PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

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FEDERAL AID PROJECT F-30-R-32

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2006 Survey Report

Nasworthy Reservoir

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Nasworthy Reservoir were surveyed in 2006 using electrofishing and trap nets, and in 2007 using gill nets. Anglers were interviewed from September 2003 to August 2004 during a creel survey. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir Description:** Nasworthy Reservoir is a 1,598-acre impoundment located on the southwestern edge of San Angelo, Texas in Tom Green County. It is a shallow, turbid reservoir with stable water levels and extensive emergent vegetation. Access is good with numerous public boat ramps and parks.

- **Management History:** Important sport fish include largemouth bass, white crappie, and channel catfish. Palmetto (hybrid striped) bass have been stocked since the 1970s, and managed with an 18-inch minimum length limit. Red drum were once an important game species, but the discontinued operation of the power plant on Nasworthy Reservoir beginning in 2003 eliminated this fishery that was dependent on the plant's heated water effluent.

- **Fish Community**
  - **Prey species:** Bluegill and gizzard shad were present in good numbers, but few gizzard shad were small enough to be available to predators. Few bluegills over 6 inches were present, and some anglers fished for and harvested this species.

  - **Catfishes:** Blue catfish and flathead catfish were present in low numbers. Channel catfish were the most popular species for anglers at Nasworthy, and a high number were harvested. Channel catfish abundance and size structure were good.

  - **Temperate basses:** White bass were present in low abundance, and were not targeted by many anglers. Palmetto bass (hybrid striped bass) were abundant, but very few fish over 18 inches were present. Few people fished specifically for palmetto bass in the creel survey.

  - **Largemouth bass:** Largemouth bass abundance was good, but large fish were uncommon. Body condition was poor to fair, and growth was slow to moderate. This species was one of the most popular among anglers, especially anglers fishing from boats. About half of the legal-size bass caught by anglers were harvested.

  - **White crappie:** White crappie were abundant; however, relatively few fish were legally harvestable (≥ 10 inches). All legal-size fish caught by anglers in the creel survey were harvested. White crappie were the fourth-most-popular species for anglers. Growth rates for crappie were moderate.

- **Management Strategies:** Investigate possible reasons for lack of large palmetto bass, skip 2008 stocking, and, if new information warrants continued stocking, request fingerlings at 4/acre every other year. Present alternative largemouth bass length limits to stakeholder groups and explore changing the regulation to improve size structure. Conduct management stocking of threadfin shad in spring 2008. Conduct standard electrofishing, trap netting, and gill netting in 2008-2009, and 2010-2011.

INTRODUCTION

This document is a summary of fisheries data collected from Nasworthy Reservoir in 2006-2007. The purpose of the 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 is presented with the 2006-2007 data for comparison.

Reservoir Description

Nasworthy Reservoir is a 1,598-acre impoundment constructed in 1930 on the South Concho River. It is located in Tom Green County on the southwestern edge of San Angelo and is operated and controlled by the City of San Angelo. Primary water uses included municipal water supply, irrigation and recreation. The reservoir was used for power plant cooling until 2003, when the plant ceased operation. Nasworthy Reservoir was eutrophic with a mean TSI chl-*a* of 52.69, which was higher than previous samples (Texas Commission on Environmental Quality 2005). Habitat at time of sampling consisted of bulkhead, riprap, boat docks, and native emergent vegetation (bulrushes and alligator weed). Boat access consisted of fifteen public boat ramps and several private boat ramps. Bank fishing access was good at the numerous lakeside city parks, including one disabled-access fishing pier. Other descriptive characteristics for Nasworthy Reservoir are in Table 1.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Van Zee 2003) included:

1. Stock Palmetto bass annually at a rate of 5-15 fingerlings per acre based upon prey availability, growth rates, and the surface area of the reservoir.
   Action: Palmetto bass fingerlings were stocked at approximately 12 per acre in 2004, and 5 per acre in 2005, 2006, and 2007.
2. Conduct a year long creel survey starting in September of 2003.
   Action: A roving creel survey was conducted as planned.
3. Discontinue stocking red drum.
   Action: Red drum stockings were discontinued, and harvest regulations pertaining to red drum were removed.
4. Continue working with the City of San Angelo to develop a vegetation treatment proposal which would protect valuable fisheries habitat while allowing the city to control vegetation in certain areas of the reservoir with appropriate herbicides.
   Action: District staff consulted with the City to arrange a suitable vegetation treatment proposal.

Harvest regulation history: Sportfishes in Nasworthy Reservoir are currently managed with statewide regulations (Table 2). In 2005, the minimum length limit and bag limit on red drum were removed to allow harvest of any remaining red drum after the closure of the reservoir's power plant; the discontinuation of hot-water discharge from the power plant made the reservoir unsuitable for this species.

Stocking history: Species stocked have included channel catfish, largemouth bass, Palmetto bass and red drum. Red drum stockings were discontinued after 2002 because the power plant on the reservoir stopped operation, eliminating the heated water effluent that enabled overwinter survival of red drum. The complete stocking history is in Table 3.

Vegetation/habitat history: Nasworthy Reservoir has historically had stable water levels (Figure 1), due to supplemental water provided from upstream Twin Buttes Reservoir. Nasworthy has supported a mix of

aquatic vegetation species. Native emergent aquatic vegetation has consisted primarily of bulrushes and some alligatorweed. Van Zee (2003) reported that most (53%) of the reservoir shoreline consisted of bulkhead. Boat docks were also prevalent (18%) along the shoreline. The City of San Angelo dredged the reservoir in 1999 to remove built-up sediment.

METHODS

Fishes were collected by electrofishing (1 hour at 12, 5-min stations), gill netting (12 net nights at 12 stations), and trap netting (6 net nights at 6 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). Roving creel surveys were conducted during daylight hours from a boat, and targeted pole-and-line anglers only. Microsatellite DNA analysis was used to determine largemouth bass genetic composition. Prior to 2005, genetic analysis was done by electrophoresis.

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 X SE of the estimate/estimate) was calculated for all CPUE statistics and for creel statistics. Ages were determined using otoliths for Palmetto bass, largemouth bass and white crappie. We attempted to collect at least 100 Palmetto bass >6 inches for aging. We collected 13 largemouth bass between 13 and 15 inches to calculate mean age at 14-inch length. We collected 22 white crappie between 9 and 11 inches to calculate mean age at 10-inch length. Water level data was provided by the City of San Angelo Water Utilities Department.

RESULTS AND DISCUSSION

Habitat: The most recent (2002) habitat survey results can be found in Van Zee 2003. In that report, Van Zee estimated that there were approximately 19 total acres of emergent vegetation. However, this calculation was based on field estimations of linear shoreline distance and average width of vegetation stands (estimated to be 8 feet). When we estimated emergent vegetation coverage using 2004 aerial photography, we found coverage to be approximately 92 acres. We found widths of vegetation stands mostly in the 30-50 yard range. Field observations confirmed the presence of bulrushes and alligatorweed in these emergent stands.

To maintain adequate shoreline access, the City of San Angelo periodically spot-treats emergent vegetation adjacent to residential lots and public parks. In 2003, the City applied to treat 3 acres of alligatorweed and 5 acres of bulrush with herbicide, and in 2006 they applied to treat < 1 acre of bulrush. The City's objective in using this chemical application is to keep the vegetation from spreading beyond desirable limits, not to decrease total acreage.

Creel: Creel survey results differed markedly between bank anglers and boat anglers. Directed fishing effort by boat anglers was highest for largemouth bass (47%), followed by anglers fishing for channel catfish (18%) and anything (18%) (Table 4). Directed effort by bank anglers was highest for channel catfish (48%), followed by anything (39%) and largemouth bass (6%). With all anglers combined, the most sought-after fish species were channel catfish (43%), anything (36%), and largemouth bass (12%). Total fishing effort for all species at Nasworthy Reservoir was 16,133 h for boat anglers and 87,291 h for bank anglers from September 2003 to August 2004 (Table 5). Boat anglers and bank anglers spent an estimated $61,204 and $261,917 on direct expenditures, respectively.

Prey species: Electrofishing catch rates of gizzard shad and bluegill were 185.0/h and 182.0/h,

respectively (Figures 2, 3). Index of vulnerability (IOV) for gizzard shad was 37, indicating that a little over a third were available to existing predators. Total CPUE of gizzard shad was lower in 2006 than in the previous two surveys, and IOV was similar to the 2004 survey, but lower than the 2002 IOV (55%). Total CPUE of bluegill was also lower in 2006 than in the previous surveys (Figure 5). Bluegill size structure in 2006 was similar to 2002 and 2004, with only about 6% of adult fish ≥ 6 inches. Directed effort for bluegill was 1,221 h (0.8 h/acre), with anglers harvesting an estimated 4,226 bluegill between 3 and 6 inches in length (Table 6, Figure 4).

Blue catfish: Blue catfish were present in Nasworthy Reservoir in very low numbers (CPUE=0.3/nn). No blue catfish were collected in 2003 or 2005, when only the standard 5 net-nights were used in the sample. No pole-and-line anglers from the creel survey targeted blue catfish specifically, precluding any meaningful creel statistics for this species.

