwy 315 bridge in the Kickapoo arm of the reservoir, overall surface coverage still remains below 9%.
- **Management history:** Important sport fish include sunfishes (*Lepomis spp.*), largemouth bass (*Micropterus salmoides*), white bass (*Morone chrysops*), palmetto bass (*Morone chrysops X saxatilis*), blue catfish (*Ictalurus furcatus*), channel catfish (*I. punctatus*), white crappie (*Pomoxis annularis*) and black crappie (*P. nigromaculatus*). The management plan from 2001 included stockings of Florida largemouth bass (*M. s. floridanus*) to increase Florida alleles in the population. Stockings were conducted in 2004 and 2005. The 12-inch length limit for white bass reverted to the statewide 10-inch limit in September 2003. Biennial monitoring of largemouth bass size distribution and growth rate has continued. Additional monitoring of temperate bass and catfish also occurs on a biennial basis. Vegetation surveys identified hydrilla (*Hydrilla verticillata*) and waterhyacinth (*Eichhornia crassipes*) in the system. Attempts were made to control waterhyacinth through manual removal.
- **Fish Community**
 - **Prey species:** Threadfin shad (*Dorosoma petenense*) continued to be present in the reservoir and electrofishing catch rate was higher than in previous surveys. Electrofishing catch rate of gizzard shad (*D. cepedianum*) was good, but few gizzard shad were available as prey to sport fish. Bluegill (*Lepomis macrochirus*), redbreast (*L. auritus*), and redear sunfish (*L. macrolophus*) are the most abundant sunfish species. Catch rates of sunfishes ≤ 4 inches continues to be low. Despite low sunfish catch rates, overall prey availability was adequate for piscivorous sportfishes.
 - **Catfishes:** Catfishes account for more directed angler effort than any other group with 35% of the directed effort. Blue catfish size distribution continues to be better than channel catfish; however, channel catfish size structure has improved from previous years. Overall gill net catch rate for channel catfish has declined compared to previous surveys, but availability of legal-length specimens has improved considerably. Catch rates of legal-length fish was higher than previously documented. A channel catfish specific fish kill was documented in 2005 and may have contributed to the improved size distribution by reducing intraspecific competition.
 - **Temperate basses:** Temperate basses (including white bass) made up 7.5% of the Lake Palestine fishery in 2005-2006. The gill net catch rate of white bass has declined from a high in 2002 and may be related to year class strength resulting from river flows. Gill net catch rate of palmetto bass was lower than previous surveys and may be due to decreased stocking rates. Growth, size distribution, and body condition of both species continues to be acceptable.
 - **Largemouth bass:** Largemouth bass are the second most sought after species at Lake Palestine accounting for approximately 22% (2.9 h/acre) of the directed effort. Size

distribution of largemouth bass was slightly below the target range for a balanced population. Electrofishing catch rates of stock-length fish decreased from 2003, but body condition of largemouth bass was in the desirable range for most size classes. Angler catch rate is good. Annual stocking of Florida largemouth bass fingerlings at 100/acre from 1997-2000 may have been responsible for the apparent increase in Florida alleles and the percentage of pure Florida largemouth bass in the population.

- **Crappie:** Both white crappie and black crappie are present in Lake Palestine and trap net catches reflect shifts in dominance between the species as dictated by environmental conditions. Crappie were the third most sought after sportfish at Lake Palestine with 17% of the directed effort. Overall angler catch rate of crappie approaches 2/h and an estimated 92,422 crappie were harvested in the past year. Trap net catch rates of white crappie have declined compared to previous surveys, but this decline is compensated by an increase in black crappie catch rate. Body condition of both species is excellent and is indicative of abundant prey availability. White crappie grow to legal length by age 2 and black crappie by age 3.
- **Management Strategies:** Largemouth bass are important in this system, therefore, additional monitoring of their growth rates and size distribution will be conducted in fall of 2006 and 2008. The sampling will also provide fish for electrophoretic analysis. Channel catfish recruitment and population structure will continue to be monitored in 2008 and 2010 samples. News releases promoting the blue catfish fishery will be continued. A long term research project investigating stocking of palmetto bass has been proposed. Discussion with the controlling authority regarding improved bank access will continue.

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INTRODUCTION

This document is a summary of fisheries data collected from Lake Palestine in 1998-2006. 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

Reservoir Description

Lake Palestine is a 23,434-acre reservoir constructed in 1962 (enlarged to present size in 1971) on the Neches River, Texas, built to supply water for municipal and industrial purposes. The lake is located in Cherokee, Anderson, Henderson, and Smith Counties and is operated and controlled by the Upper Neches River Authority. Lake Palestine is a mesotrophic reservoir with a mean TSI *chl-a* of 44.97, which was lower than previous samples (Texas Commission on Environmental Quality 2002). The littoral zone consists of a variety of physical habitat types (Table 4). 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 10% of the total surface area. Native submersed and emergent species are present, but the exotic species hydrilla (*Hydrilla verticillata*) is the most abundant. Alligator weed (*Althernanthera philoxeroides*) and waterhyacinth (*Eichornia crassipes*), also non-native, are present. Standing timber, not included in the 10%, is abundant throughout the reservoir and can be found in various water depths. 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 (Ott and Bister 2002) included:

1. Increase Florida largemouth bass (*Micropterus salmoides floridanus*) alleles in population.
Action: Florida largemouth bass fingerlings were stocked in 2004 and 2005. The recommendation was to stock fingerlings at a rate of 25 fish/acre for two years; however, fish were stocked at 5 fish/acre, or 500,000 each year.
2. Consult controlling agency regarding the possibility of aquatic vegetation introduction through nursery colonies.
Action: Upper Neches Municipal River Authority was contacted, but recommendations were not considered.
3. Angler uncertainty concerning regulations.
Action: Lake-specific regulation posters were provided to vendors of angling-oriented businesses serving the Lake Palestine vicinity. Additional signs were provided to controlling authority to post at access sites.
4. Assessment of long-term gill net data indicated an inverse correlation between catch rates of white bass (*Morone chrysops*) and Palmetto bass (*Morone chrysops X saxatilis*). Reducing stocking rates of hybrids may be necessary to allow consistent recruitment of white bass.
Action: A pre-proposal has been submitted to investigate this issue. Lake Palestine and Lake O' the Pines have been proposed as study sites.
5. Catfish population is dominated by small slow growing channel catfish (*Ictalurus punctatus*). Blue catfish (*I. furcatus*) size distribution is substantially better and individuals exhibit adequate growth and body condition.
Action: A regulation change was proposed in 2002 to improve the growth of channel catfish, but was declined. News releases were provided to educate and encourage anglers to seek the larger blue catfish.

Harvest regulation history: Sportfishes in Lake Palestine are currently managed with statewide regulations (Table 2). White bass regulations have fluctuated from 10-inch minimum length limit to a 12-inch minimum limit. The current statewide regulation (10-inch minimum and 25 fish bag) started on September 1, 1988. The 12-inch limit started on September 1, 1992. 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 all regulated by the 12-inch minimum length limit. Palestine reverted to the statewide 10-inch minimum length limit for white bass on September 1, 2003.

Stocking history: Palmetto bass and Florida largemouth bass are the most frequently stocked at Lake Palestine. Palmetto bass fingerlings were first stocked in 1987. Stocking continues as supplemental support for the fishery. Florida strain largemouth bass were initially stocked in 1981 and have been stocked strategically since then to enhance the trophy potential of the fishery. Largemouth bass were first stocked in 1971, and the population has been self-sustaining since. Lake Palestine supports an abundant channel and blue catfish fishery, which was initially stocked in 1971. The blue catfish fishery required supplemental stockings in late 1970's and mid 1980's; however, the population is currently self-sustaining. As with many Texas reservoirs, a walleye fishery was attempted in the mid 1970's, but stockings were unsuccessful. Threadfin shad 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 at Lake Palestine consists of a diverse array and combination of native and exotic plants. Native emergents can be found around the perimeter of the lake, when water levels remain stable. In 2001, the emergent vegetation benefited from the stable water levels, occupying 46 miles of shoreline, which is 34% of the total perimeter (Ott and Bister 2002). The submersed vegetation present in Lake Palestine is 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 is exotic hydrilla, and is concentrated in the Kickapoo arm located at the north end of the reservoir. Other exotics present include alligatorweed and floating waterhyacinth. The physical habitat types have remained constant over the last decade; extended shoreline development has appeared to stop for the time being (Table 4).

Local interest groups have established restoration and habitat improvement projects. The Palestine Cypress Project began in 1996 and has continued into the present. Over the years approximately 3,500 cypress trees have been planted in the upper end of the reservoir to replace the native fallen timber.

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 nets, as the number of fish per net night (fish/nn). All survey sites were randomly selected and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2005).

Sampling statistics (CPUE for various length categories), structural indices [Proportional Stock Density (PSD), Relative Stock Density (RSD)], and condition indices [relative weight (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 ($RSE = 100 \times SE$ of the estimate/estimate) was calculated for all CPUE statistics and for creel statistics and SE was calculated for structural indices and IOV. Ages were determined using otoliths from 13 specimens with lengths ranging from one inch below to one inch above the legal length limit. Source for water level data was the United States Geological Survey (USGS) website.

RESULTS AND DISCUSSION

Habitat: A survey of the littoral zone was conducted in 2005. Native floating, emergent, and submergent vegetation were all identified. Native submersed species included: fanwort (*Cabomba carolinia*), coontail (*Ceratophyllum demersum*) and pondweed (*Potamogeton spp.*). Native floating species included: frogs-bit (*Limnobium spongia*), water meal (*Wolffia spp.*) and common duckweed (*Lemna minor*). Emergent vegetation was composed of American lotus (*Nelumbo lutea*), cattail (*Typha spp.*), giant cutgrass (*Zizaniopsis milacea*), maidencane (*Panicum hemitomon*), square-stem spikerush (*Eleocharis quadrangulata*), water primrose (*Ludwigia spp.*), white water-lily (*Nymphaea odorata*), spatterdock (*Nuphar luteum*), water willow (*Justicia americana*) and was less than 1% of total surface area. Fluctuating water levels (Figure 1) may be the cause for the dramatic decrease in emergent vegetation from the previous survey in 2001 (Ott and Bister 2002). Native submersed vegetation occupied less than 1% of the total reservoir surface area (Table 4). Hydrilla dominated the submersed vegetation community with approximately 900 acres present, but is still covers only 3% of the total. Collectively aquatic vegetation was present in less than 10% of the reservoir surface area. Waterhyacinth and alligatorweed were again documented, but occupied 1.5 total surface acres. Since 1972, 22 fish kills have been investigated on Lake Palestine or its major tributaries (Personal Communication Gregg Conley, TPWD Kills and Spills Team). In most cases multiple species were involved and the cause was not determined. In 2005 a species specific fish kill involving only channel catfish resulted in an estimated 17,000 fish killed. Although a disease was suspected (due to the species specific nature of the kill) the causative pathogen was not identified.

Creel: Directed fishing effort by anglers was highest for catfishes (35%), followed by anglers fishing for black basses (21%) (Table 5). While directed angler effort by species group remained similar to previous years, total fishing effort increased 35% from 2001-2002 creel survey and total directed expenditures doubled. Total fishing effort for all species at Lake Palestine was 308,053 angler hours from June 2005 – May 2006, and anglers spent an estimated \$1,583,692 on direct expenditures (Table 6).

Prey species: Gizzard shad (*Dorosoma cepedianum*) and threadfin shad (*D. petenense*) were collected at Lake Palestine. Catch rates increased since 2003, and are higher than the five year average of 197.0 fish/h and 405.0 fish/h, respectively. However, the Index of vulnerability (IOV) of gizzard shad was poor, indicating only 27% of gizzard shad were available to predators. This is improvement from the 2003 IOV estimate of 16% (Figure 2), but is considerably lower than IOV values from 1998-2001. Forage availability does not appear to be a limiting factor for sportfish growth. Bluegill (*Lepomis macrochirus*), redbreast (*L. auritus*), and redear sunfish (*L. macrolephus*) are the most abundant sunfish species (Figures 3-5). Catch rates of sunfishes ≤ 4 inches continue to be low (141.0 fish/h). Sunfish angling pressure and harvest are minimal as indicated by the 2005-2006 creel survey (Table 7; Figure 6).

Catfish: Catfishes account for more directed angler effort than any other group with 35% of the total effort. Since 1996, the majority of blue catfish sampled by gill netting have been legal-sized fish; whereas most channel catfish have been less than the minimum length limit. Size distribution of channel catfish continues to show improvement. Catch rate of stock (≥ 11 inches) channel catfish has remained similar to historical averages and should continue to increase into next year (Figure 8). The declining trend of smaller channel catfish (≤ 11 inches) catch rate continues. Channel catfish growth continues to be slow, with fish taking over 4 years to reach legal size and appears to be due to intra-specific competition for food. A fish kill affecting only channel catfish (estimated mortality 17,000 fish) occurred in the summer of 2005, which may have reduced competition for food and temporarily increased growth rates. In addition, harvest of channel catfish has increased from 2 fish/acre in 2001 to 6 fish/acre (Table 8).

Size distribution of blue catfish is considerably better than channel catfish. Historical blue catfish growth rates are high, with fish reaching the 12-inch minimum length limit in approximately three years. Catch rates of blue catfish continue to increase from previous surveys (Figure 7). Two strong year classes of fish, which are now 16 – 20 inches, currently dominate the size distribution. The PSD (25) has increased

dramatically from 2004, and is similar to the five-year average (23). Body condition (W_r) of blue catfish sampled was desirable, ranging from 90 to 120. Blue catfish harvest has also increased from 2001 (Table 8).

Temperate basses: The gill net catch rate of white bass was 1.4/nn in 2006 (Figure 10). This was similar to gill net catch rates in 1998 and 1999 but suggests a declining trend from a high of 7.1/nn in 2002. The peak in catch rate for 2002 may have been due to a strong 2001 year-class produced by high inflows in 2001 (Figure 1). However, it may have also been related to a temporary suspension of Palmetto bass stockings between 1999 and 2001. Ott and Bister (2002) documented a significant ($P < 0.05$) negative relationship ($r = -0.53$) between gill net catch rates of white bass and palmetto bass at lake Palestine. The PSD and RSD-P values exceed expectations for this fishery at 100 and 43, respectively. Relative weight was generally above 90 except for one 15 inch individual which may have been senescent. Temperate basses (including white bass) made up 7.5% of the Lake Palestine fishery in 2005-2006 compared to 9.1% in 2001-2002 (Ott and Bister 2002). Directed effort toward temperate basses was approximately 1 man hour/acre in 2005-2006 and is similar to 2001-2002. Angler catch rate is relatively high (1.5/h) and size distribution of the harvest was from 10-14 inches with a modal size of 13 inches (Figure 11, Table 9). Overall harvest was approximately 1/acre.

Gill net catch rate of palmetto bass was 2.7/nn in 2006 (Figure 12). This was similar to gill net catch rates in 2004 but is approximately half of the rate in 2002 and 1999, and quarter the rate in 1998. Decline in catch rate is likely due to a decrease in stocking rate since 1998 (particularly for 2003), (Table 3). The unusually low stocking rate of 2.5/acre in 2003 has resulted in gaps in the size distribution for 2006; however, PSD and RSD-P has been above 90% for palmetto bass since 2002. Directed angler catch rate for temperate basses at Lake Palestine is relatively high (1.5/h). Fortunately, voluntary release of legal-length palmetto bass (71% in 2001-2002) allows some specimens to reach 24 inches in length. Anglers harvested an estimated 7,363 palmetto bass at Lake Palestine in 2005-2006 (Figure 13, Table 10).