Channel catfish: Gill net catch rate of channel catfish was good at 6.3/nn; this was similar to catch rates in 2005 (8.8/nn) and 2003 (3.6/nn) (Figure 5). Size structure was also good, with PSD = 37, and fish up to 24". Condition of channel catfish was poor-fair for fish under 15 inches, but was excellent for fish ≥20 inches (Figure 6). Directed effort for channel catfish by boat anglers was 2,937 h (Table 8), but bank angler directed effort was much higher (41,642 h). An estimated 3,241 channel catfish were harvested, with lengths of harvested fish between 10 and 23 inches (Table 7, Figure 6).

Flathead catfish: Flathead catfish were present in low (0.8/nn) numbers, comparable to the gill net catch rates in 2005 (0.8/nn) and 2003 (1.8/nn) (Figure 7). Most flathead catfish in the survey were over the 18-inch minimum length limit. Few pole-and-line anglers targeted flathead catfish, precluding any meaningful creel statistics for this species.

White bass: Gill net data from 2007 indicated that white bass were present in low abundance (0.3/nn). White bass abundance declined considerably since 2003, when the catch rate was 13.0/nn (Figure 8). Directed angler effort for this species was relatively low (1,045 h), as was estimated harvest (301 fish) (Table 8, Figure 9).

Palmetto bass: Palmetto bass (hybrid striped bass) gill net catch rates were high in 2007 (13.3/nn) compared to 2005 (8.5/nn) and 2003 (3.2/nn) (Figure 10). Condition was poor, with W_r values generally less than 80. Only 4% of adult fish were above the 18-inch minimum length limit. Directed angler effort was low, at 440 h (Table 9), and only 2 harvested fish were observed during the creel (Figure 11), leading to an estimated harvest rate of 102 fish per year. Palmetto bass growth was poor; our sample indicated that not many age-4 fish had reached the 18-inch minimum length limit, and very few fish over age 4 were present in the reservoir (Figure 12).

Largemouth bass: Electrofishing catch rate of largemouth bass was 126.0/h, similar to catch rates from previous years (Figure 13). Size structure continued to be poor, with PSD = 12, and only 5% of adult bass over the 14-inch minimum length limit. Fish condition was poor-fair, with W_r values averaging less than 90. Directed angler effort was high compared to other species, at 12,391 h (Table 10). Angler catch rate was 0.4/h, and total harvest was estimated to be 608 fish. Not including tournament-held fish, harvest was estimated to be 286 fish. Compliance with the length-limit regulation was 100% in the creel survey, with harvested fish ranging from 14 to 19 inches (Figure 14). About half (46%) of legal-size largemouth bass caught by anglers were harvested (Table 10). Florida largemouth bass influence appeared in 57% of alleles, but none of the fish tested were pure Florida genotype (Table 11). Mean age at 14-inch length was 3.3 years, showing slow-moderate growth. Length-at-age data from 2004 showed a similar result, and also revealed the paucity of bass over age 3 in the reservoir (Figure 15).

White crappie: Trap net catch rate for white crappie was high (29.2/nn), more than in previous years (Figure 16). However, size structure was poor, with only 3% of adult crappie over the 10-inch minimum

length limit. This statistic was slightly lower than in the previous surveys, where RSD-10 was 10-13. Directed angler effort was 4,938 h, with most effort by bank anglers (Table 12). Angler catch rate was good (0.8/h), and harvest was estimated to be 1,912 fish. Anglers interviewed for the creel survey harvested 100% of the legal-size crappie that were caught. These harvested fish ranged from 10 to 13 inches (Figure 17). In 2006, mean age at 10-inch length was 2.8 years. Length-at-age data from 2004 showed crappie reaching 10 inches by age 2; age-1 fish ranged widely from 4 to 9 inches in length (Figure 18).

Fisheries management plan for Nasworthy Reservoir, Texas

Prepared – July 2007.

ISSUE 1: Palmetto bass have been stocked semi-regularly since the 1970s in Nasworthy Reservoir. The stocking of this species has been only somewhat successful, with very few fish ≥18 inches found in the reservoir. Harvest of this species was low in the 2003-2004 creel survey.

MANAGEMENT STRATEGIES

1. Investigate possible reasons for lack of large Palmetto bass in the reservoir, including potential escape through the dam into the South Concho River or irrigation canals, and whether a nighttime harvest component exists that was undiscovered by the daytime creel survey.

2. Do not request Palmetto bass fingerlings for 2008. If new information indicates that stockings should resume, request fingerlings at 4/acre in every other year after 2008.

ISSUE 2: Largemouth bass size structure is poor. Growth of bass to the minimum length limit (14”) is slow, and percentage of legal bass being harvested is high compared to other Texas lakes. Nasworthy largemouth bass may benefit from an alternative length limit to decrease harvest of larger fish, while allowing harvest of small fish.

MANAGEMENT STRATEGY

1. Present at least one length limit alternative to stakeholder groups, including local bass clubs, at a public meeting. Also discuss enforcement issues with local game wardens. If input from the public and from game wardens is favorable, go forward with proposing a length limit change.

ISSUE 3: Growth rates are inadequate for several sport fish species in the reservoir (e.g. largemouth bass, Palmetto bass, white crappie). Prey availability appears limited.

MANAGEMENT STRATEGIES

1. Conduct a management stocking of threadfin shad in April 2008.

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule includes standard electrofishing, trap netting, and gill netting in 2008/2009, and mandatory monitoring in 2010/2011 (Table 13). This schedule is adequate for monitoring the status of the most important game fish species: largemouth bass, white crappie, Palmetto bass, and channel catfish.

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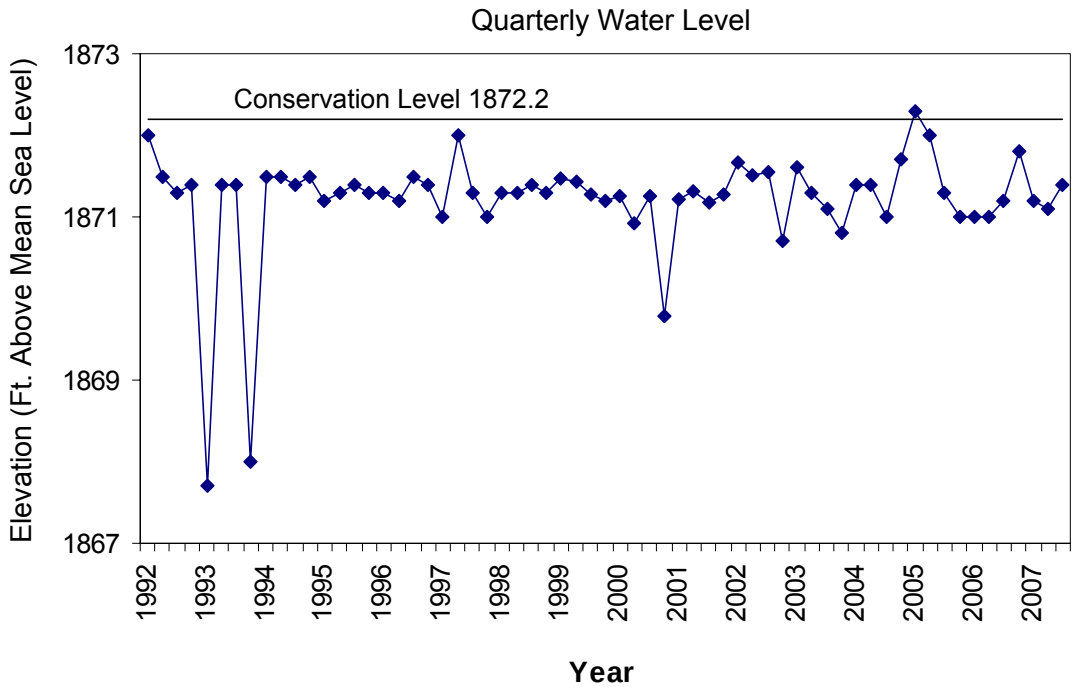


Figure 1. Quarterly water level elevations in feet above mean sea level recorded for Nasworthy Reservoir, Texas.

Table 1. Characteristics of Nasworthy Reservoir, Texas.

Characteristic	Description
Year constructed	1930
Controlling authority	City of San Angelo
County	Tom Green
Reservoir type	Mainstream
Shoreline Development Index	7.01
Conductivity	1,000 umhos/cm

Table 2. Harvest regulations for Nasworthy Reservoir, Texas.

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 (hybrid striped)	5	18 - No Limit
Bass, largemouth	5	14 - No Limit
Crappie: white and black crappie, their hybrids and subspecies	25 (in any combination)	10 - No Limit

Table 3. Stocking history of Nasworthy Reservoir, Texas. Size categories are: FRY =<1 inch; FGL = 1-3 inches; ADL = adult, and UNK = unknown.

Year	Number	Size
Threadfin shad		
1984	8,800	UNK
Channel catfish		
1966	32,000	UNK
1968	26,000	UNK
1969	15,000	UNK
1970	20,000	UNK
1971	10,000	UNK
1972	20,425	UNK
1973	15,000	UNK
1974	10,000	UNK
1990	16,637	FGL
1991	16,191	FGL
1993	400	FGL
Species Total	181,653	
Palmetto bass		
1974	17,767	UNK
1975	16,000	UNK
1977	16,000	UNK
1979	8,430	UNK
1981	16,000	UNK
1982	16,176	UNK
1994	28,600	FGL
1995	32,080	FGL
1996	23,897	FGL
1997	25,164	FGL
1998	24,021	FGL
1999	24,140	FGL
2002	24,108	FGL
2003	19,410	FGL
2004	19,386	FGL
2005	6,933	FGL
2006	6,775	FGL
2007	8,611	FGL
Species Total	333,498	
Redear sunfish		
1970	4,900	UNK
White crappie		
1972	16,000	UNK
Florida largemouth bass		
1980	8,100	FGL
1986	201,600	FGL
1987	2,159	ADL
1990	159,799	FRY
1991	159,854	FGL
1995	159,840	FGL
1995	172	ADL
Species Total	691,524	
Green X Redear sunfish		
1966	14,700	UNK
Red drum		
1984	101,276	FGL
1985	195,387	FGL
1986	159,604	FGL
1991	164,950	FGL
1994	165,732	FGL
1995	171,200	FGL
1996	161,805	FGL
1997	161,401	FGL
1999	194,089	FGL
2000	197,515	FGL
2001	224,122	FGL
2002	239,895	FGL
Species Total	2,136,976	
Largemouth bass		
1968	440	UNK
1969	24,000	UNK
1970	271,000	UNK
1972	68,700	UNK
1993	145	ADL
1997	52,600	FGL
Species Total	416,885	

Table 4. Percent directed angler effort by species for Nasworthy Reservoir, Texas, September 2003 – August 2004.

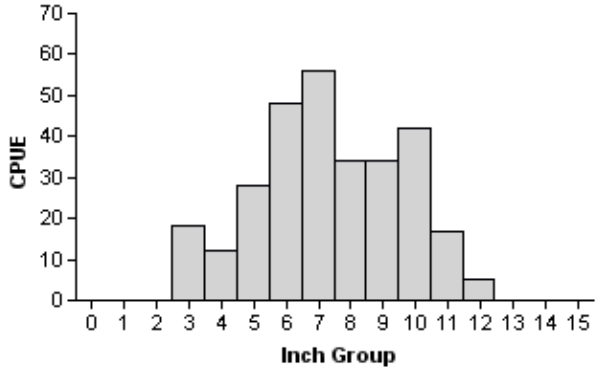
Species	Angler Type		
	Boat	Bank	Combined
Catfishes		1.5	1.3
Other sunfishes		0.1	0.1
White bass	2.9	0.7	1.0
Palmetto bass	0.5	0.4	0.4
Bluegill	3.3	0.8	1.2
Largemouth bass	46.8	5.5	12.0
White crappie	7.5	4.3	4.8
Anything	18.2	39.0	35.8
Common carp		<0.1	<0.1
Channel catfish	18.2	47.7	43.1
Flathead catfish	2.6		0.4

Table 5. Total fishing effort (h) for all species and total directed expenditures at Nasworthy Reservoir, Texas, September 2003 – August 2004.

Creel Statistic	Angler Type		
	Boat	Bank	Combined
Total fishing effort	16,133	87,291	103,424
Total directed expenditures	$61,204	$261,917	$323,121

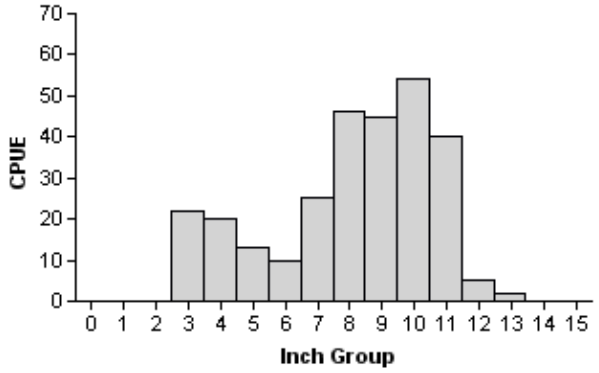
Gizzard Shad

2002



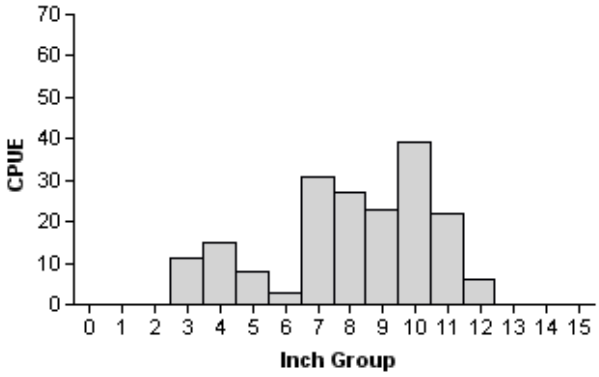
Effort =	1.0
Total CPUE =	294.0 (23; 294)
IOV =	55.1 (6.1)

2004



Effort =	1.0
Total CPUE =	282.0 (42; 282)
IOV =	31.9 (5.0)

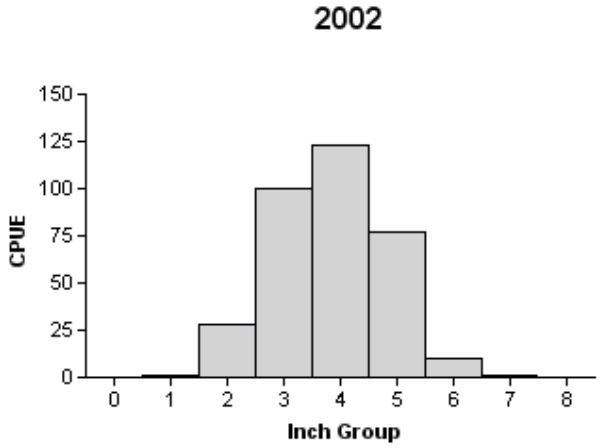
2006



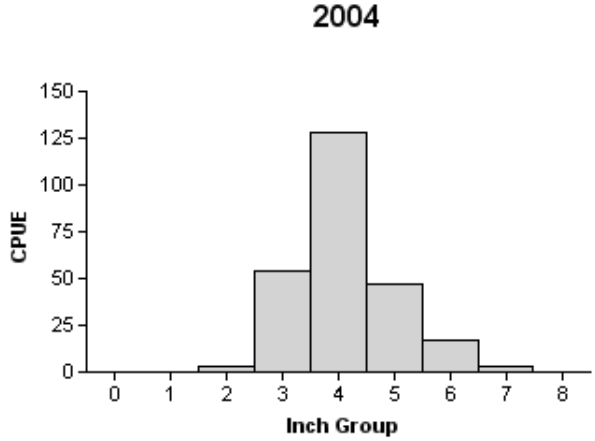
Effort =	1.0
Total CPUE =	185.0 (21; 185)
IOV =	36.8 (6.2)

Figure 2. Number of gizzard shad caught per hour (CPUE) and population indices (RSE and N are in parentheses) for fall electrofishing surveys, Nasworthy Reservoir, Texas, 2002, 2004, and 2006.

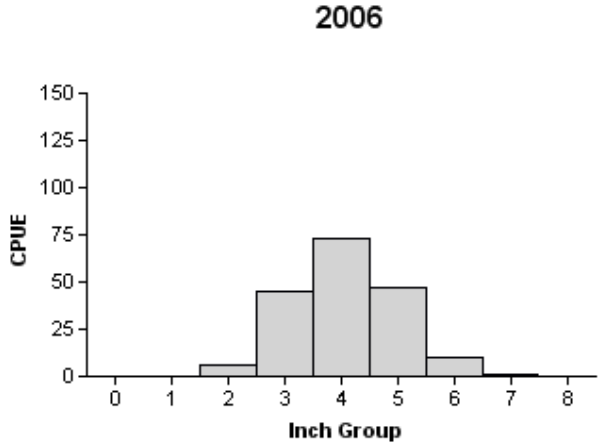
Bluegill



Effort =	1.0
Total CPUE =	340.0 (22; 340)
Stock CPUE =	311.0 (22; 311)
PSD =	4 (1.1)



Effort =	1.0
Total CPUE =	252.0 (29; 252)
Stock CPUE =	249.0 (29; 249)
PSD =	8 (4.7)



Effort =	1.0
Total CPUE =	182.0 (17; 182)
Stock CPUE =	176.0 (16; 176)
PSD =	6 (2.3)

Figure 3. Number of bluegill caught per hour (CPUE) and population indices (RSE and N are in parentheses) for fall electrofishing surveys, Nasworthy Reservoir, Texas, 2002, 2004, and 2006.