Largemouth bass: Size distribution of largemouth bass (*Micropterus salmoides*) was slightly below the target range for a balanced population. Electrofishing catch rates of stock-length fish decreased from 2003 (23 fish/hour) to 2005 (14 fish/hour). Body condition of largemouth bass was desirable ($W_r > 90$) for most size classes (Figure 14), and similar to the range exhibited in previous surveys. Size structure for 2005 (PSD=36) was similar to 2003 (PSD=37) and 1999 (PSD=40), but was higher than the 1998 and 2001 (PSD=32) survey. Growth rate was excellent, with most specimens reaching the 14-inch minimum length by age 2 (Figure 16). The relative lack of fish > 14 inches is a concern as is the decrease in total catch rate (39/h) compared to the historical range. Although total harvest (15,275) appears to have increased compared to the 2001/2002 creel (4,606) the increase may be due to inclusion of fish in live wells in the harvest estimate (Table 11). Directed effort for largemouth bass approaches 3 h/acre; somewhat higher than 2001/2002, and is second only to catfishes (Table 5). Angler catch rate is very good (0.8/h) and is improved over the 0.5/h in 2001/2002. Although length distribution of the harvest is somewhat skewed toward 15 inch fish, specimens up to 23 inches in length were harvested (Figure 15). Annual stocking of Florida largemouth bass fingerlings at 100/acre from 1997-2000 may have been responsible for the apparent increase in Florida alleles from 32% in 1997 to 38% in 2001 and 42% in 2003 (Table 12). The percentage of pure Florida largemouth bass in the population similarly increased from 0% in 1997 to 4% in 2001 and 14% in 2003. Stockings were continued in 2004 and 2005. Subsequent collection and analysis are needed to document their status.

Crappie: Both white crappie and black crappie are present in Lake Palestine, and trap net catches reflect shifts in dominance between the species as dictated by environmental conditions. Trap net catch rate of white crappie in 2005 (1.1/nn) was below the 1999 and 2001 surveys (4.6 and 4.5/nn respectively), but was similar to 1998 (Figure 17). Size distribution of white crappie in 2005 is good (PSD=93; RSD-P=60); however, the 2004 year-class appears to have been weaker than in earlier surveys. Growth rate of white crappie is excellent, with most growing to the 10-inch minimum length by age 1 (Figure 18).

Trap net catch rate of black crappie in 2005 (8.1/nn) was higher than in previous years (Figure 19). Unlike white crappie, size distribution of black crappie suggests a good 2004 year class. The percentage

of legal length black crappie was lower than white crappie but annual recruitment appears to be more consistent. PSD (69) and RSD-P (21) of black crappie in 2005 is similar to previous years. Growth rate of black crappie is slower than white crappie (most grow to legal length by age 2), but is consistent with biological differences between the species. Relative weight was ≥ 100 for most size groups and suggests an abundance of prey.

Crappie were the third most sought after sport fish group at Lake Palestine in 2005-2006 accounting for 17% (4.6 h/acre) of the directed effort (Table 5, 13). Overall angler catch rate of crappie (1.8/h) was slightly higher than in 2001/2002 (1.4/h) and accounted for an estimated 42,829 white crappie and 49,593 black crappie harvested. Length frequency of harvested crappie was good, with individuals of both species reaching 15 inches.

Fisheries management plan for Lake Palestine, Texas

Prepared – July 2006

ISSUE 1: Florida largemouth bass fingerlings were stocked at 10 fish/acre from 1997-2000 and may have been responsible for the apparent increase in pure Florida largemouth bass from 4% in 2001 to 14% in 2003. The target level of >20% pure Florida has not yet been achieved, therefore Florida largemouth bass fingerlings were recommended and stocked in 2004 and 2005 at 20 fish/acre.

MANAGEMENT STRATEGY

1. Evaluate largemouth bass allele frequencies in fall of 2007. Additional stockings may be recommended pending analysis.

ISSUE 2: The channel catfish population has exhibited poor growth possibly due to intraspecific competition. An increase in harvest and a fish kill in the summer of 2005 may have improved growth and altered population dynamics. Previous surveys have shown a decline of small channel catfish (<11 inches), while larger channel catfish numbers have remained constant. Previous recommendations have involved proposals for length limit adjustments. In light of the 2006 sample, those proposals will not be made.

MANAGEMENT STRATEGIES

1. Continue monitoring size distribution and growth in spring 2008, with additional gill netting.
2. If the trend in poor growth continues, modifications to length limits may again be recommended.

ISSUE 3: Lake Palestine supports a popular catfish fishery and is the most sought after sport fish. Channel catfish are abundant and can support a significant increase in harvest, benefiting the fishery. Additionally, area anglers underutilize the blue catfish fishery, which currently supports trophy fish.

MANAGEMENT STRATEGIES

1. Provide news releases to area anglers encouraging harvest of these species, and inform them of alternative methods to possibly increase chances of catching trophy blue catfish.

ISSUE 4: Bank access is inadequate and limits fishing opportunities for area anglers. The Upper Neches River Water Authority has expressed interest in acquiring lands to build fishing piers.

MANAGEMENT STRATEGIES

1. Continue building and maintaining working relationships with the Upper Neches River Water Authority and discuss strategies to put a plan into action.

ISSUE 5: Assessment of long-term gill net data indicated an inverse correlation between catch rates of white bass and hybrid striped bass. Reducing stocking rates of hybrids may be necessary to allow consistent recruitment of white bass.

MANAGEMENT STRATEGIES

1. A research pre-proposal for assessing alternate year stocking of palmetto bass has been approved.
2. Additional sampling will be based upon further project development.

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule includes additional electrofishing in 2007, additional gill netting in

2008, and mandatory monitoring in 2009/2010 (Table 13). An additional electrofishing survey in 2007 is necessary to provide fish for electrophoresis analysis in an effort to evaluate stockings of Florida strain largemouth bass. Optional gill netting in the spring of 2008 will provide additional trend data on the catfish fishery and growth data regarding channel catfish.

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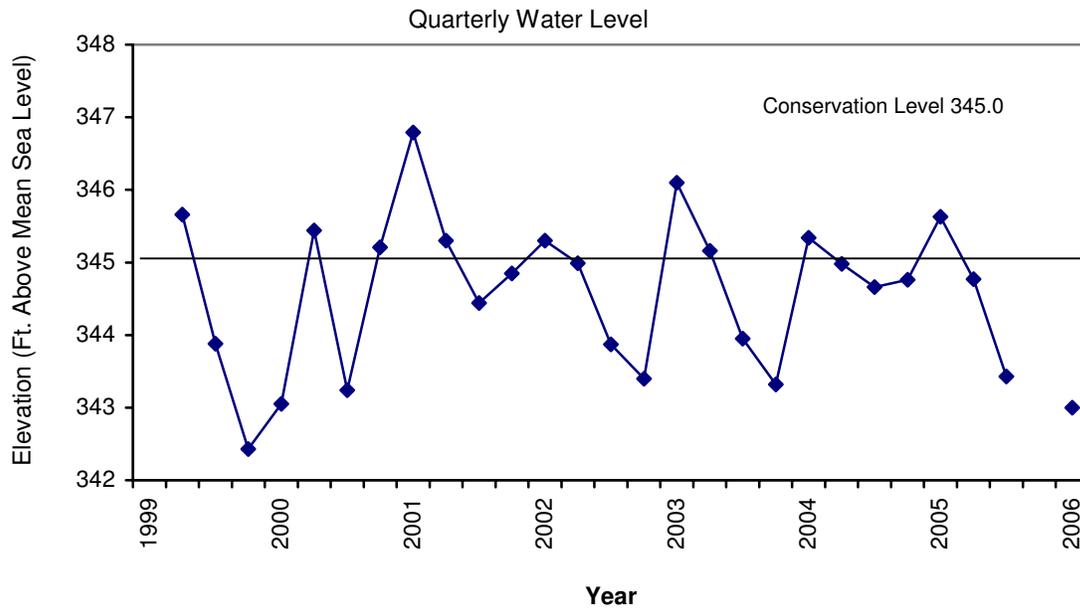


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Lake Palestine, Texas.

Table 1. Characteristics of Lake Palestine, Texas.

Characteristic	Description
Year constructed	1962, enlarged to present size in 1971
Controlling authority	Upper Neches River 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.

Species	Bag Limit	Minimum-Maximum Length (inches)
Catfish: channel and blue catfish, 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: largemouth	5 (in aggregate with spotted bass)	14 – No Limit
Bass: spotted	5 (in aggregate with largemouth bass)	None
Crappie: white and black crappie, 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	2,500	ADL
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	<u>101,117</u>	FGL	
		4,440,370	
Largemouth bass	1971	1,600,000	FGL
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	<u>589,360</u>	FGL
		2,411,261	
Walleye	1974	2,580,000	FRY
	1975	2,250,000	FRY
	1976	<u>1,000,000</u>	FRY
		5,830,000	

Table 4. Survey of littoral zone and physical habitat types, Lake Palestine, Texas. Abiotic habitat survey was conducted in 2001. Biotic habitat survey of littoral zone vegetation was conducted in 2005. 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			4.48	< 1.0
Native emergent vegetation			471.43	2.0
Native emergent & hydrilla			752.22	3.2
Native floating			645.93	2.76
Alligatorweed			0.56	< 1.0
Hydrilla			147.06	< 1.0
Water hyacinth			1.02	< 1.0
No vegetation			21,410	91.3

¹Abiotic habitat feature

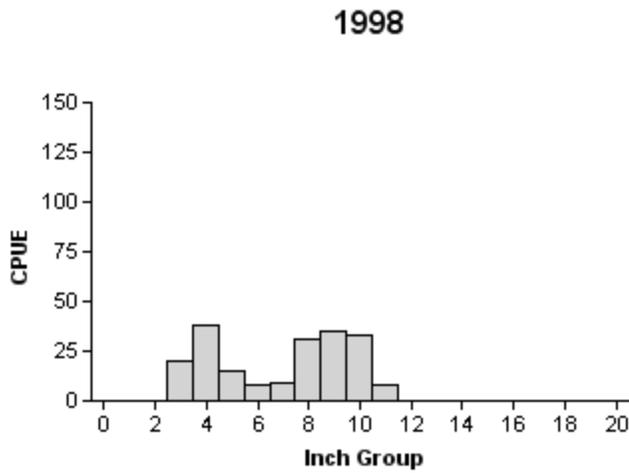
Table 5. Percent directed angler effort by species for Lake Palestine, Texas, June 2001 – May 2002 and June 2005 - May 2006.

Species	Year	
	2001/2002	2005/2006
Catfish spp.	37.9	35.2
Temperate basses	9.1	7.5
Sunfishes	1.7	2.3
Black basses	23.7	21.8
Crappie spp.	11.4	17.4
Anything	16.1	15.9

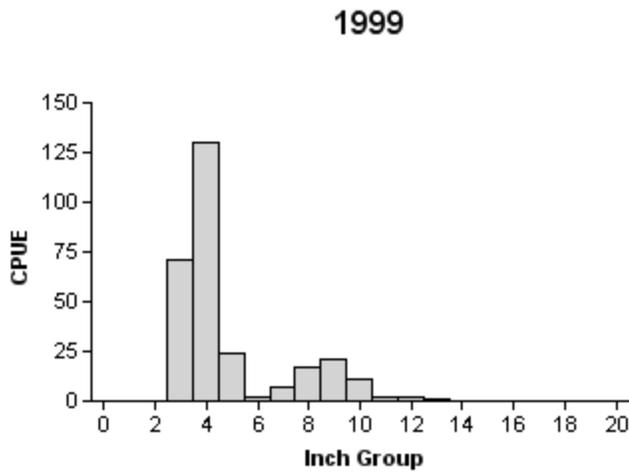
Table 6. Total fishing effort (h) for all species and total directed expenditures at Lake Palestine, Texas, June 2001 – May 2002 and June 2005 - May 2006.

Creel Statistic	Year	
	2001/ 2002	2005/ 2006
Total fishing effort	227,768	308,053
Total directed expenditures	\$763,875	\$1,583,692

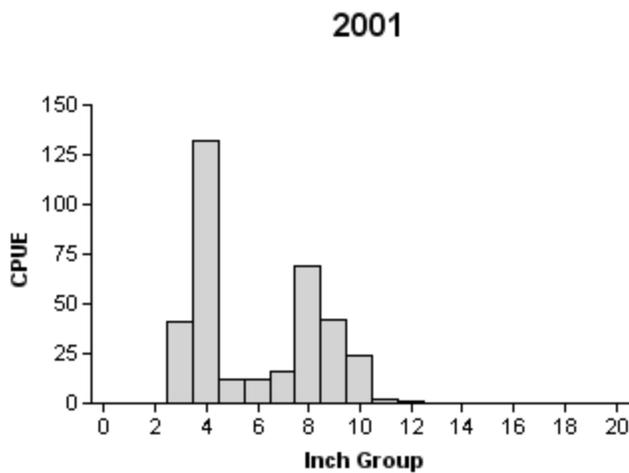
Gizzard Shad



Effort = 2.0
 Total CPUE = 201.0 (14; 402)
 Stock CPUE = 118.0 (17; 236)
 PSD = 8.0 (0.02)
 IOV = 45.32 (0.07)



Effort = 2.0
 Total CPUE = 291.5 (16; 583)
 Stock CPUE = 64.0 (21; 128)
 PSD = 10.0 (0.04)
 IOV = 80.62 (0.04)

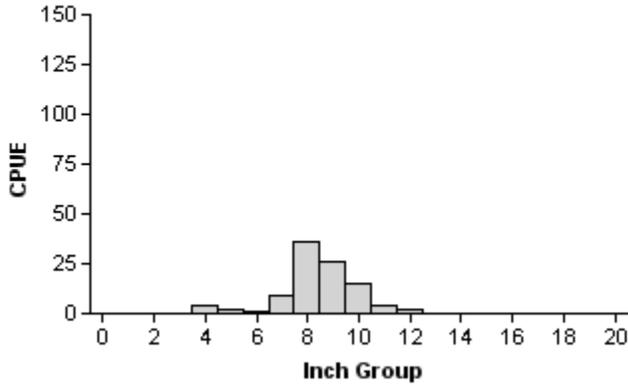


Effort = 2.0
 Total CPUE = 355.0 (19; 710)
 Stock CPUE = 156.5 (20; 313)
 PSD = 3.0 (0.01)
 IOV = 51.93 (0.06)

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, 1998, 1999, 2001, 2003, and 2005. Continued on next page.....

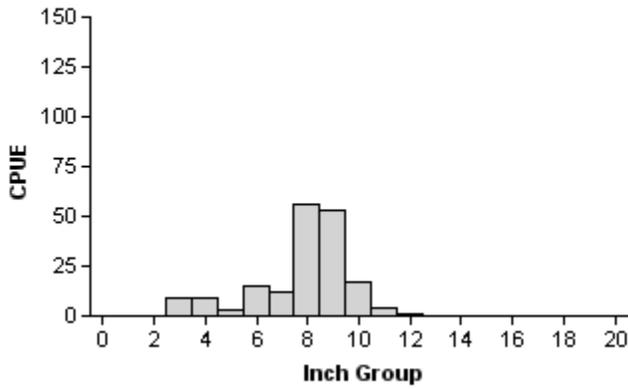
Gizzard Shad

2003



Effort = 2.0
 Total CPUE = 102.0 (18; 204)
 Stock CPUE = 95.0 (18; 190)
 PSD = 8.0 (0.03)
 IOV = 15.69 (0.05)

2005



Effort = 2.0
 Total CPUE = 183.0 (16; 366)
 Stock CPUE = 145.5 (19; 291)
 PSD = 4.0 (0.02)
 IOV = 27.05 (0.05)

Figure 2 cont... 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, 1998,1999, 2001, 2003, and 2005.