Bluegill

Table 6. Creel survey statistics for bluegill at Nasworthy Reservoir from September 2003 through August 2004, where total catch per hour is for anglers targeting bluegill and total harvest is the estimated number of bluegill harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Angler Type		
	Boat	Bank	Combined
Directed effort (h)	529.4 (49.8)	691.7 (59.1)	1,221.1 (39.8)
Directed effort/acre	0.3	0.4	0.8
Total catch per hour	0.56 (78.95)	0.42 (106.77)	0.48 (92.80)
Total harvest	9 (244)	4,257 (57)	4,266 (56)
Harvest/acre	0.01	2.66	2.67
Percent legal released	92.4	66.8	67.1

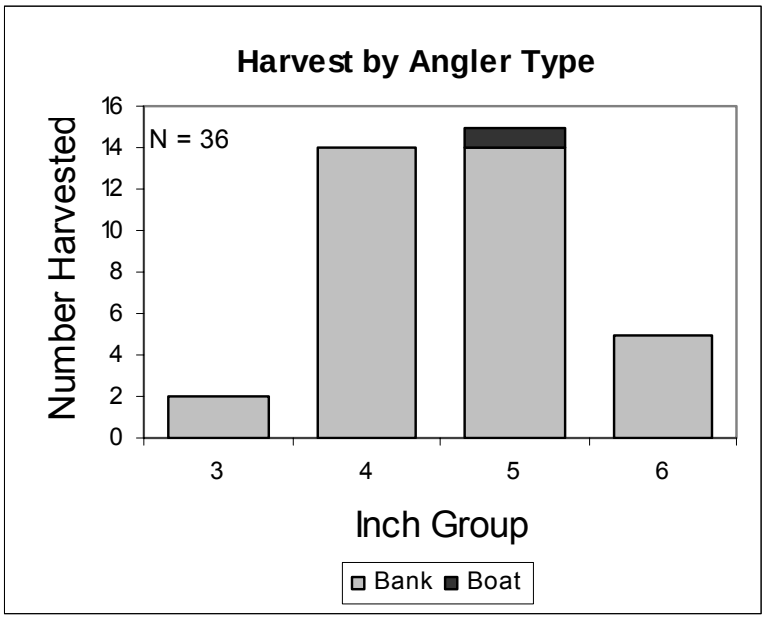
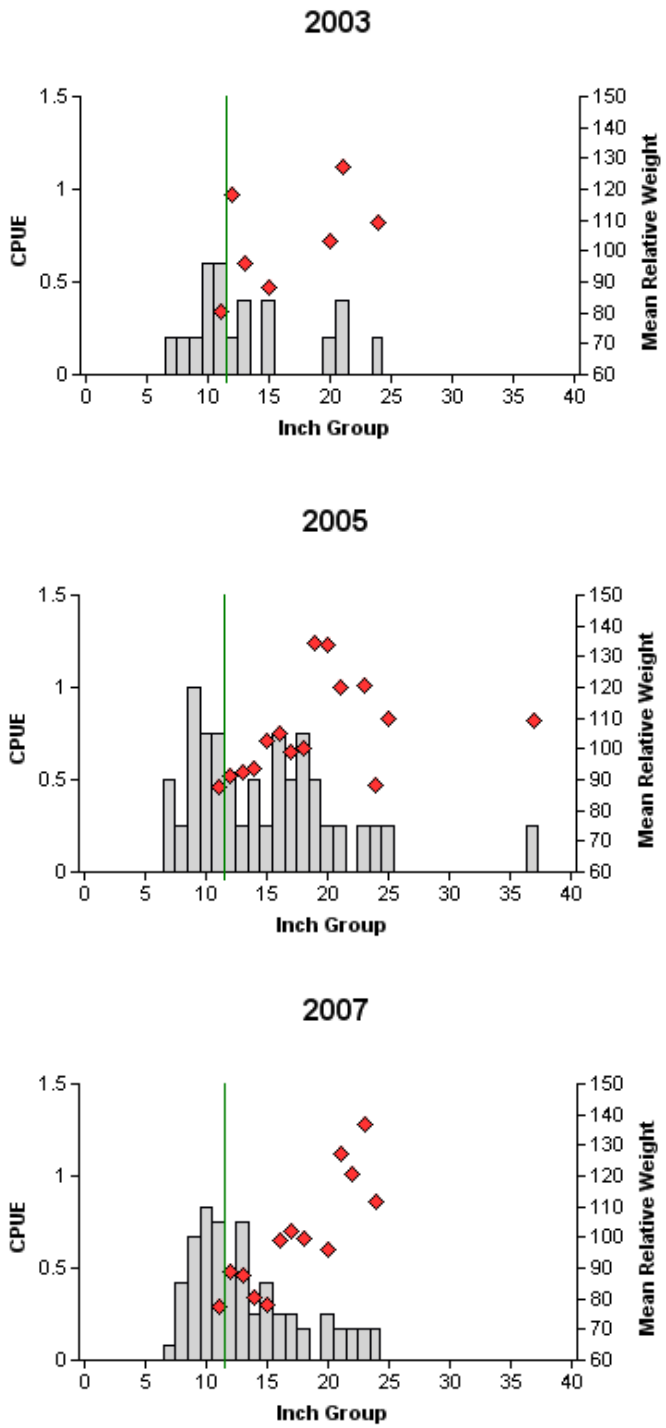


Figure 4. Length frequency of harvested bluegill observed during creel surveys at Nasworthy Reservoir, Texas, September 2003 through August 2004, separated by angler type (boat vs. bank). N is the number of harvested bluegill observed during creel surveys.

Channel Catfish



Effort =	5.0
Total CPUE =	3.6 (53; 18)
Stock CPUE =	2.4 (50; 12)
PSD =	33 (14.4)
RSD-12 =	75 (7.4)

Effort =	4.0
Total CPUE =	8.8 (22; 35)
Stock CPUE =	6.3 (21; 25)
PSD =	64 (9.9)
RSD-12 =	88 (6.5)

Effort =	12.0
Total CPUE =	6.3 (19; 75)
Stock CPUE =	4.3 (16; 51)
PSD =	37 (9.5)
RSD-12 =	82 (7.5)

Figure 5. Number of channel catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N are in parentheses) for spring gill net surveys, Nasworthy Reservoir, Texas, 2003, 2005, and 2007. Vertical line represents the minimum length limit.

Channel Catfish

Table 7. Creel survey statistics for channel catfish at Nasworthy Reservoir from September 2003 through August 2004, where total catch per hour is for anglers targeting channel catfish and total harvest is the estimated number of channel catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Angler Type		
	Boat	Bank	Combined
Directed effort (h)	2,937.6 (27.0)	41,642.5 (13.6)	44,580.1 (12.8)
Directed effort/acre	1.8	26.1	27.9
Total catch per hour	0.43 (0.03)	0.21 (37.17)	0.22 (36.48)
Total harvest	131 (146)	3110 (46)	3241 (45)
Harvest/acre	0.08	1.95	2.03
Percent legal released	19.6	8.8	9.3

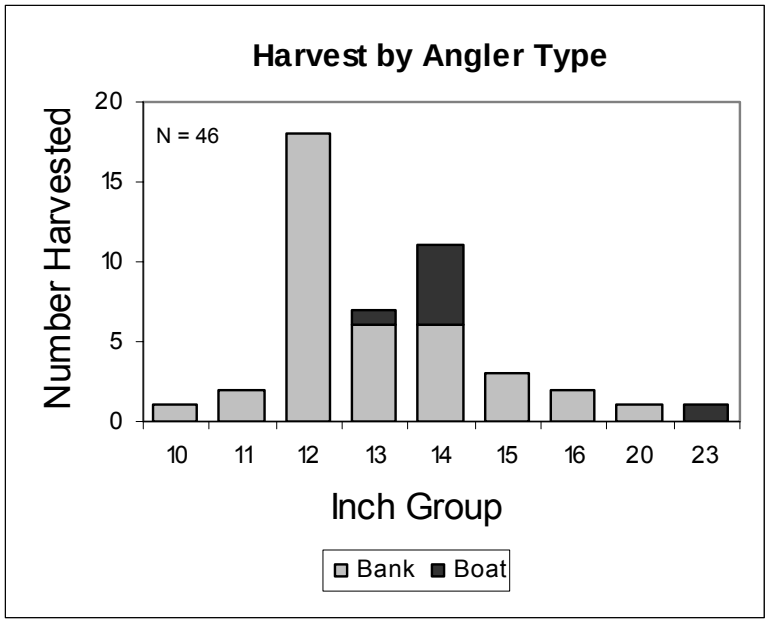
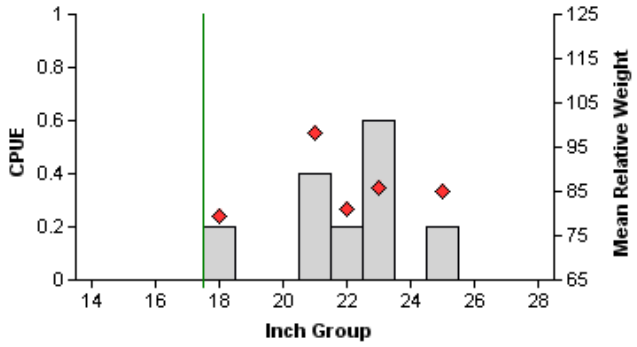


Figure 6. Length frequency of harvested channel catfish observed during creel surveys at Nasworthy Reservoir, Texas, September 2003 through August 2004, separated by angler type (boat vs. bank). N is the number of harvested channel catfish observed during creel surveys.

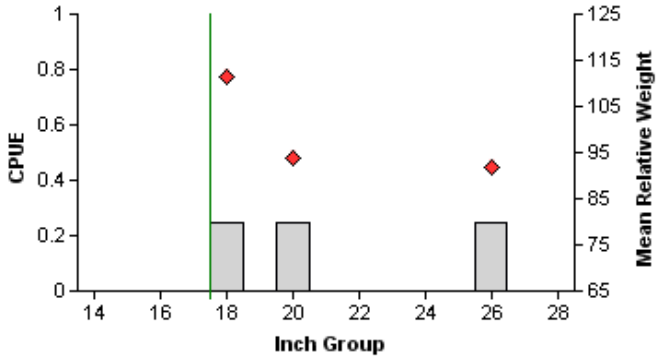
Flathead Catfish

2003



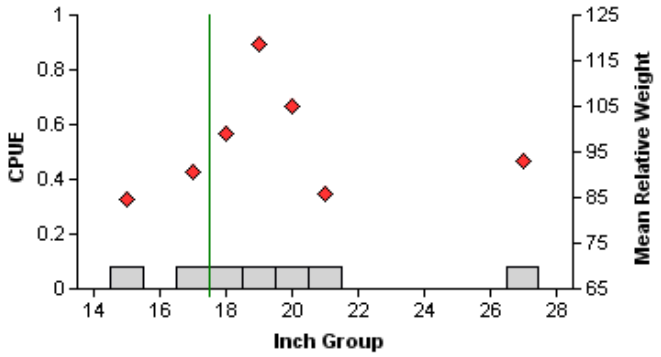
Effort =	5.0
Total CPUE =	1.8 (27; 9)
PSD =	89 (12.6)
RSD-18 =	100 (0)

2005



Effort =	4.0
Total CPUE =	0.8 (64; 3)
PSD =	67 (18.2)
RSD-18 =	100 (0)

2007

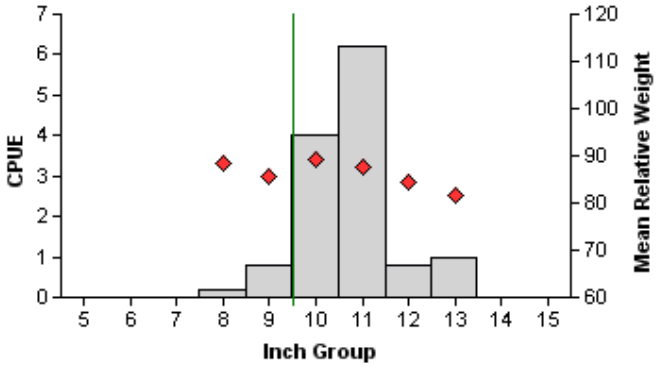


Effort =	12.0
Total CPUE =	0.8 (47; 9)
PSD =	43 (30)
RSD-18 =	71 (18.4)

Figure 7. Number of flathead catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N are in parentheses) for spring gill net surveys, Nasworthy Reservoir, Texas, 2003, 2005, and 2007. Vertical line represents the minimum length limit.

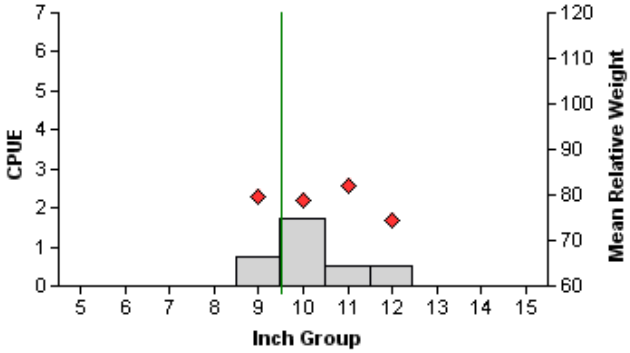
White Bass

2003



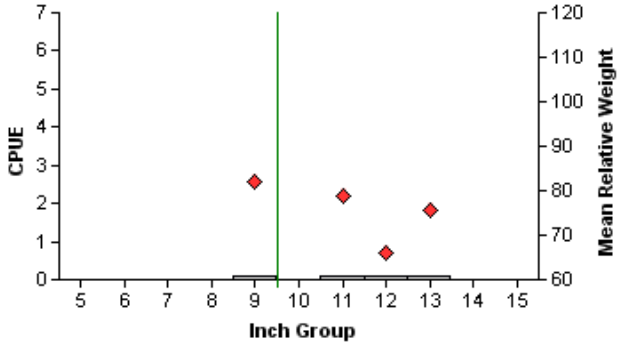
Effort = 5.0
Total CPUE = 13.0 (44; 65)
Stock CPUE = 13.0 (44; 65)
PSD = 98 (1.9)
RSD-10 = 92 (5.1)

2005



Effort = 4.0
Total CPUE = 3.5 (18; 14)
Stock CPUE = 3.5 (18; 14)
PSD = 100 (0.0)
RSD-10 = 79 (11.4)

2007



Effort = 12.0
Total CPUE = 0.3 (56; 4)
Stock CPUE = 0.3 (56; 4)
PSD = 100 (0)
RSD-10 = 75 (16)

Figure 8. Number of white bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N are in parentheses) for spring gill net surveys, Nasworthy Reservoir, Texas, 2003, 2005, and 2007. Vertical line represents the minimum length limit.

White Bass

Table 8. Creel survey statistics for white bass at Nasworthy Reservoir from September 2003 through August 2004, where total catch per hour is for anglers targeting white bass and total harvest is the estimated number of white bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Angler Type		
	Boat	Bank	Combined
Directed effort (h)	474.3 (65.2)	570.4 (62.2)	1,044.7 (45.1)
Directed effort/acre	0.3	0.4	0.7
Total catch per hour	0.0 (.)	0.42 (88.61)	0.23 (162.28)
Total harvest	0 (.)	301 (129)	301 (129)
Harvest/acre	0.0	0.19	0.19
Percent legal released	100.0	41.2	76.7

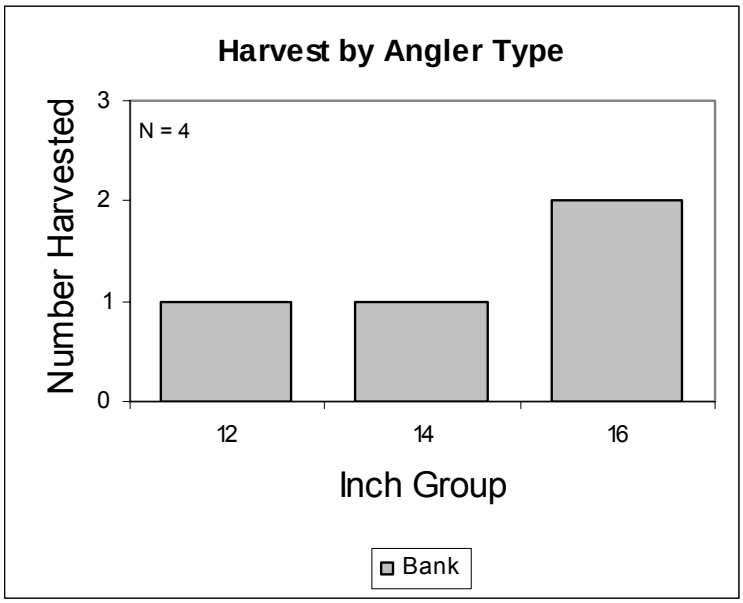
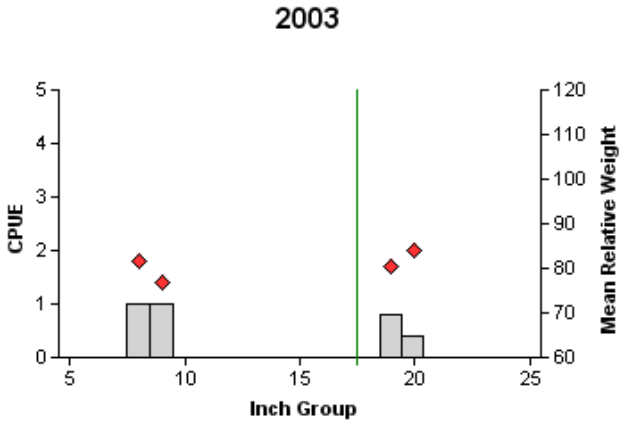
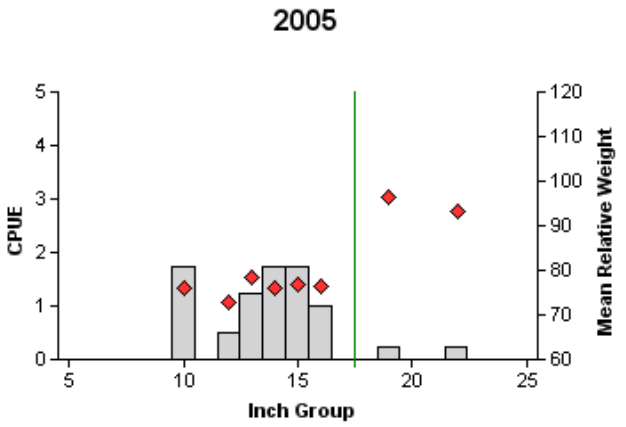


Figure 9. Length frequency of harvested white bass observed during creel surveys at Nasworthy Reservoir, Texas, September 2003 through August 2004, all anglers combined. N is the number of harvested white bass observed during creel surveys.