Redbreast Sunfish

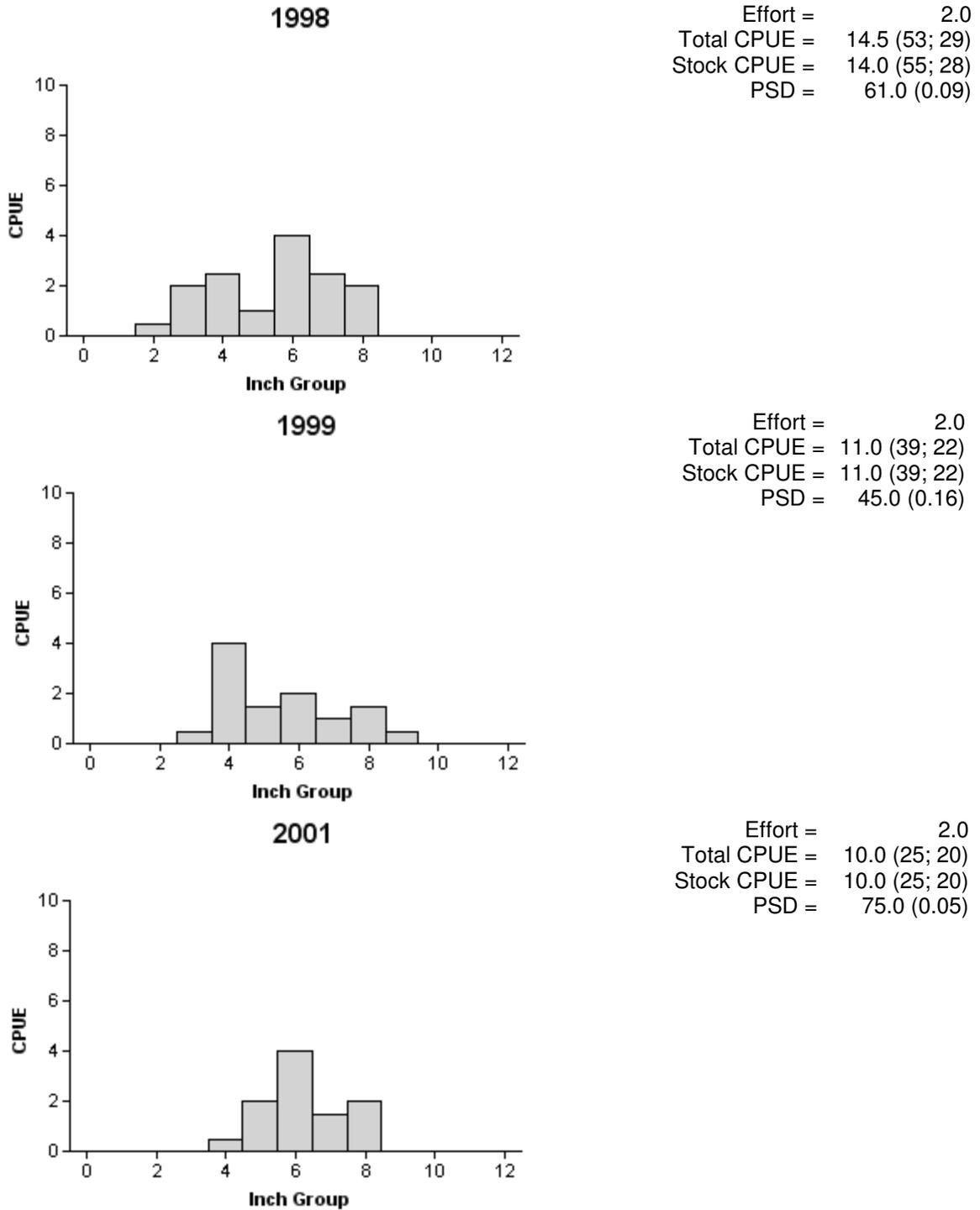


Figure 3. Number of redbreast sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Lake Palestine, Texas, 1998, 1999, 2001, 2003, and 2005. Continued on next page.....

Redbreast Sunfish

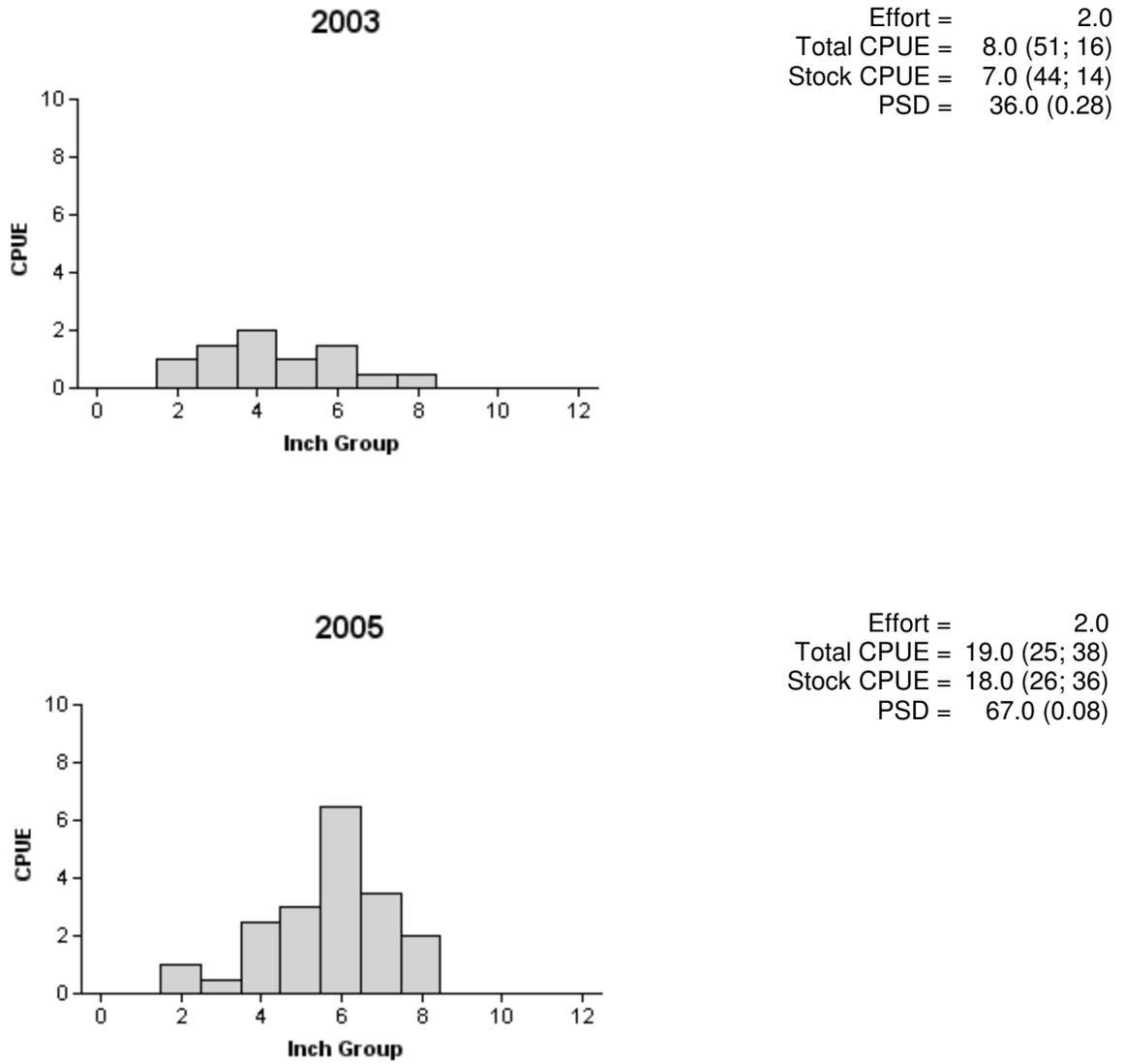


Figure 3 cont... Number of redbreast sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Lake Palestine, Texas, 1998, 1999, 2001, 2003, and 2005.

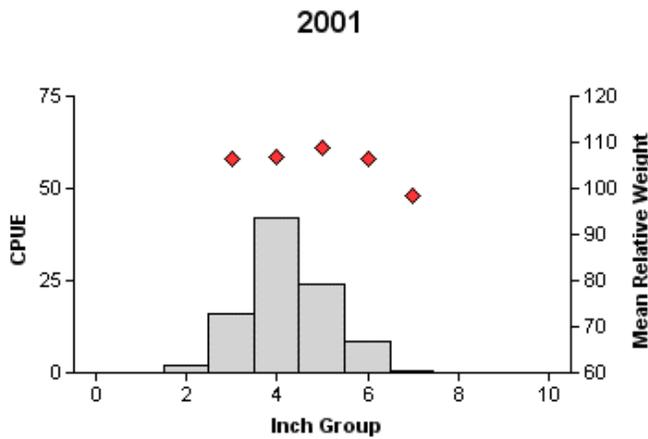
Bluegill



Effort = 2.0
 Total CPUE = 208.0 (19;
 Stock CPUE = 416)
 PSD = 200.5 (19;
 401)
 18.0 (0.03)



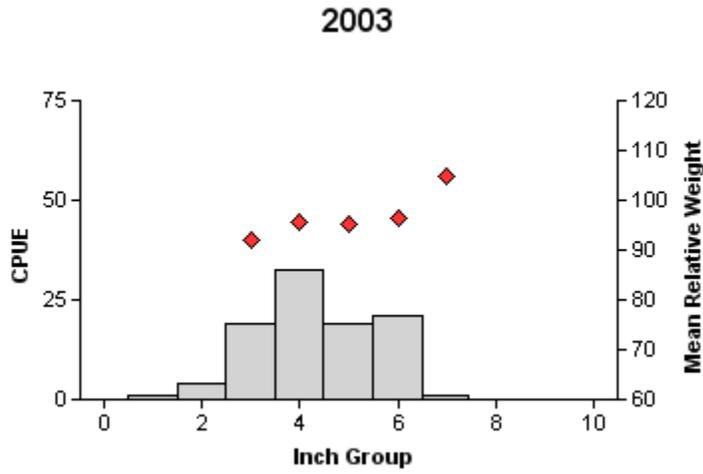
Effort = 2.0
 Total CPUE = 93.5 (16; 187)
 Stock CPUE = 85.0 (16; 170)
 PSD = 14.0 (0.05)



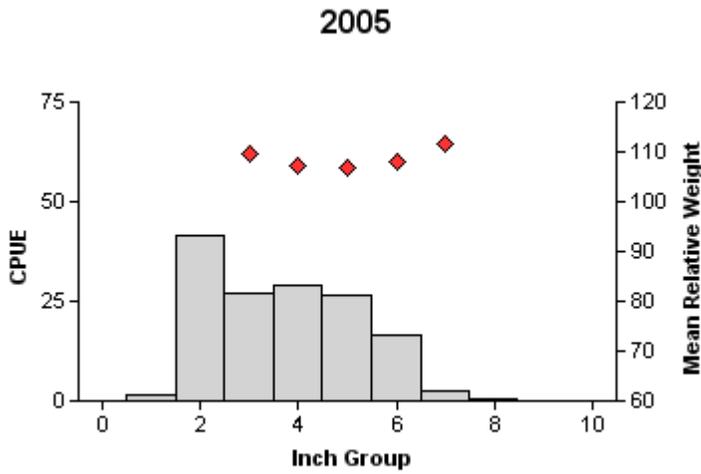
Effort = 2.0
 Total CPUE = 93.0 (18; 186)
 Stock CPUE = 91.0 (17; 182)
 PSD = 10.0 (0.03)

Figure 4. Number of bluegill 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, 1998, 1999, 2001, 2003, and 2005. Continued on next page.....

Bluegill



Effort = 2.0
 Total CPUE = 97.5 (28; 195)
 Stock CPUE = 92.5 (29; 185)
 PSD = 24.0 (0.09)



Effort = 2.0
 Total CPUE = 145.0 (24; 290)
 Stock CPUE = 102.0 (23; 204)
 PSD = 19.0 (0.05)

Figure 4 cont... Number of bluegill 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, 1998, 1999, 2001, 2003, and 2005.

Redear sunfish

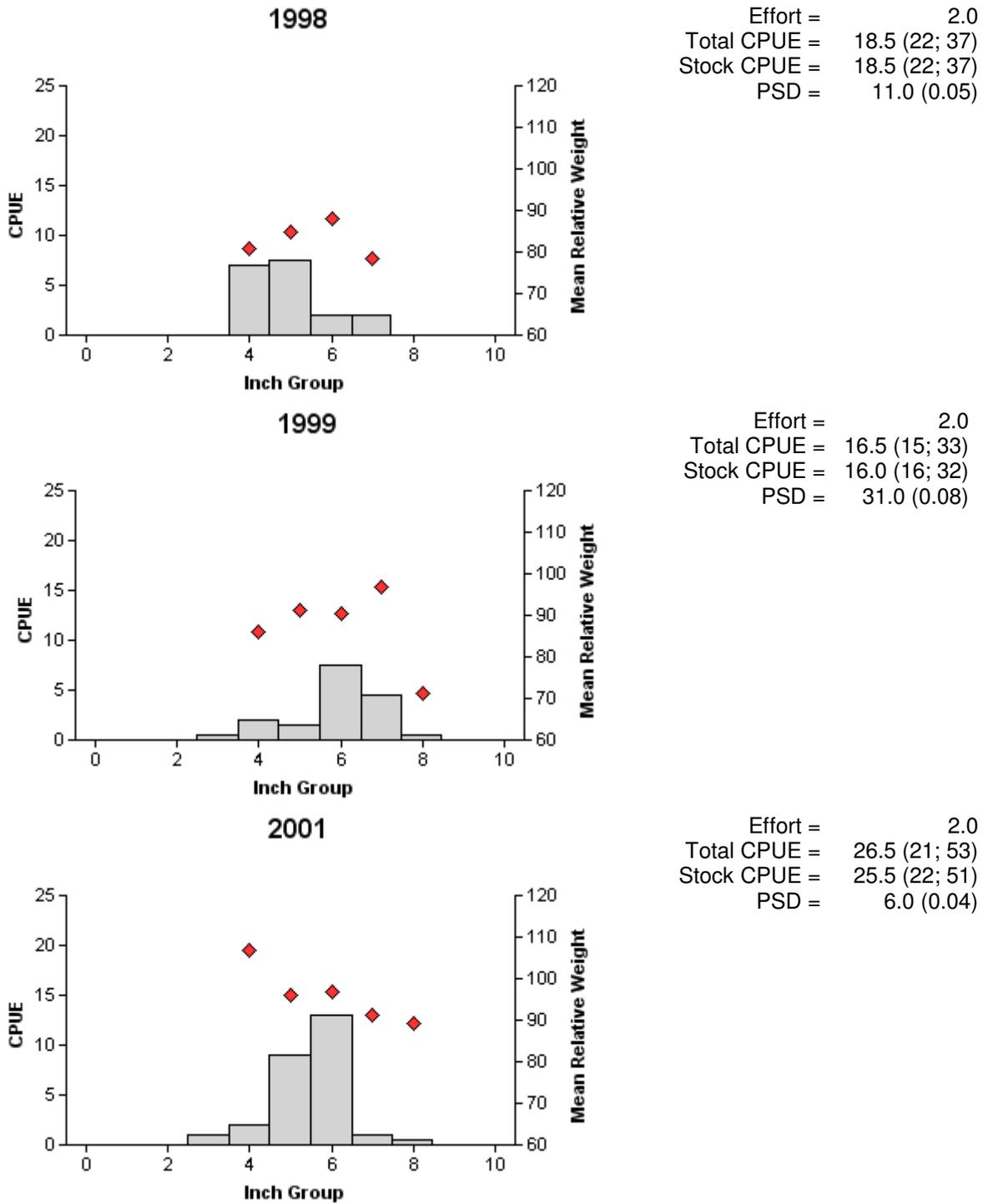
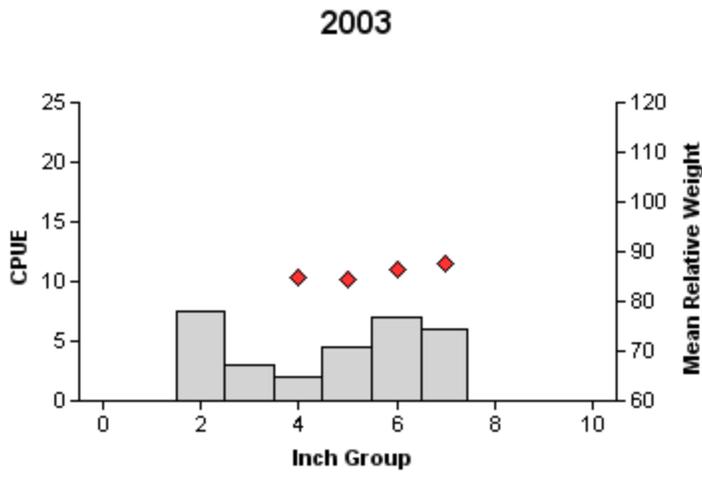


Figure 5. Number of redear sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Lake Palestine, Texas, 1998, 1999, 2001, 2003, and 2005. Continued on next page.....

Redear sunfish



Effort = 2.0
 Total CPUE = 30.0 (31; 60)
 Stock CPUE = 19.5 (21; 39)
 PSD = 31.0 (0.11)



Effort = 2.0
 Total CPUE = 43.5 (27; 87)
 Stock CPUE = 21.0 (25; 42)
 PSD = 26.0 (0.12)

Figure 5 cont... Number of redear sunfish 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, 1998, 1999, 2001, 2003, and 2005.

Sunfish

Table 7. Creel survey statistics for sunfish at Lake Palestine from June 2001 through May 2002 and June 2005 through May 2006, 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	
	2001/ 2002	2005/ 2006
Directed effort (h)	3,802 (55.9)	7,035(56.9)
Directed effort/acre	0.2 (55.9)	0.3 (59.6)
Total catch per hour	5.6 (47.3)	2.9 (45.3)
Total harvest	14,241 (86.4)	4,018 (123.3)
Bluegill	13,612 (61.12)	4,018 (123.3)
Redear	629 (642.8)	0
Harvest/acre	0.61 (86.4)	0.2 (123.3)
Bluegill	0.58 (61.12)	0.2 (123.3)
Redear	0.03 (642.8)	0
Percent legal released	26	92

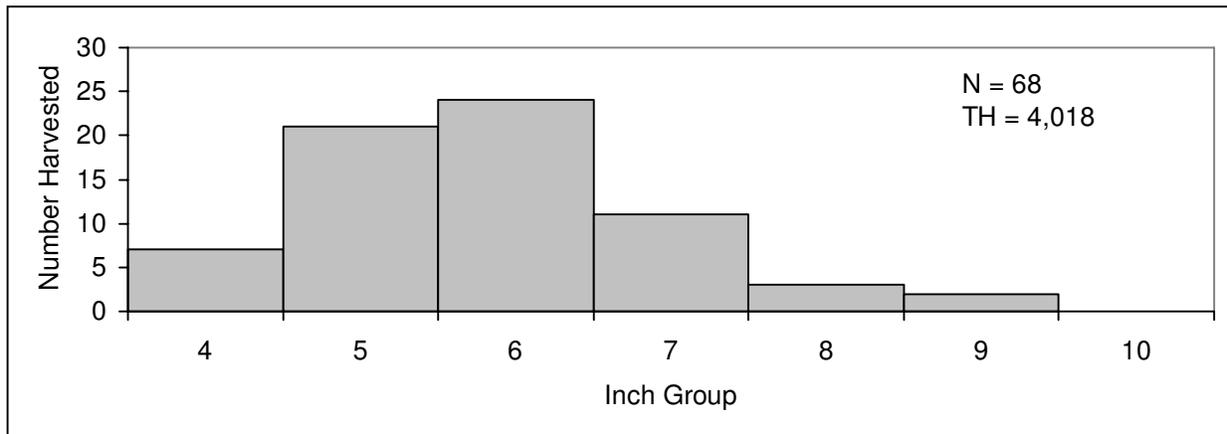


Figure 6. Length frequency of harvested bluegill observed during creel surveys at Lake Palestine, Texas, June 1, 2005 through May 31, 2006, all anglers combined. N is the number of harvested bluegill observed during creel surveys, and TH is the total estimated harvest for the creel period.

Blue catfish

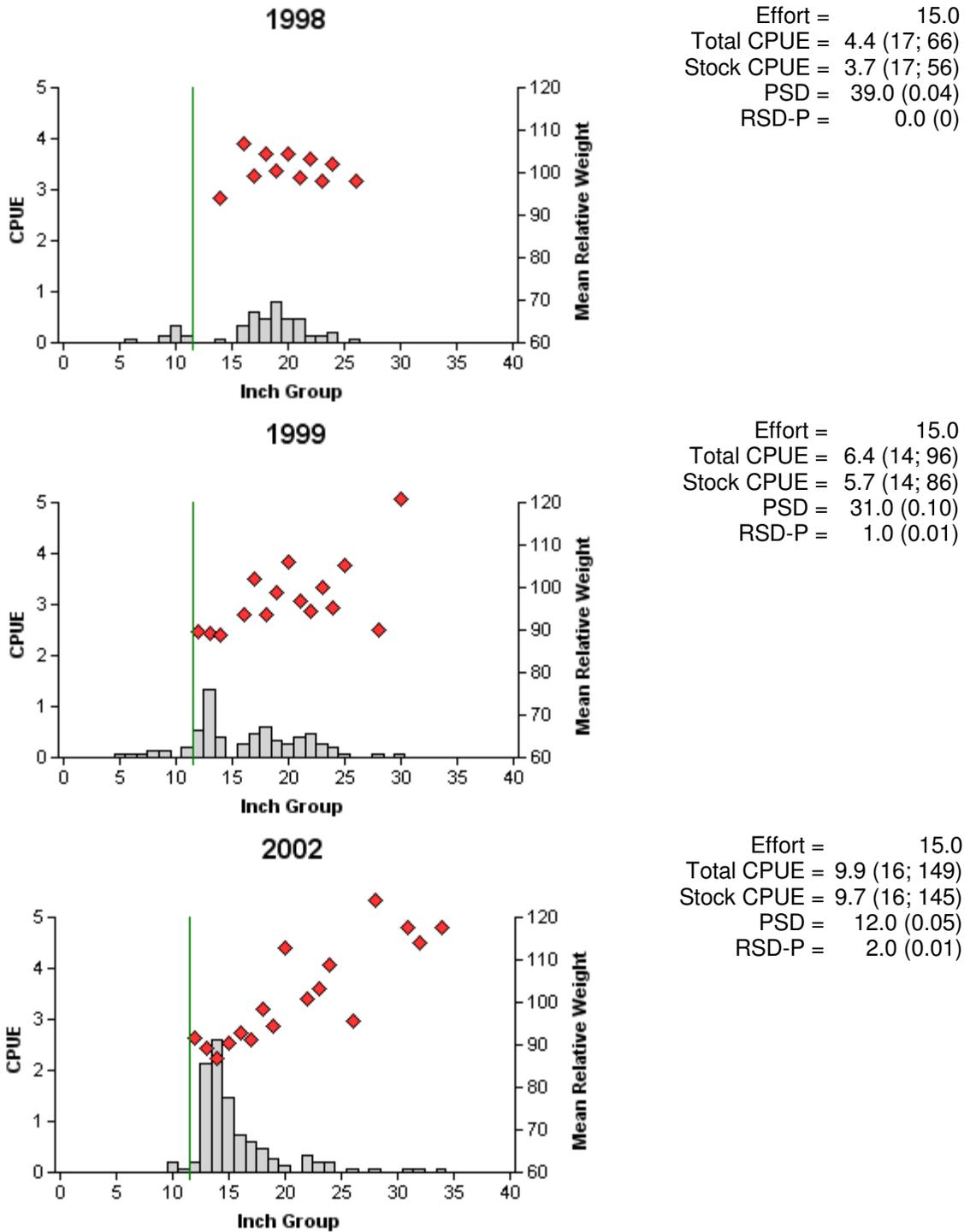
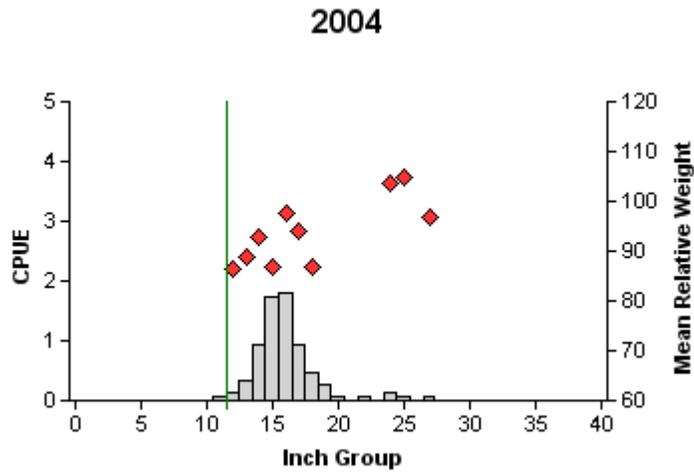
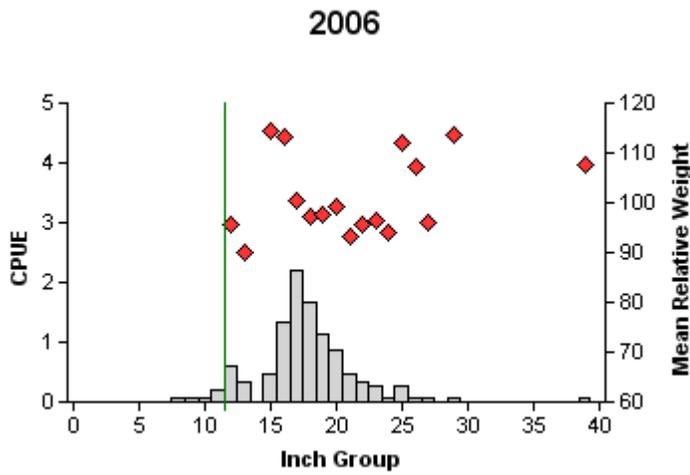


Figure 7. Number of blue catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Palestine, Texas, 1998, 1999, 2002, 2004 and 2006. Continued on next page.....

Blue catfish



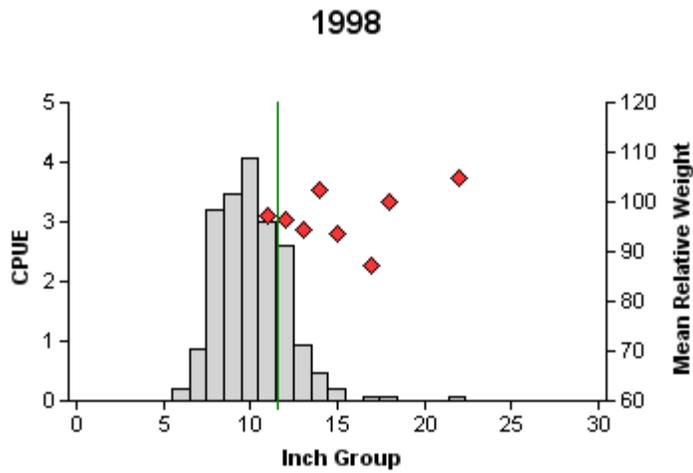
Effort = 15.0
 Total CPUE = 7.1 (19; 106)
 Stock CPUE = 7.0 (20; 105)
 PSD = 6.0 (0.02)
 RSD-P = 0.0 (0)



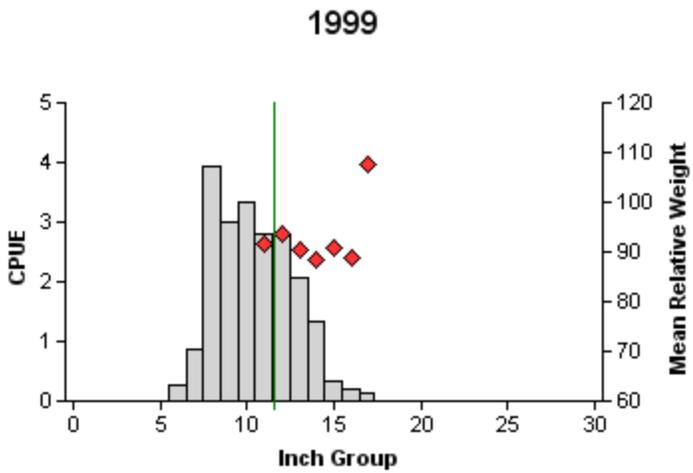
Effort = 15.0
 Total CPUE = 10.7 (17; 160)
 Stock CPUE = 10.3 (16; 154)
 PSD = 25.0 (0.06)
 RSD-P = 1.0 (0.01)

Figure 7 cont... Number of blue catfish 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, 1998, 1999, 2002, 2004 and 2006.

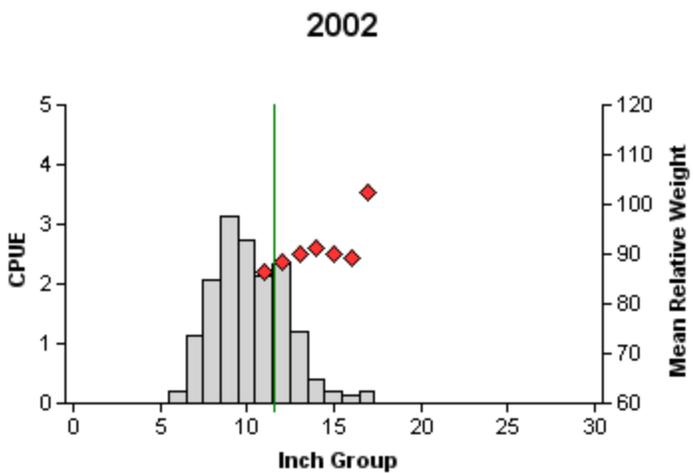
Channel catfish



Effort = 15.0
 Total CPUE = 19.2 (17; 288)
 Stock CPUE = 7.4 (17; 111)
 PSD = 3.0 (0.01)
 RSD-P = 0.0 (0)



Effort = 15.0
 Total CPUE = 21.1 (20; 316)
 Stock CPUE = 9.7 (18; 145)
 PSD = 3.0 (0.01)
 RSD-P = 0.0 (0)



Effort = 15.0
 Total CPUE = 15.9 (22; 238)
 Stock CPUE = 6.6 (16; 99)
 PSD = 5.0 (0.03)
 RSD-P = 0.0 (0)

Figure 8. Number of channel catfish 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, 1998, 1999, 2002, 2004 and 2006. Continued on next page.....