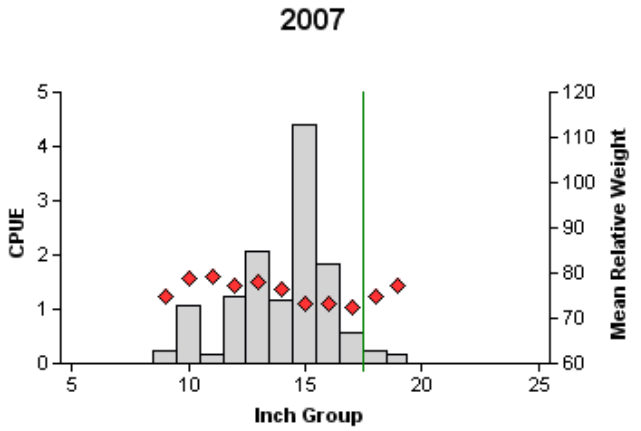
Palmetto Bass



Effort = 5.0
Total CPUE = 3.2 (27; 16)
Stock CPUE = 3.2 (27; 16)
PSD = 38 (20.2)
RSD-18 = 38 (20.2)



Effort = 4.0
Total CPUE = 8.5 (12; 34)
Stock CPUE = 8.5 (12; 34)
PSD = 79 (8.2)
RSD-18 = 6 (5.3)



Effort = 12.0
Total CPUE = 13.3 (27; 159)
Stock CPUE = 13.3 (27; 159)
PSD = 89 (4.4)
RSD-18 = 4 (1.3)

Figure 10. Number of Palmetto bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N are in parentheses) for spring gill net surveys, Nasworthy Reservoir, Texas, 2003, 2005, and 2007. Vertical line represents the minimum length limit.

Palmetto Bass

Table 9. Creel survey statistics for Palmetto bass at Nasworthy Reservoir from September 2003 through August 2004, where total catch per hour is for anglers targeting Palmetto bass and total harvest is the estimated number of Palmetto bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Angler Type		
	Boat	Bank	Combined
Directed effort (h)	76.9 (115.3)	363.4 (75.4)	440.3 (65.4)
Directed effort/acre	0.05	0.23	0.28
Total catch per hour	0.0 (.)	0.0 (.)	0.0 (.)
Total harvest	9 (178)	94 (366)	102 (336)
Harvest/acre	0.01	0.06	0.06
Percent legal released	78.0	0.0	23.9

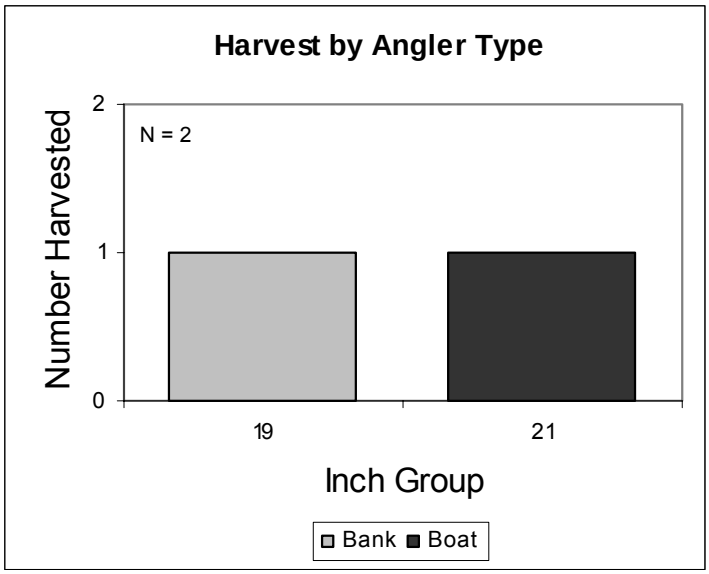


Figure 11. Length frequency of harvested Palmetto bass observed during creel surveys at Nasworthy Reservoir, Texas, September 2003 through August 2004, separated by angler type (boat vs. bank). N is the number of harvested Palmetto bass observed during creel surveys.

Palmetto bass

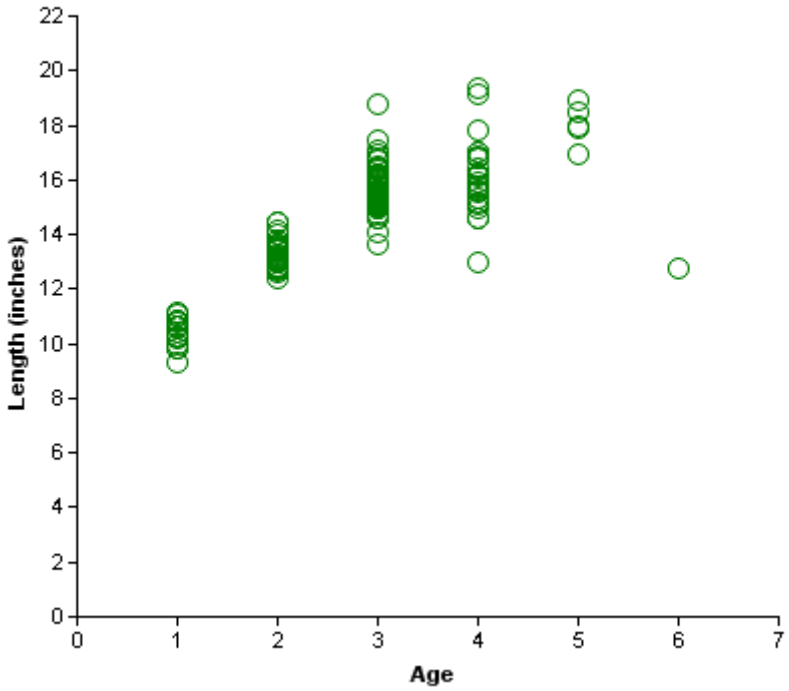
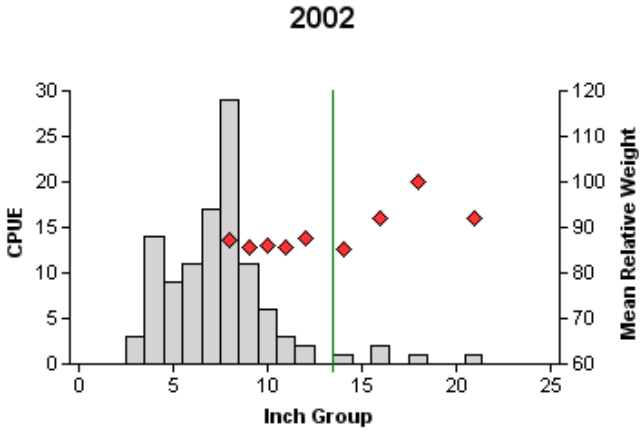
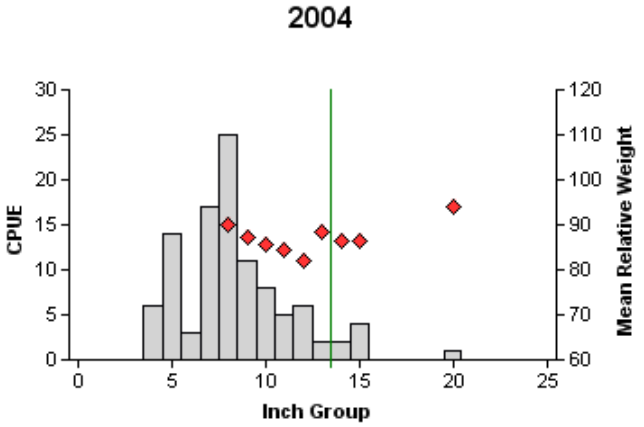


Figure 12. Length at age for Palmetto bass collected by gill netting at Nasworthy Reservoir, Texas, March 2007. N = 159.

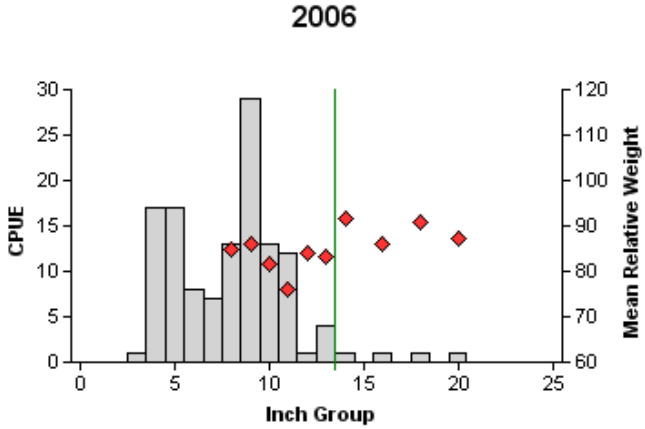
Largemouth Bass



Effort =	1.0
Total CPUE =	110.0 (19; 110)
Stock CPUE =	56.0 (23; 56)
PSD =	12 (3.9)
RSD-14 =	9 (3.5)
CPUE-14 =	5 (45; 5)



Effort =	1.0
Total CPUE =	104.0 (32; 104)
Stock CPUE =	64.0 (28; 64)
PSD =	23 (8.0)
RSD-14 =	11 (4.6)
CPUE-14 =	7 (39; 7)



Effort =	1.0
Total CPUE =	126.0 (18; 126)
Stock CPUE =	76.0 (19; 76)
PSD =	12 (4.7)
RSD-14 =	5 (2.7)
CPUE-14 =	4 (43; 4)

Figure 13. Number of largemouth bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N are in parentheses) for fall electrofishing surveys, Nasworthy Reservoir, Texas, 2002, 2004, and 2006. Vertical line represents the minimum length limit.

Largemouth Bass

Table 10. Creel survey statistics for largemouth bass at Nasworthy Reservoir from September 2003 through August 2004, where total catch per hour is for anglers targeting largemouth bass and total harvest is the estimated number of largemouth bass harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Angler Type		
	Boat	Bank	Combined
Directed effort (h)	7,553.6 (17.6)	4,837.2 (26.4)	12,390.9 (14.9)
Directed effort/acre	4.7	3.0	7.7
Total catch per hour	0.42 (50.5)	0.23 (48.7)	0.35 (521.0)
Total harvest	336 (54)	271 (99)	608 (53)
Harvest/acre	0.21	0.17	0.38
Percent legal released	37.0	53.6	45.6

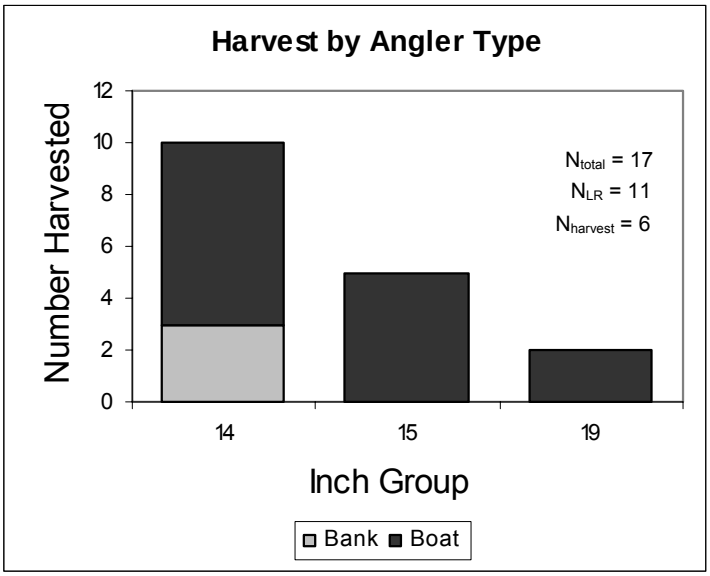


Figure 14. Length frequency of harvested largemouth bass observed during creel surveys at Nasworthy Reservoir, Texas, September 2003 through August 2004, separated by angler type (boat vs. bank). N_{total} is the total number of largemouth bass observed during the angler creel survey. N_{LR} is the number of largemouth bass observed during creel surveys in possession by tournament anglers and later released. $N_{harvest}$ is the number of harvested largemouth bass observed during creel surveys.

Largemouth Bass

Table 11. Results of genetic analysis of largemouth bass collected by fall electrofishing, Nasworthy Reservoir, Texas, 2002, 2004, and 2006. FLMB = Florida largemouth bass, NLMB = Northern largemouth bass, FxN Hybrid = hybrid between a FLMB and a NLMB.

		Genotype				
Year	Sample size	FLMB	FxN Hybrid	NLMB	% FLMB alleles	% pure FLMB
2002	30	2	27	1	54.2	6.6
2004	30	3	24	3	55.8	10.0
2006	60	0	60	0	57.2	0.0

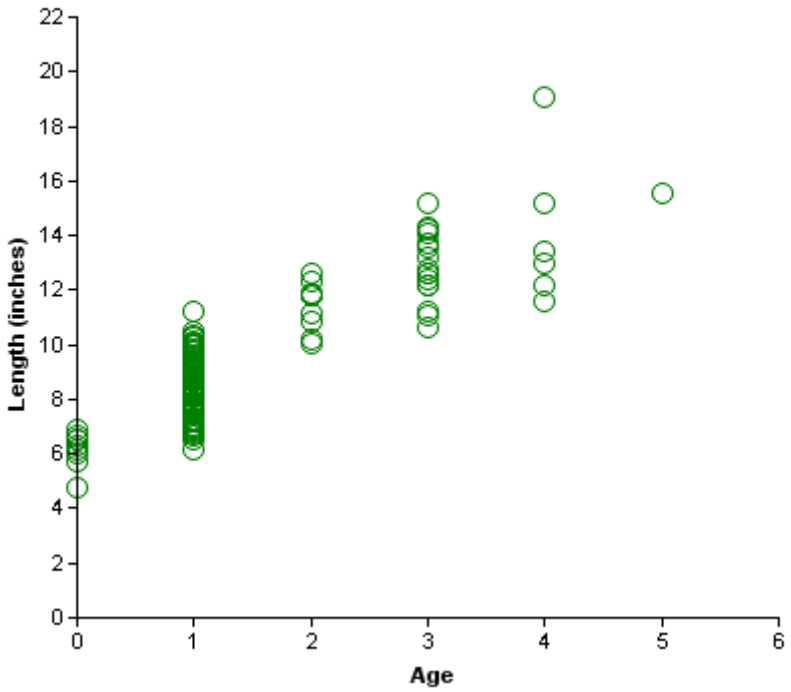
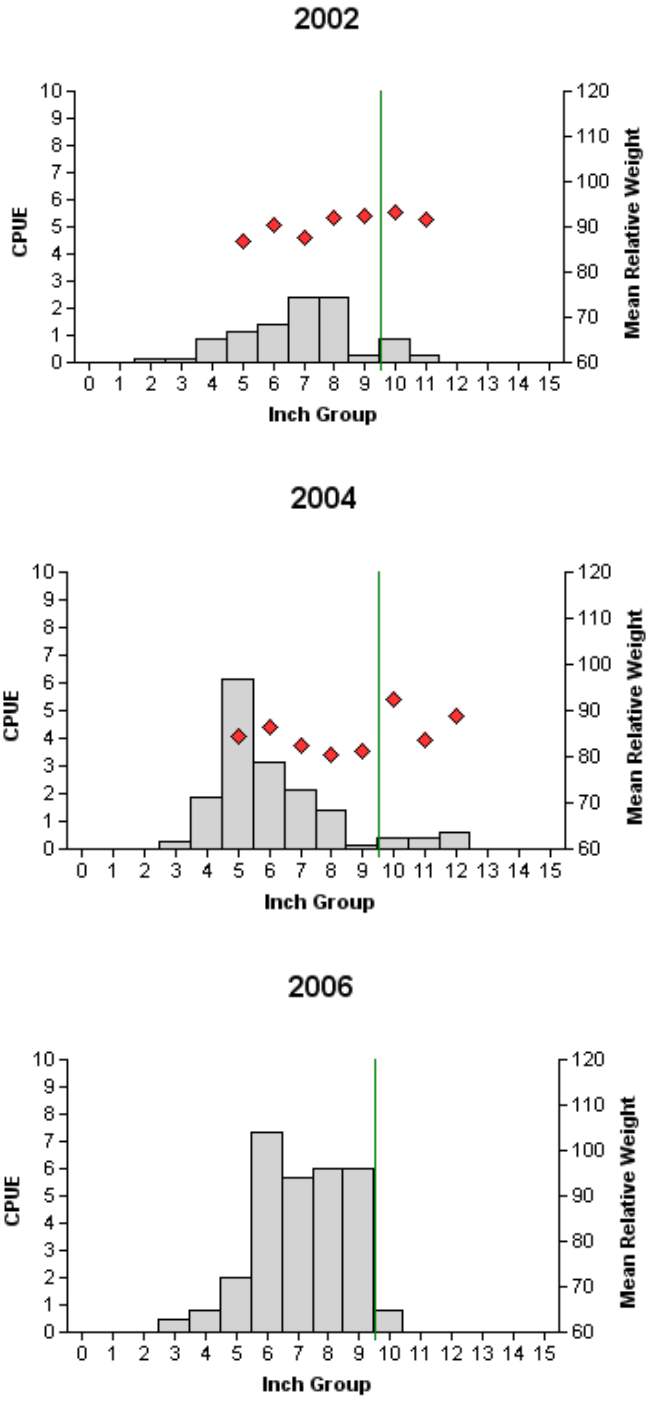


Figure 15. Length at age for largemouth bass collected by electrofishing at Nasworthy Reservoir, Texas, October 2004. N = 141.