Channel catfish

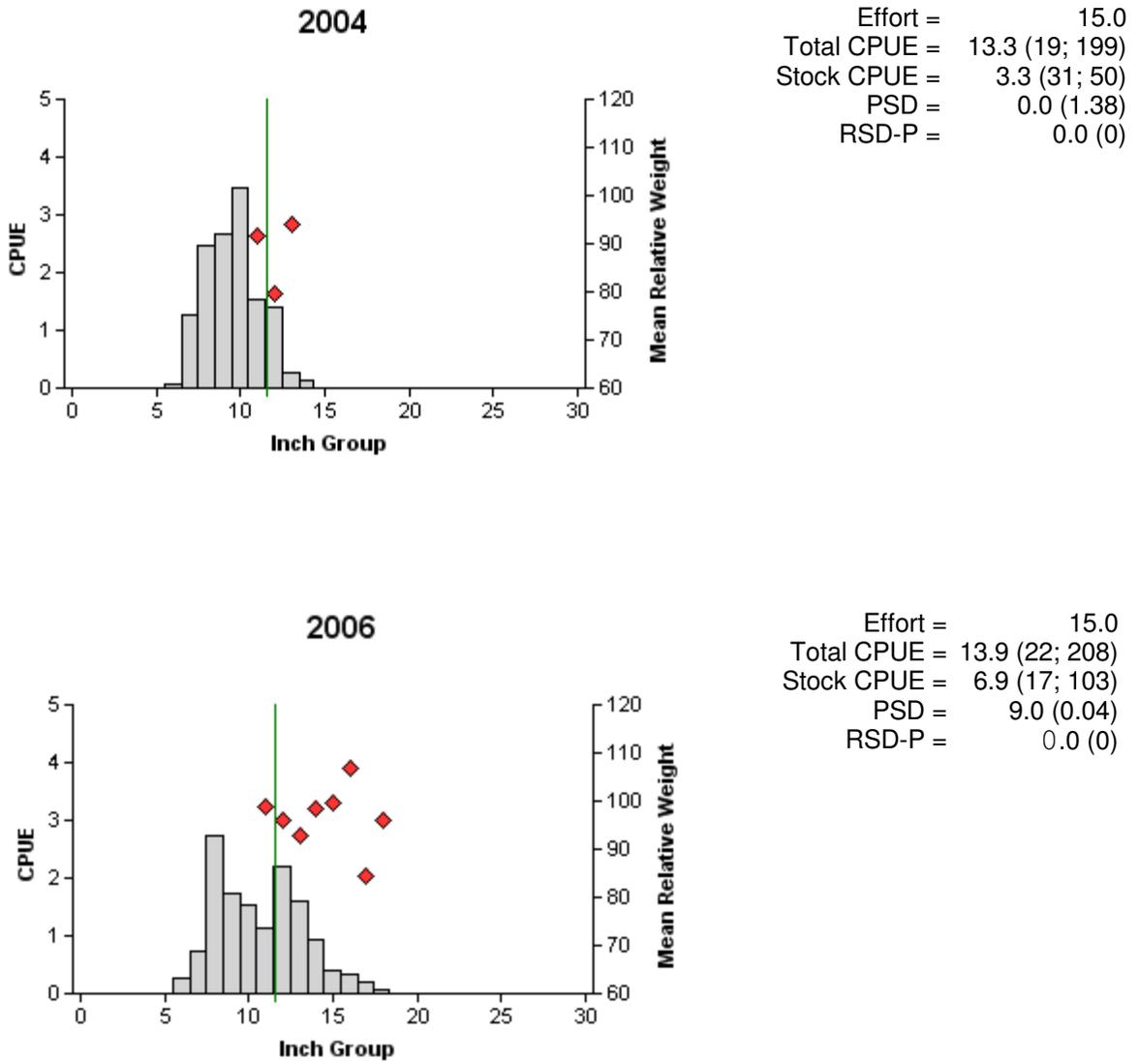


Figure 8 cont... Number of channel catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Texas, 1998, 1999, 2002, 2004 and 2006.

Catfish

Table 8. Creel survey statistics for catfish at Lake Palestine from June 2001 through May 2002 and June 2005 through May 2006, where total catch per hour is for anglers targeting all 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	
	2001/ 2002	2005/ 2006
Directed effort (h)	86,245 (18.4)	108,347 (16.2)
Directed effort/acre	3.6 (18.4)	4.6 (16.2)
Total catch per hour	2.1 (41.0)	1.4 (44.1)
Total harvest	62,337 (52.2)	175,118 (28.7)
Channel catfish	44,728 (32.9)	139,524 (26.0)
Blue catfish	17,609 (44.1)	35,594 (43.3)
Harvest/acre	2.7 (52.2)	7.4 (28.7)
Channel catfish	1.9 (32.9)	5.9 (26.0)
Blue catfish	0.8 (44.1)	1.5 (43.3)
Percent legal released	17	16

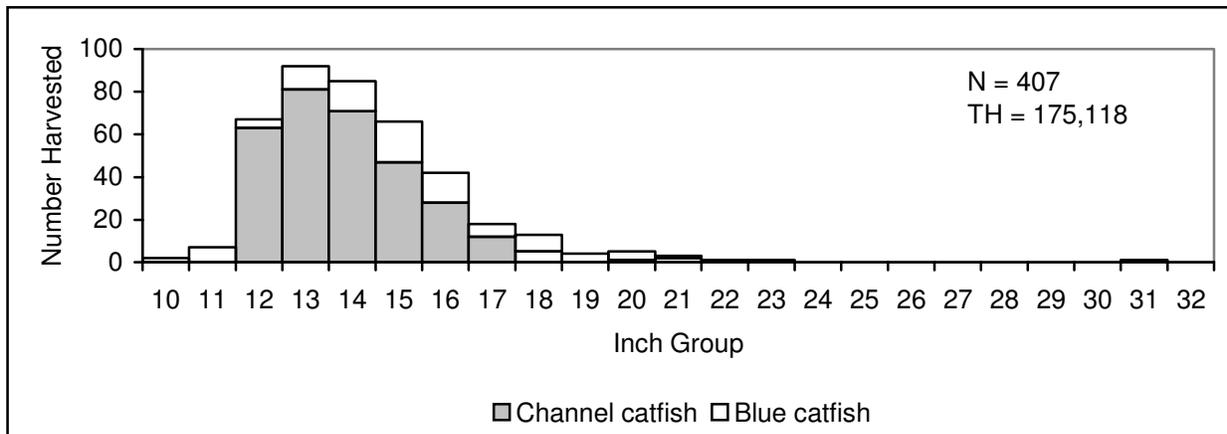


Figure 9. Length frequency of harvested catfish observed during creel surveys at Lake Palestine, Texas, June 2005 through May 2006, all anglers combined. N is the number of harvested catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

White bass

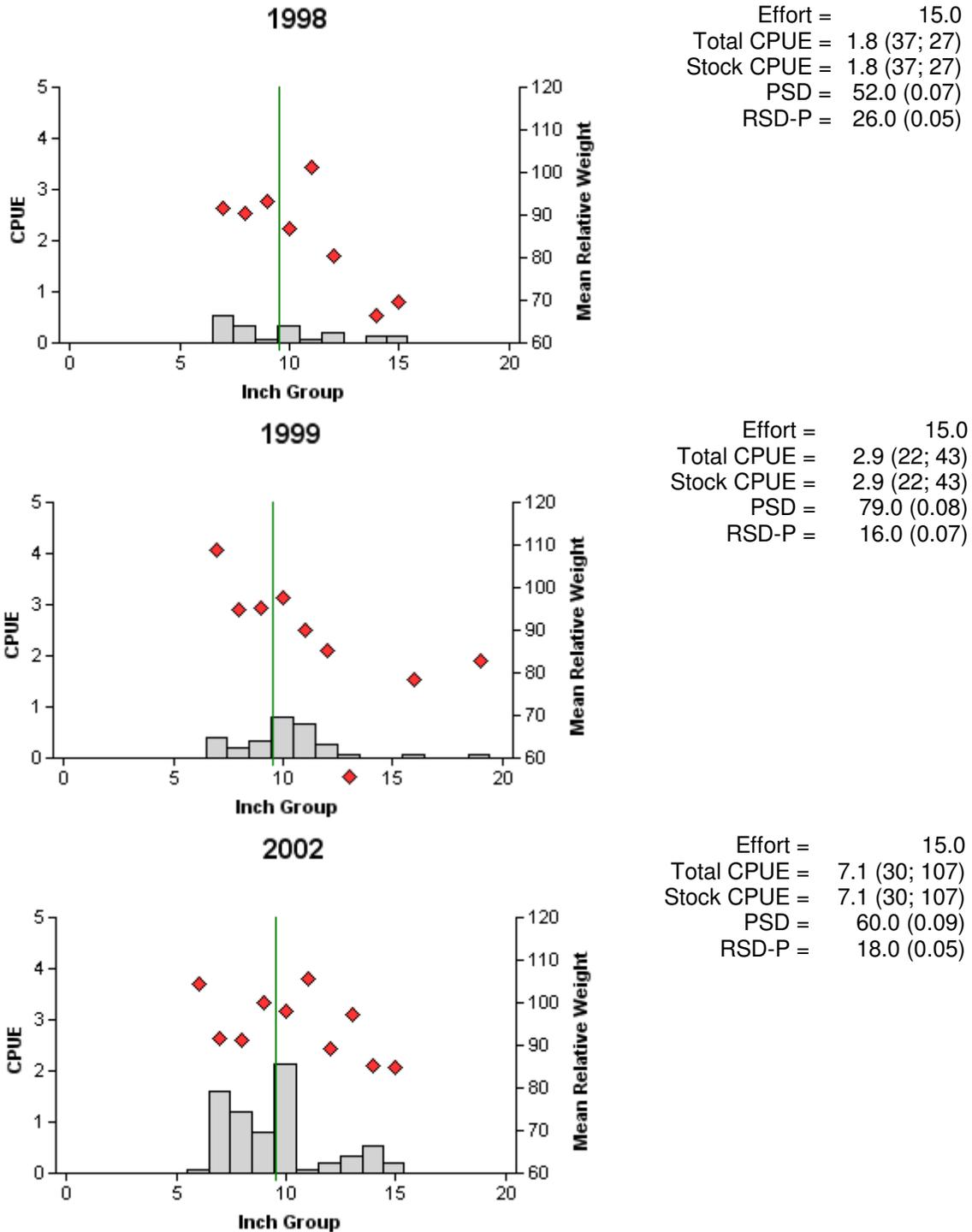
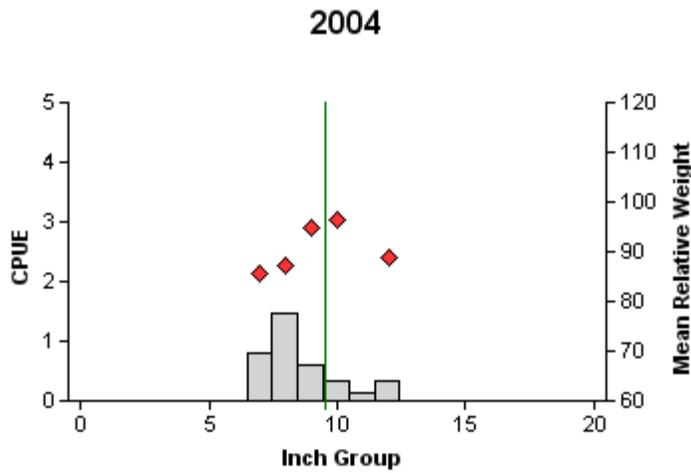
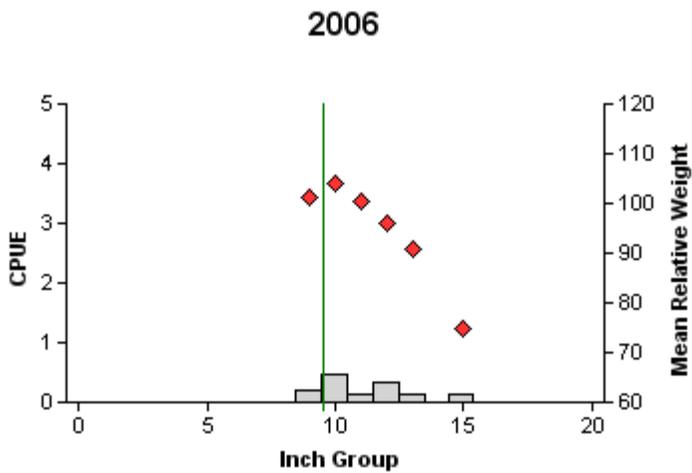


Figure 10. Number of white bass caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Palestine, Texas, 1998, 1999, 2002, 2004 and 2006. Continued on next page.....

White bass



Effort = 15.0
 Total CPUE = 3.7 (26; 55)
 Stock CPUE = 3.7 (26; 55)
 PSD = 38.0 (0.08)
 RSD-P = 9.0 (0.06)



Effort = 15.0
 Total CPUE = 1.4 (23; 21)
 Stock CPUE = 1.4 (23; 21)
 PSD = 100.0 (0.00)
 RSD-P = 43.0 (0.13)

Figure 10 cont... 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, Texas, 1998, 1999, 2002, 2004 and 2006.

White bass

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

Creel Survey Statistic	Year	
	2001/ 2002	2005/2006
Directed effort (h)	20,726 (43.2)	22,942 (39.3)
Directed effort/acre	0.9 (43.2)	1.0 (39.3)
Total catch per hour	1.2 (101.7)	1.5 (48.2)
Total harvest	5,373 (109.5)	22,659 (76.6)
Harvest/acre	0.2 (109.5)	1.0 (76.6)
Percent legal released	15	NA

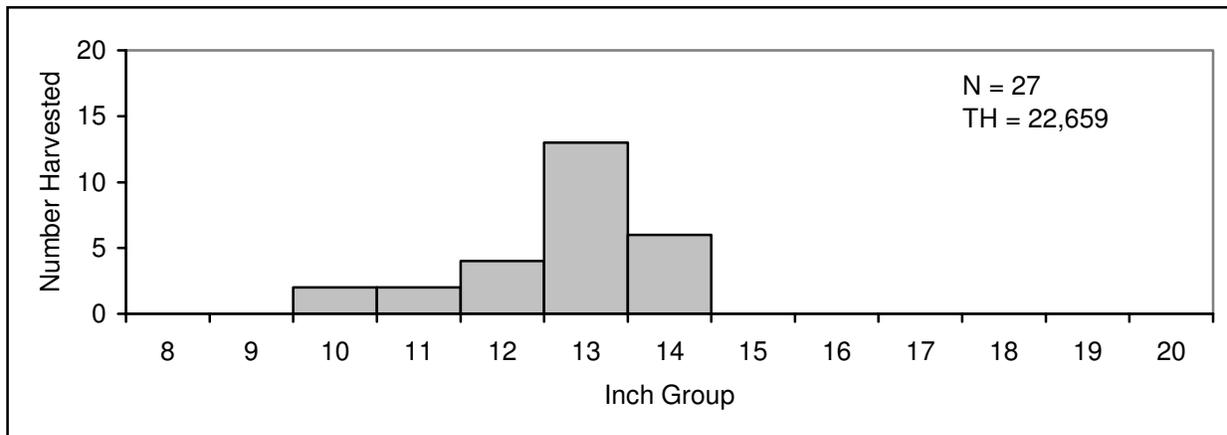
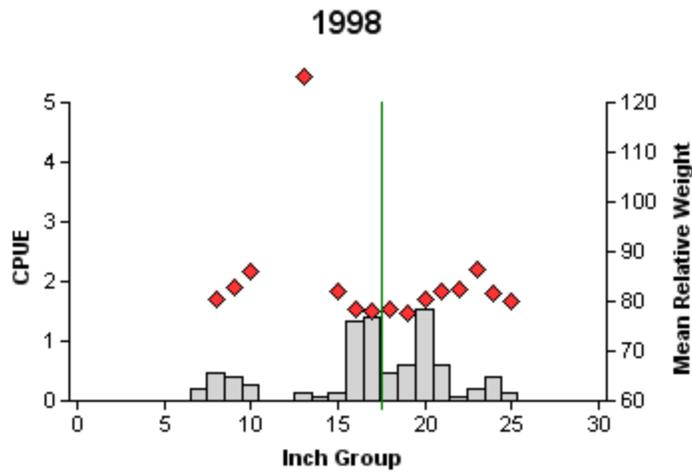
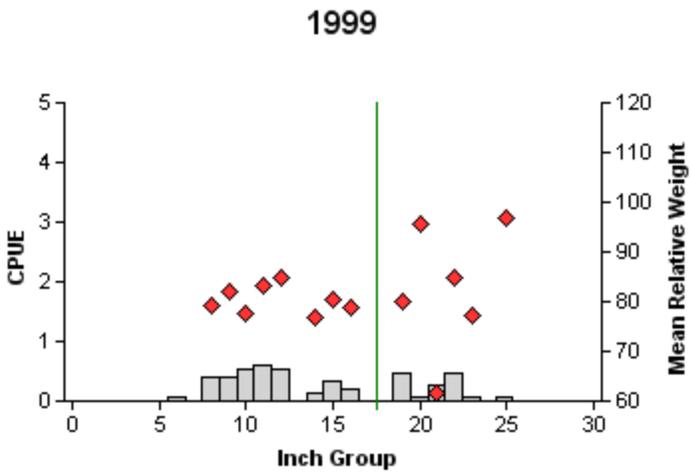


Figure 11. Length frequency of harvested white bass observed during creel surveys at Lake Palestine, Texas, June 2005 through May 2006, all anglers combined. N is the number of harvested white bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

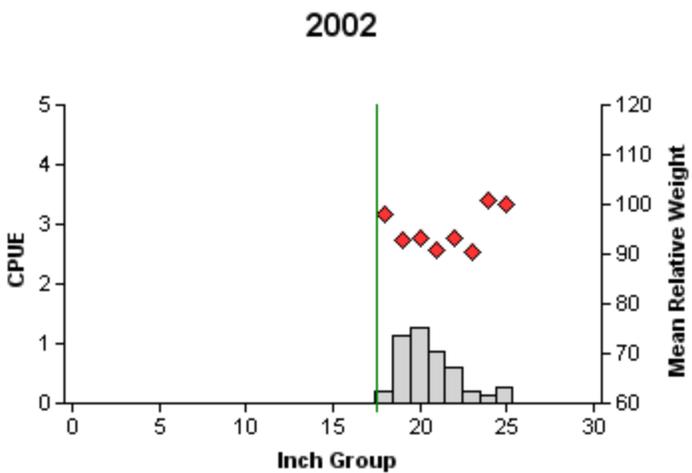
Palmetto bass



Effort = 15.0
 Total CPUE = 8.4 (26; 126)
 Stock CPUE = 8.2 (26; 123)
 PSD = 86.0 (0.05)
 RSD-P = 84.0 (0.05)



Effort = 15.0
 Total CPUE = 4.6 (34; 69)
 Stock CPUE = 4.5 (34; 68)
 PSD = 57.0 (0.05)
 RSD-P = 43.0 (0.09)



Effort = 15.0
 Total CPUE = 4.7 (51; 70)
 Stock CPUE = 4.7 (51; 70)
 PSD = 100.0 (0)
 RSD-P = 100.0 (0)

Figure 12. 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, 1998, 1999, 2002, 2004 and 2006. Continued on next page.....

Palmetto bass

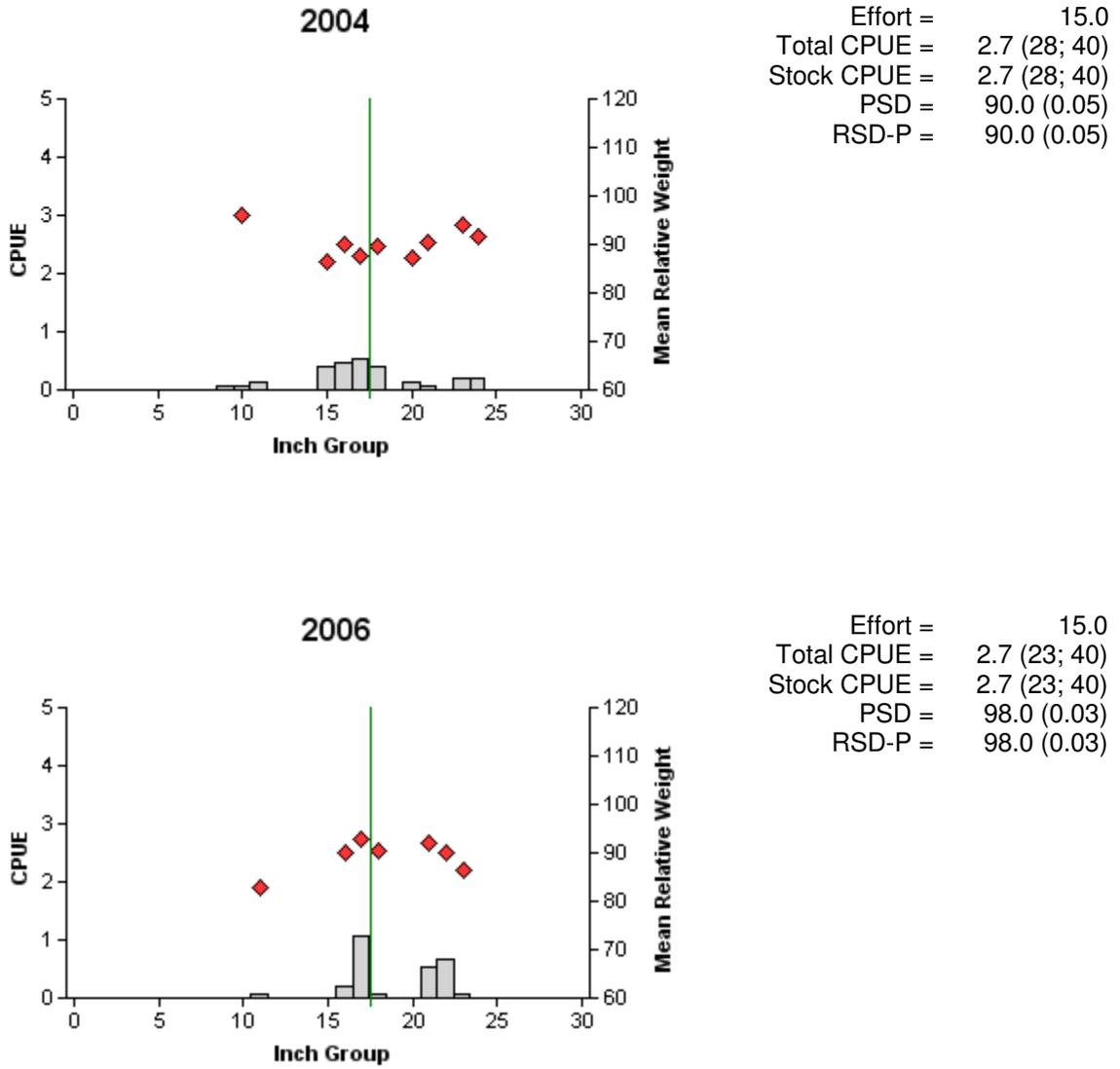


Figure 12 cont... Number of palmetto bass caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Texas, 1998, 1999, 2002, 2004 and 2006.

Palmetto bass

Table 10. Creel survey statistics for Palmetto bass at Lake Palestine, from June 2001 through May 2002 and June 2005 through May 2006, where total catch per hour is for anglers targeting "morones" spp., and total harvest is the estimated number of palmetto bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year	
	2001/ 2002	2005/ 2006
Directed effort (h)	20,726 (43.2)	22,942 (39.3)
Directed effort/acre	0.9 (43.2)	1.0 (39.3)
Total catch per hour	0.5 (45.8)	1.5 (48.2)
Total harvest	1,023 (144.9)	7,363 (78.9)
Harvest/acre	0.04 (144.9)	0.3 (78.9)
Percent legal released	71	NA

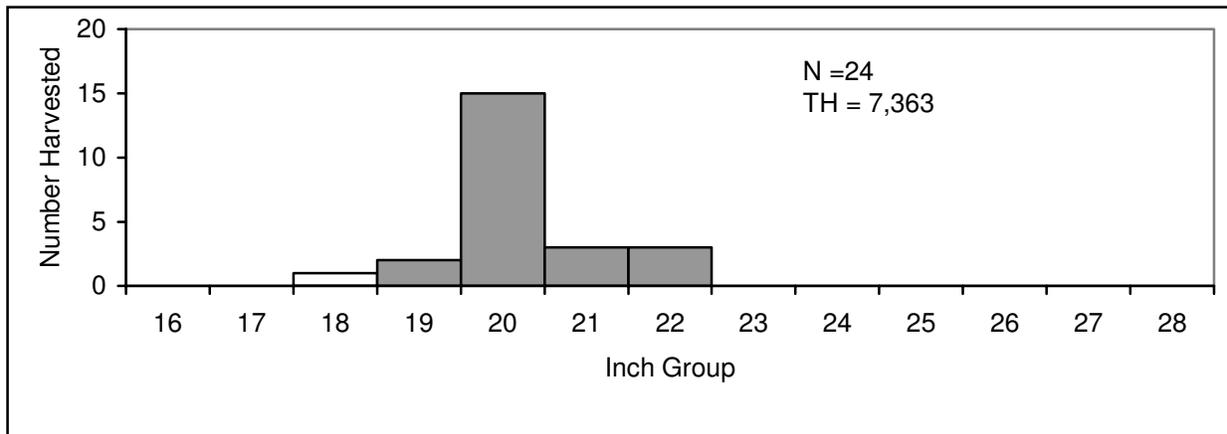


Figure 13. Length frequency of harvested palmetto bass observed during creel surveys at Lake Palestine, Texas, June 2005 through May 2006, all anglers combined. N is the number of harvested white bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

Largemouth bass

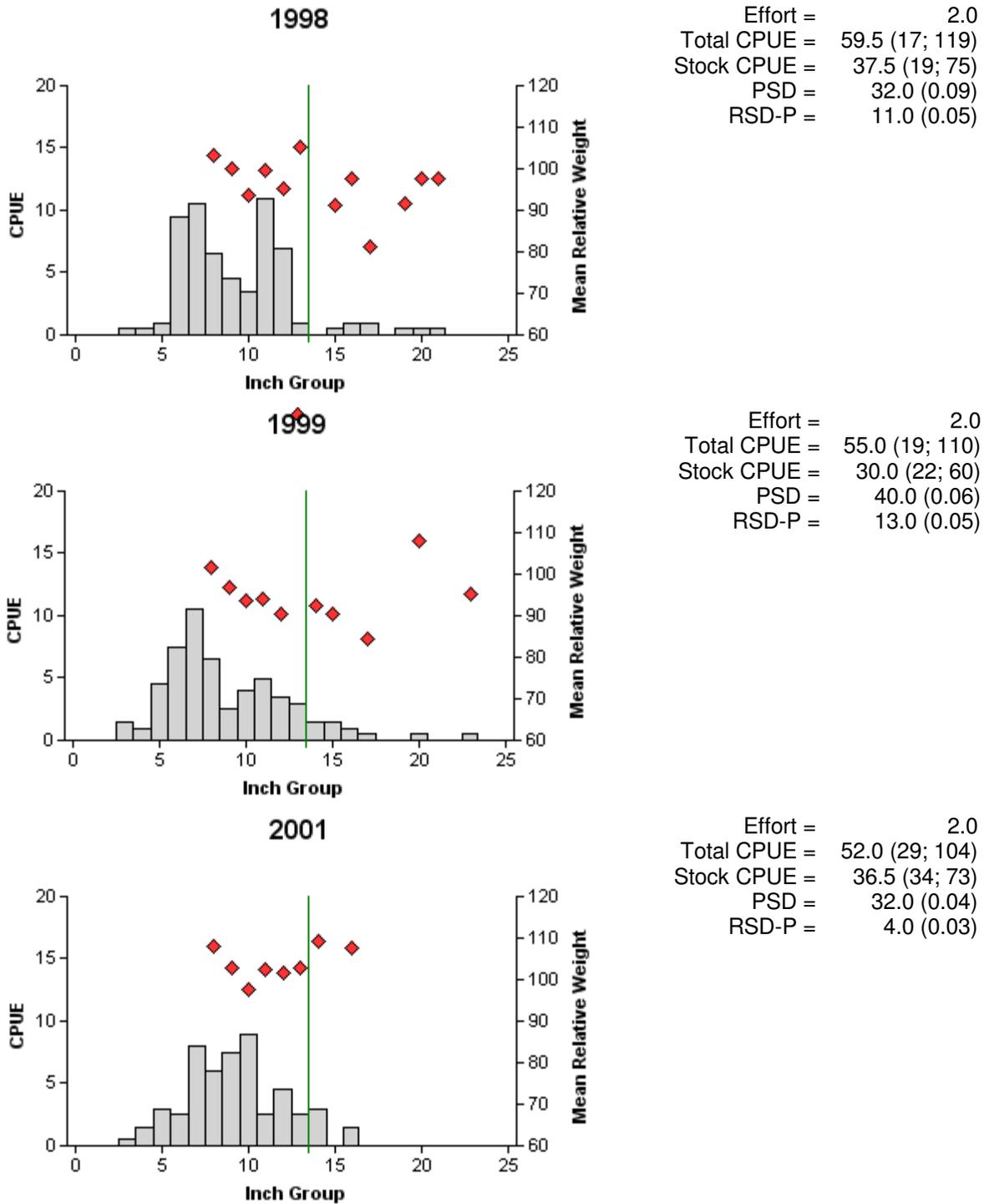


Figure 14. Number of largemouth bass caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Lake Palestine, Texas, 1998, 1999, 2001, 2003, and 2005. Continued on next page.....

Largemouth bass

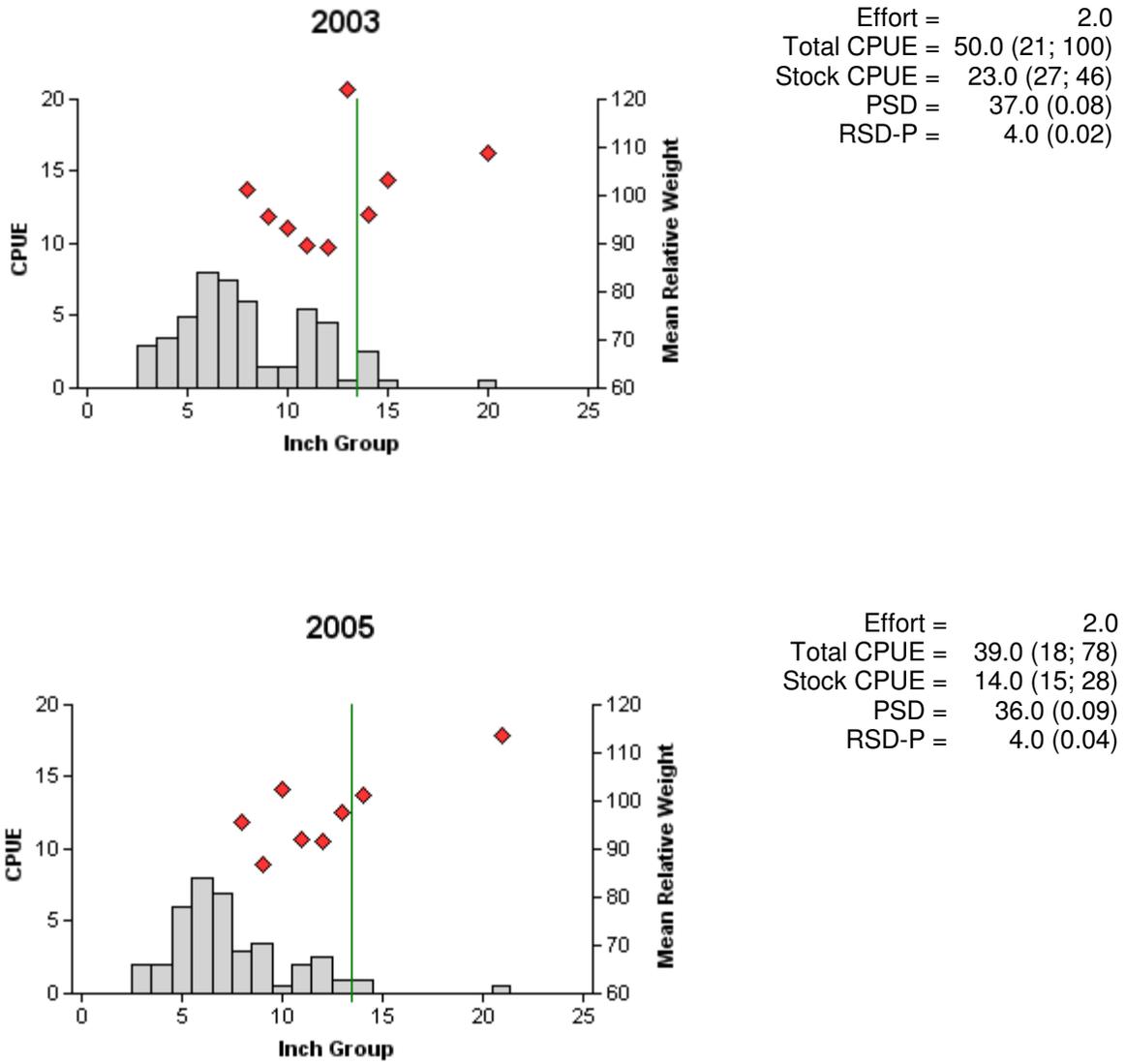


Figure 14 cont... Number of largemouth bass caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Lake Palestine, Texas, 1998, 1999, 2001, 2003, and 2005.