White Crappie



Effort =	7.0
Total CPUE =	10.0 (24; 70)
Stock CPUE =	8.9 (23; 62)
PSD =	44 (6.8)
RSD-10 =	13 (4)

Effort =	7.0
Total CPUE =	16.6 (36; 116)
Stock CPUE =	14.4 (38; 101)
PSD =	21 (4.9)
RSD-10 =	10 (4.7)

Effort =	6.0
Total CPUE =	29.2 (23; 175)
Stock CPUE =	27.8 (24; 167)
PSD =	46 (5.1)
RSD-10 =	3 (2)

Figure 16. Number of white crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N are in parentheses) for fall trap netting surveys, Nasworthy Reservoir, Texas, 2002, 2004, and 2006. Vertical line represents the minimum length limit.

White Crappie

Table 12. Creel survey statistics for white crappie at Nasworthy Reservoir from September 2003 through August 2004, where total catch per hour is for anglers targeting white crappie and total harvest is the estimated number of white crappie harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Angler Type		
	Boat	Bank	Combined
Directed effort (h)	1,205.2 (38.9)	3,732.4 (27.1)	4,937.6 (22.6)
Directed effort/acre	0.8	2.3	3.1
Total catch per hour	0.98 (65.10)	0.75 (67.30)	0.80 (64.27)
Total harvest	480 (69)	1432 (64)	1912 (51)
Harvest/acre	0.30	0.90	1.20
Percent legal released	0.0	0.0	0.0

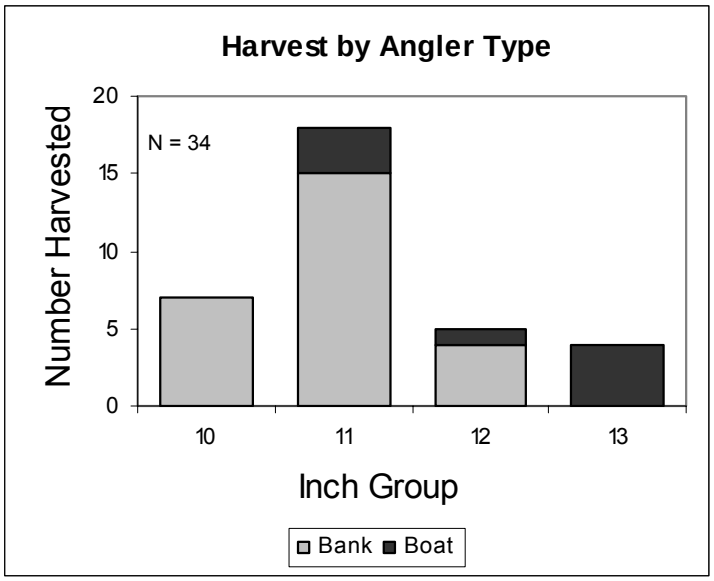


Figure 17. Length frequency of harvested white crappie observed during creel surveys at Nasworthy Reservoir, Texas, September 2003 through August 2004, separated by angler type (in a boat vs. on the bank). N is the number of harvested white crappie observed during creel surveys.

White Crappie

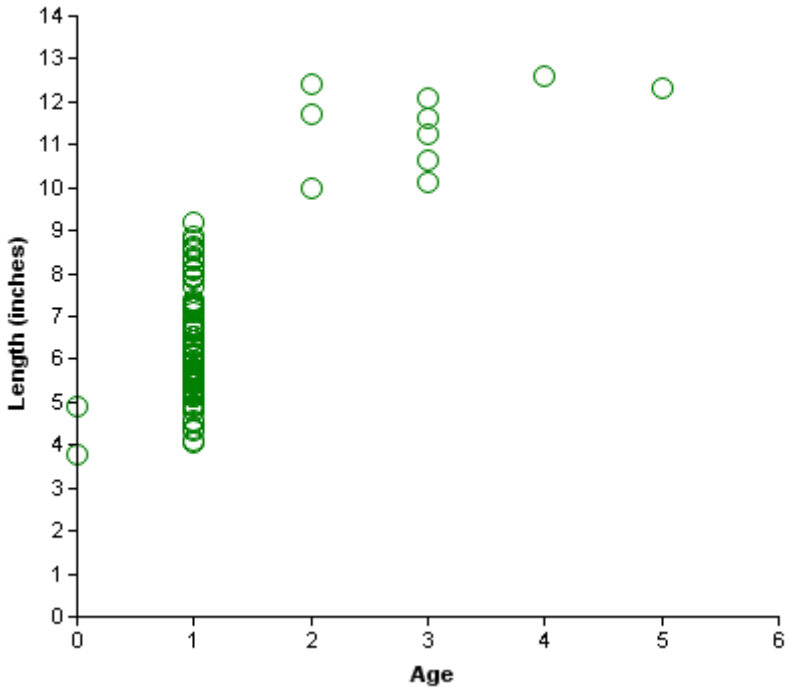


Figure 18. Length at age for white crappie collected by trap netting at Nasworthy Reservoir, Texas, November 2004. N = 113.

Table 13. Proposed sampling schedule for Nasworthy Reservoir, 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.

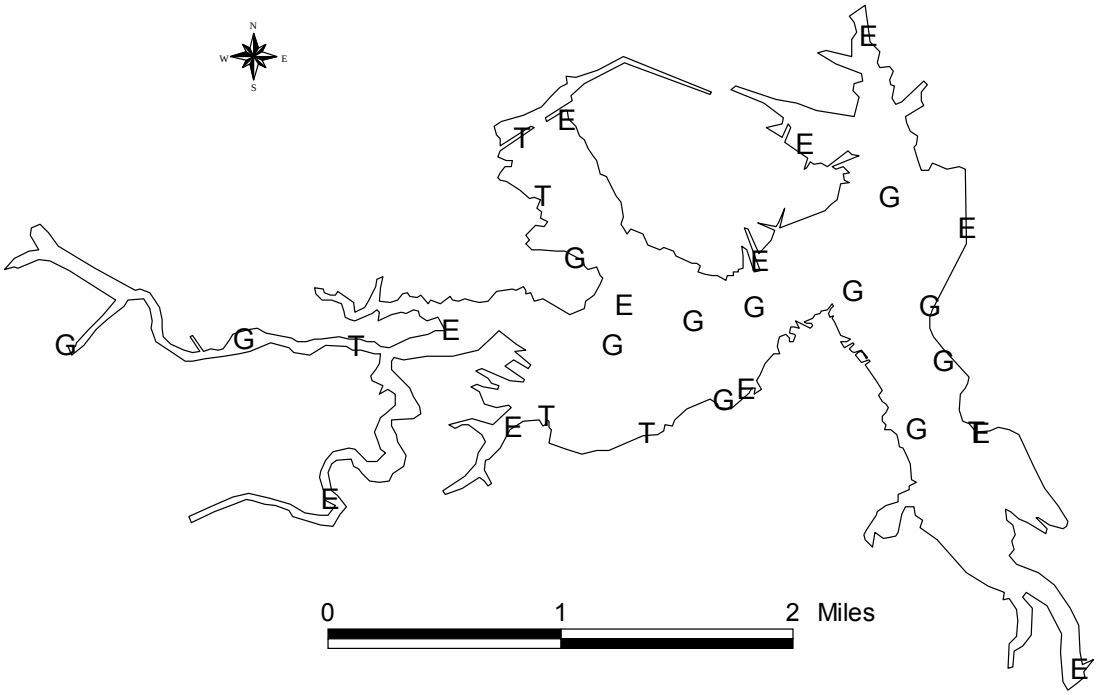
Survey Year	Electrofisher	Trap Net	Gill Net	Report
Fall 2007-Spring 2008				
Fall 2008-Spring 2009	S	S	S	
Fall 2009-Spring 2010				
Fall 2010-Spring 2011	S	S	S	S

APPENDIX A

Number (N) and catch rate (CPUE) of all species collected from all gear types from Nasworthy Reservoir, Texas, 2006-2007.

Species	Gill Netting		Trap Netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Longnose gar	25	2.1				
Gizzard shad	525	43.8			185	185.0
Threadfin shad					2	2.0
Common carp	32	2.7				
River carpsucker	27	2.3				
Blue catfish	3	0.3				
Channel catfish	75	6.3				
Flathead catfish	10	0.8				
White bass	4	0.3				
Palmetto bass	160	13.3				
Redbreast sunfish					1	1.0
Warmouth					11	11.0
Bluegill	3	0.3			182	182.0
Longear sunfish					81	81.0
Redear sunfish					8	8.0
Largemouth bass	4	0.3			126	126. 0
White crappie	19	1.6	175	29.2	1	1.0
Freshwater drum	5	0.4				

APPENDIX B



Location of sampling sites, Nasworthy Reservoir, Texas, 2006-2007. Trap net, gill net, and electrofishing stations are indicated by T, G, and E, respectively. Water level was approximately 1 foot below conservation pool at time of sampling.