Largemouth bass

Table 11. Creel survey statistics for largemouth bass at Lake Palestine from June 2001 through May 2002 and June 2005 through May 2006, where total catch per hour is for anglers targeting 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
Directed effort (h)	54,137.46 (22.4)	67,231 (16.8)
Directed effort/acre	2.3 (22.4)	2.9 (16.8)
Total catch per hour	0.5 (56.6)	0.8 (40.4)
Total harvest	4,606 (96.0)	15,275 (84.0)
Harvest/acre	0.2 (96.0)	0.7 (84.0)
Percent legal released	21	56

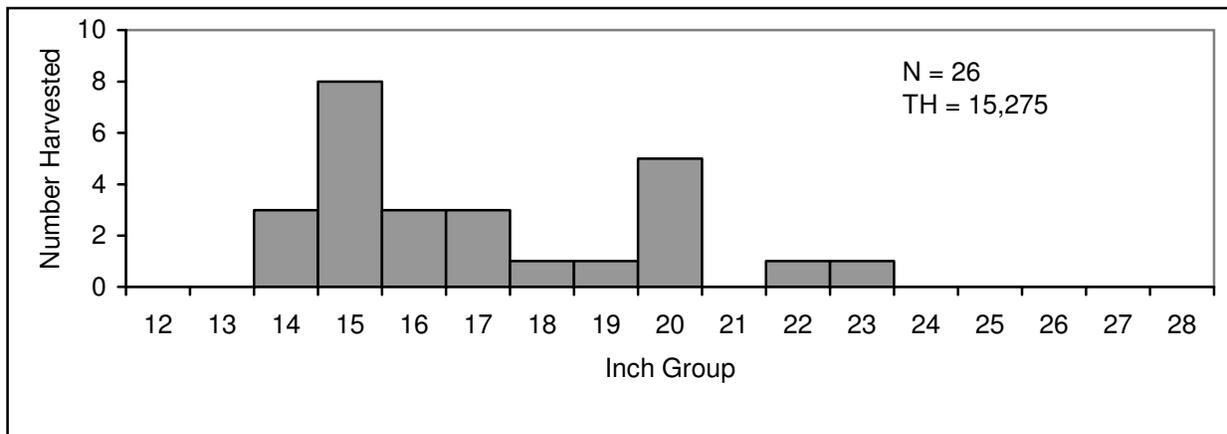


Figure 15. Length frequency of harvested largemouth bass observed during creel surveys at Lake Palestine, Texas, June 2005 through May 2006, all anglers combined. N is the number of harvested largemouth bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

Largemouth bass

Table 12. Results of genetic analysis of largemouth bass collected by fall electrofishing at Lake Palestine, Texas, 1994, 1995, 1996, 1997, 2001, and 2003. FLMB = Florida largemouth bass, NLMB = Northern largemouth bass, F1 = first generation hybrid between a FLMB and a NLMB, Fx = second or higher generation hybrid between a FLMB and a NLMB.

Year	Sample size	Genotype				% FLMB alleles	% pure FLMB
		FLMB	F1	Fx	NLMB		
1994	59	4	10	32	13	42	6.8
1995	30	2	12	10	6	42	6.9
1996	30	1	8	9	12	31	3.3
1997	32	0	7	19	6	32	0.0
2001	24	1	8	13	2	38	4.1
2003	30	5	4	15	5	42	14.3

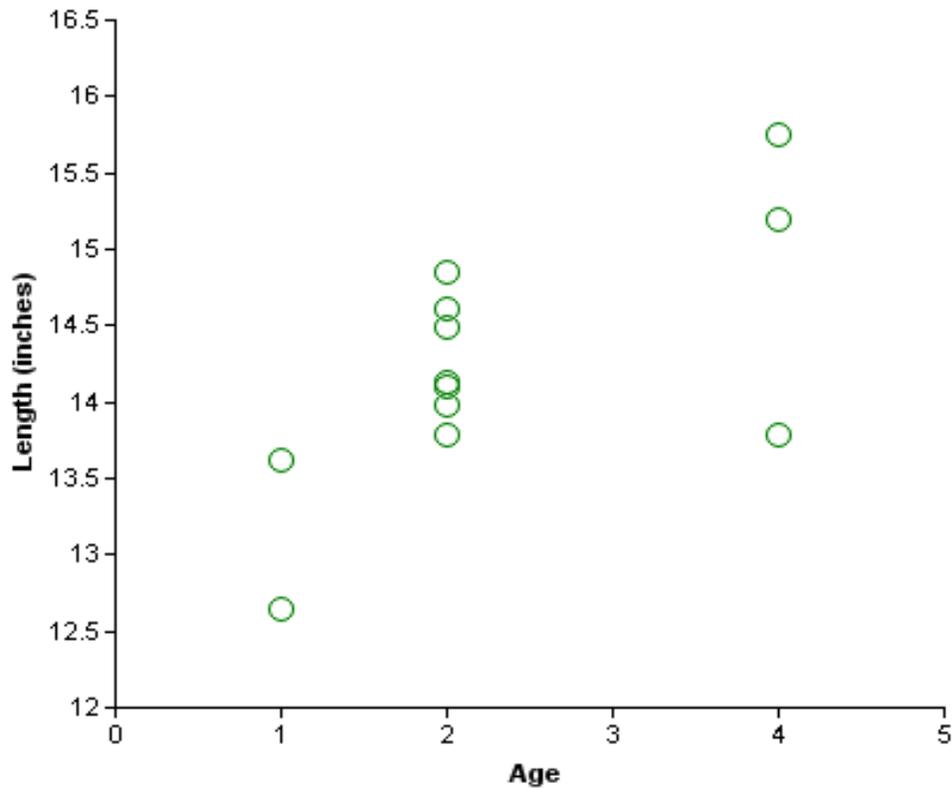


Figure 16. Length at age for largemouth bass collected by electrofishing at Lake Palestine, Texas, October 2005.

White crappie

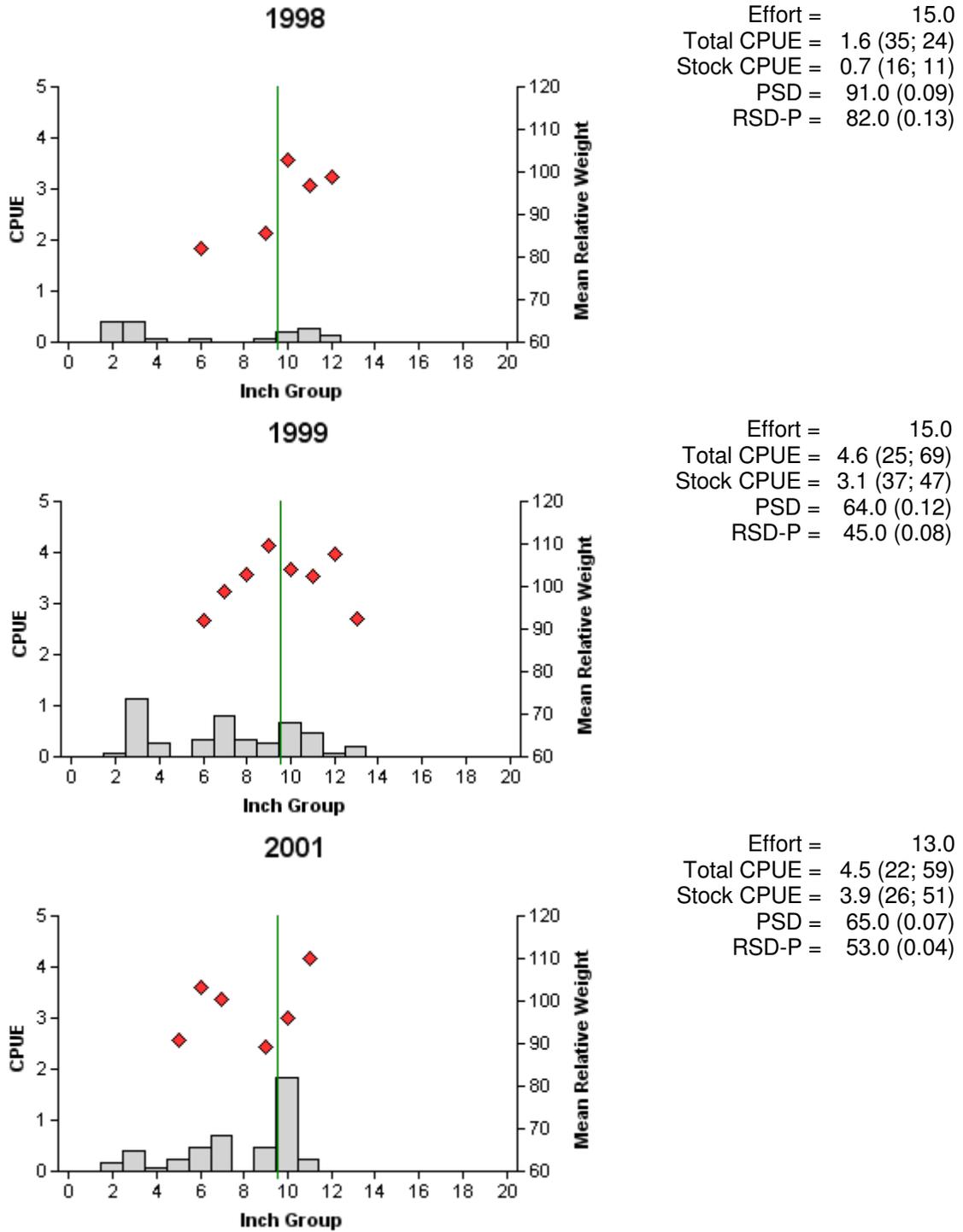


Figure 17. Number of white crappie caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap net surveys, Lake Palestine, Texas, 1998, 1999, 2001, 2003 and 2005. Continued on next page.....

White crappie

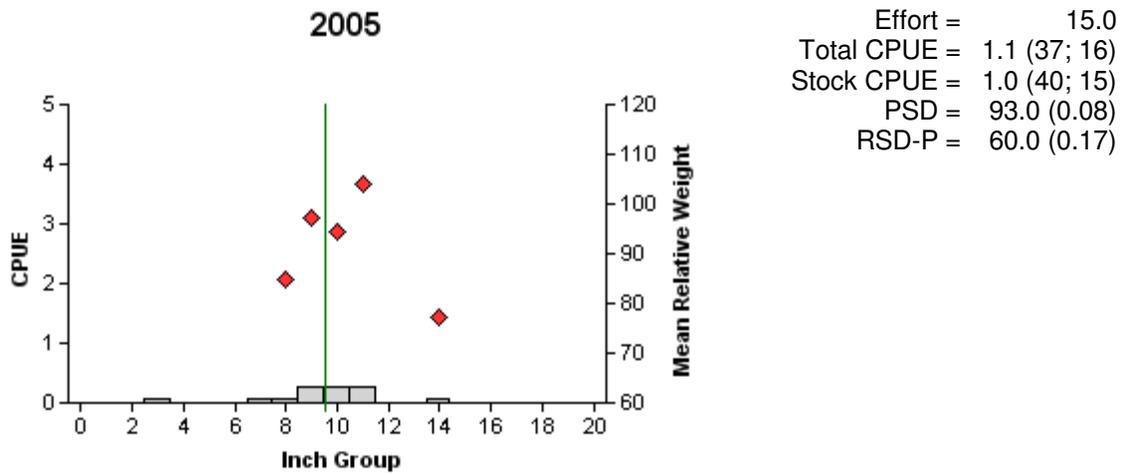


Figure 17 cont... Number of white crappie caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap net surveys, Lake Palestine, Texas, 1998, 1999, 2001, 2003 and 2005.

White crappie

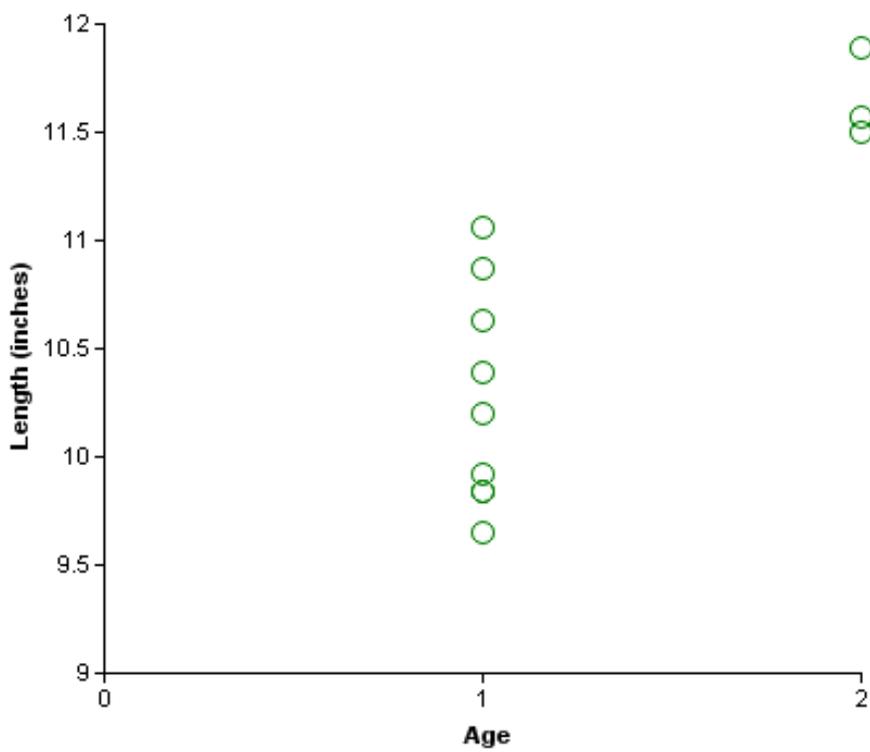


Figure 18. Length at age for white crappie collected from trap nets at Lake Palestine, Texas, November 2005.

Black crappie

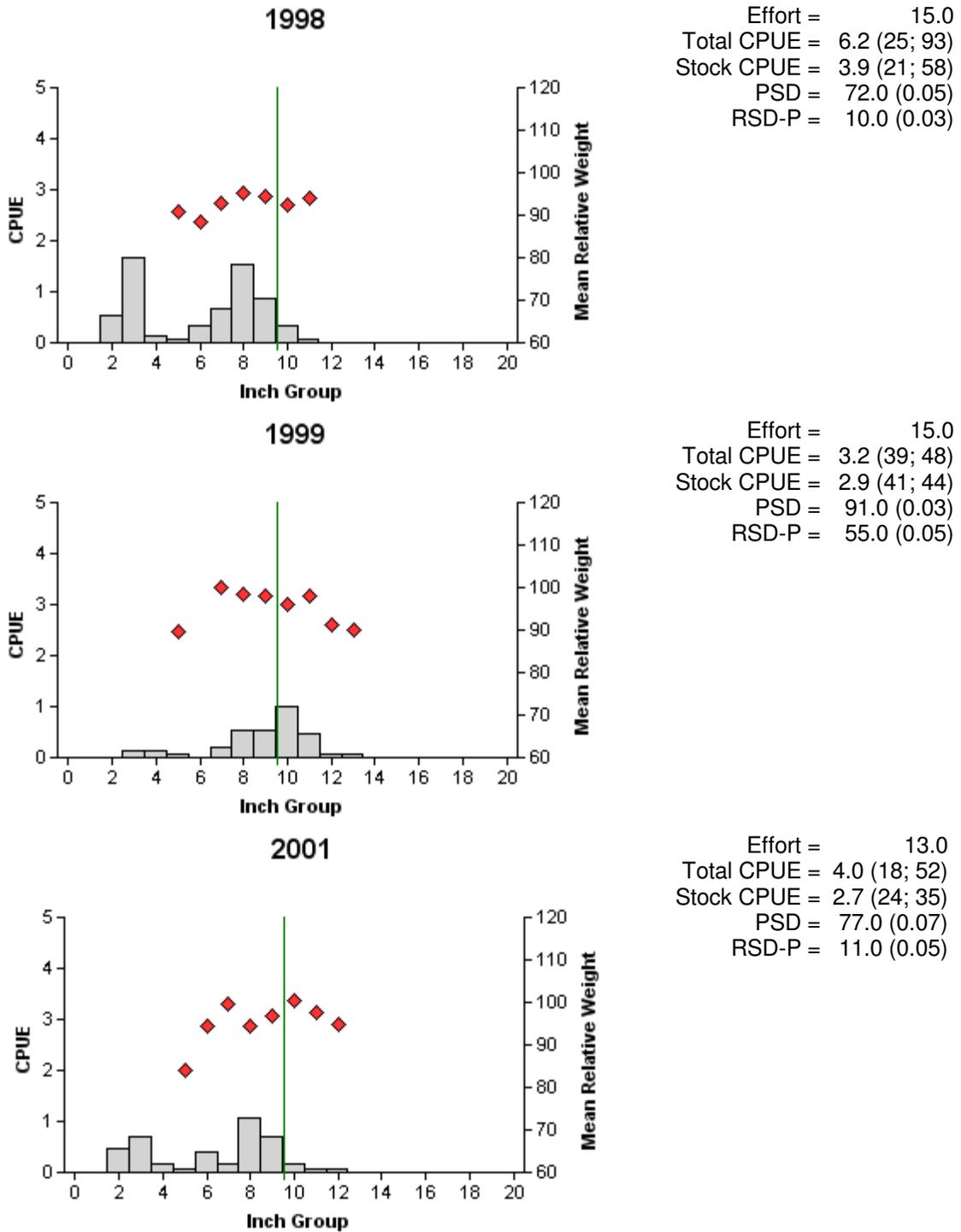


Figure 19. Number of black crappie caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap net surveys, Lake Palestine, Texas, 1998, 1999, 2001, 2003 and 2005. Continued on next page.....

Black crappie

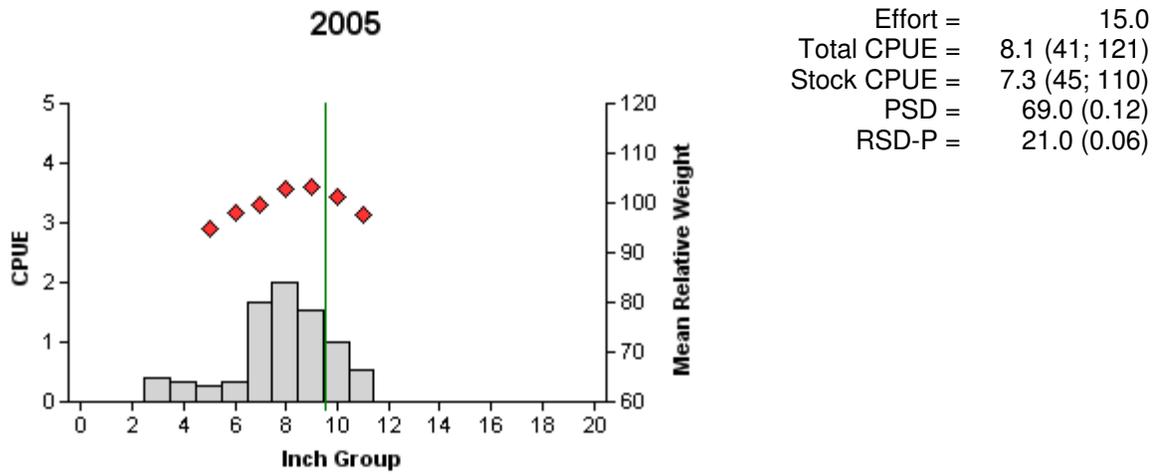


Figure 19 cont... Number of black crappie caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap net surveys, Lake Palestine, Texas, 1998, 1999, 2001, 2003 and 2005.

Black crappie

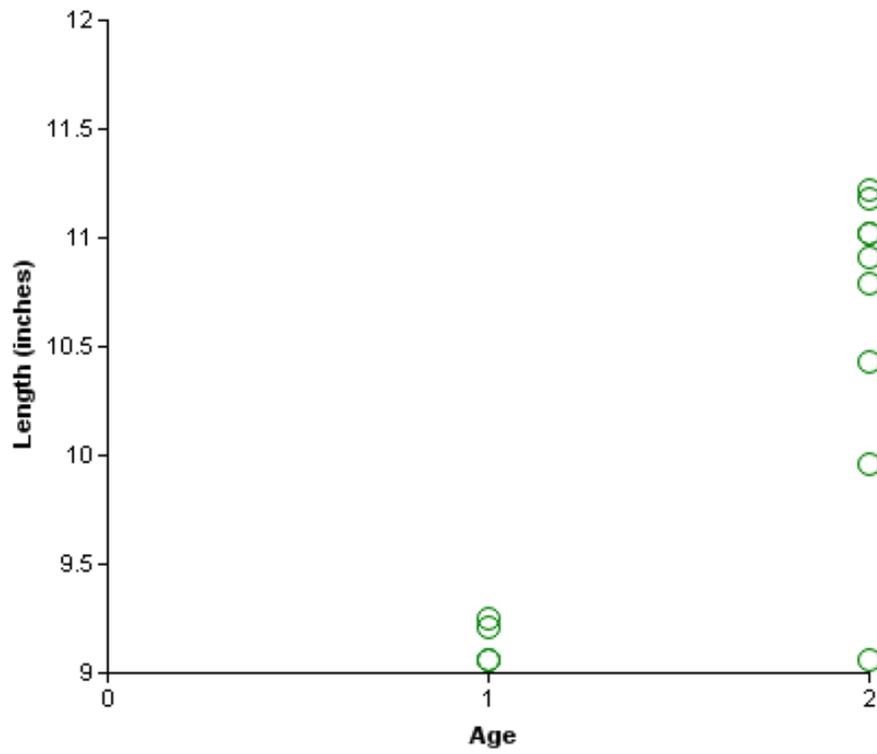


Figure 20. Length at age for black crappie collected from trap nets at Lake Palestine, Texas, November 2005.

Crappie

Table 13. Creel survey statistics for crappie at Lake Palestine, from June 2001 through May 2002 and June 2005 through May 2006, 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	
	2001/2002	2005/2006
Directed effort (h)	25,992 (22.9)	53,539 (17.8)
Directed effort/acre	1.1 (22.9)	4.6 (17.8)
Total catch per hour	1.4 (46.0)	1.8 (48.2)
Total harvest	23,772 (66.7)	92,422 (28.2)
White crappie	16,827 (54.1)	42,829 (43.7)
Black crappie	6,945 (97.6)	49,593 (15.5)
Harvest/acre	1.0 (66.7)	3.9 (28.2)
White crappie	0.7 (54.1)	1.8 (43.7)
Black crappie	0.3 (97.6)	2.1 (15.5)
Percent legal released	1	2

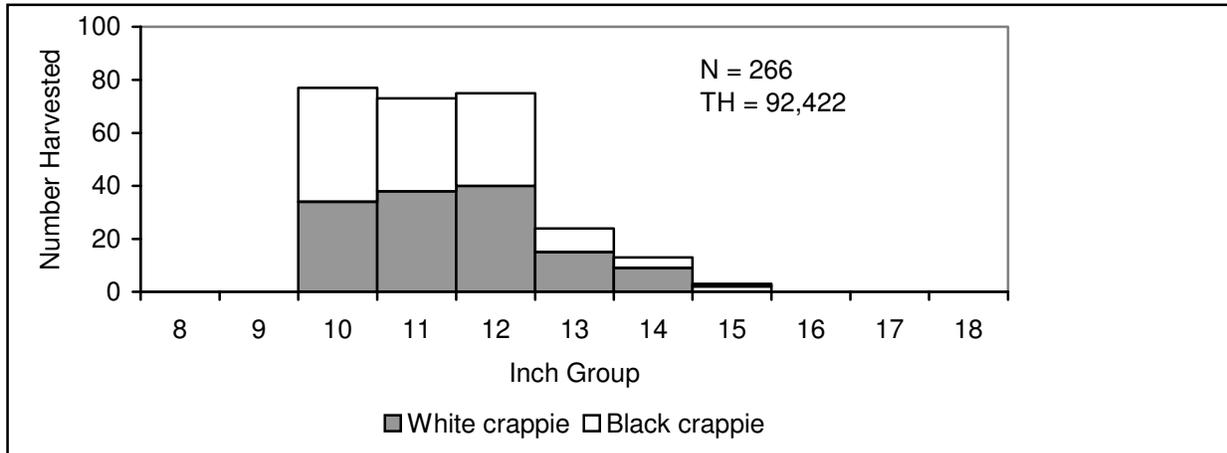


Figure 21. Length frequency of harvested white crappie observed during creel surveys at Lake Palestine, Texas, June 2005 through May 2006, all anglers combined. N is the number of harvested white crappie observed during creel surveys, and TH is the total estimated harvest for the creel period.

Table 14. 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.

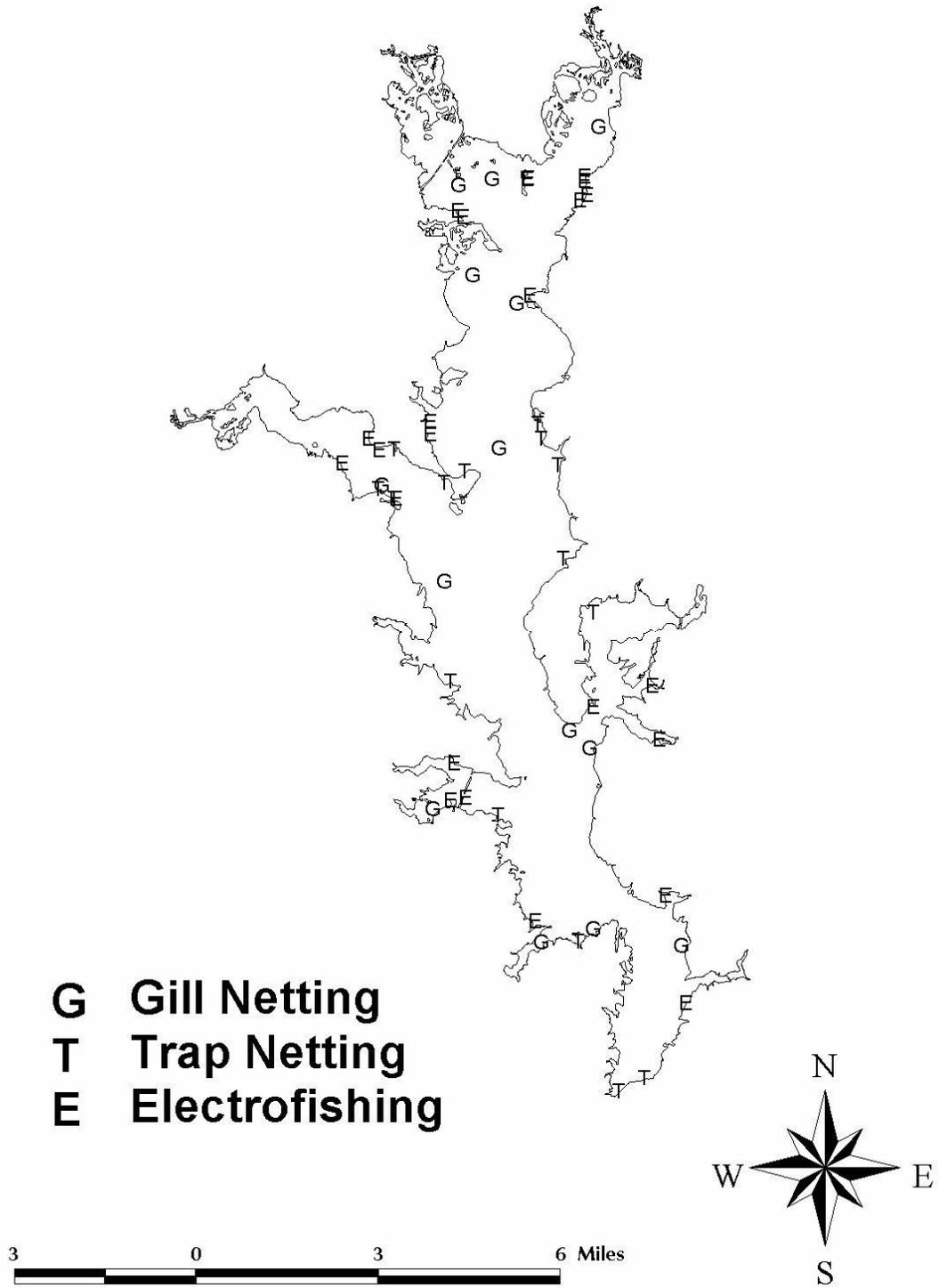
Survey Year	Electrofishing	Trap Net	Gill Net	Creel Survey	Report
Fall 2006-Spring 2007					
Fall 2007-Spring 2008	A		A		
Fall 2008-Spring 2009					
Fall 2009-Spring 2010	S	S	S	A	S

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APPENDIX A

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Lake Palestine, Texas, 2005-2006.

Species	Gill Netting		Trap Netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Gizzard shad					366	183.0
Threadfin shad					1,446	723.0
Blue catfish	160	10.7				
Channel catfish	208	13.9				
White bass	21	1.4				
Palmetto bass (striped x white bass hybrid)	40	2.7				
Redbreast sunfish					38	19.0
Spotted sunfish					3	1.5
Bluegill					290	145.0
Longear sunfish					97	48.5
Redear sunfish					87	43.5
Spotted bass					33	16.5
Largemouth bass					78	39.0
White crappie			16	1.1		
Black crappie			121	8.1		

APPENDIX B



Location of sampling sites, Lake Palestine, Texas, 2005-2006. Trap net, gill net, and electrofishing stations are indicated by T, G, and E, respectively.