PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-1

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2010 Survey Report

Bardwell Reservoir

Prepared by:

Richard A. Ott, Jr., District Management Supervisor
and
Daniel L. Bennett, Assistant District Management Supervisor

Inland Fisheries Division
District 3-C, Tyler, Texas

Carter P. Smith
Executive Director

Gary E. Saul, PhD
Director, Inland Fisheries

July 31, 2011

TABLE OF CONTENTS

SURVEY AND MANAGEMENT SUMMARY

Fish populations in Lake Bardwell were surveyed in 2010 using electrofishing and trap netting and in 2011 using gill netting. Vegetation and angler access surveys were conducted in August 2010. This report summarizes results of these surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir Description:** Lake Bardwell is a 3,138-acre reservoir constructed in 1965 on Waxahachie Creek, a tributary of the Trinity River, Texas, for flood control and as a water supply for municipal and industrial purposes. The reservoir is located in Ellis County and is operated and controlled by the U.S. Army Corps of Engineers (USACOE). Lake Bardwell is classified as hyper-eutrophic. Habitat consists of featureless shoreline, eroded bank, and small amounts of native submersed, and native emergent vegetation. Angler access and facilities are very good with five public access areas and one commercial marina.

- **Management History:** Important sport fish include channel catfish, white bass, palmetto bass largemouth bass, and white crappie. The management plan from the 2006 survey report included: continued stocking of palmetto bass, additional promotion of the fishery, and discussions with the controlling authority regarding enhancement of the aquatic plant community. The fish community continued to be managed under statewide harvest regulations.

- **Fish Community**
  - **Prey species:** Gizzard shad abundance has declined from previous surveys but size distribution was good and abundance of threadfin shad abundance had increased and compensated for the decline. Bluegill and longear sunfish provide additional prey fish.

  - **Catfishes:** Gill net catch rate of channel catfish was within the historical range; size distribution was very good with high relative abundance of legal-length fish. Blue catfish catch rate was lower than channel catfish and large specimens (historically present) were not collected in this survey.

  - **Temperate basses:** Gill net catch rate of white bass declined from previous surveys, but size distribution was similar and body condition was within the target range. Reduced abundance was likely due to low inflows and poor spawning conditions in 2009 and 2010. Palmetto bass fingerlings have not been stocked since 2007 and although nearly two million fry were stocked in 2010 there was no evidence of survival.

  - **Largemouth bass:** Abundance of largemouth bass was within the historical range and there was evidence of a strong 2010 year class. Size distribution indicated a balanced population. Body condition was moderate for most size classes.

  - **Crappie:** White and black crappie were both present in the reservoir. Trap net catch rate of white crappie was below the historical range, and relative abundance of legal-length white crappie was low. Only one black crappie was collected.

  - **Management Strategies:** Standard surveys will be conducted in 2014-2015 with additional gill netting in 2013 to monitor palmetto bass and blue catfish populations. Consult with USACOE regarding the possibility of overexploitation of large blue catfish, request stocking of blue catfish fingerlings. Continue requesting palmetto bass at 10/acre annually. Conduct a quantitative assessment of the aquatic plant community during routine habitat survey in 2014. Investigate the possibility of a native aquatic plant enhancement project. Coordinate with USACOE to promote invasive aquatic species awareness and prevention.

INTRODUCTION

This document is a summary of fisheries data collected from Lake Bardwell from June 2010 through May 2011. The purpose of this document is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other species of fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2010 and 2011 data for comparison where appropriate.

Reservoir Description

Lake Bardwell is a 3,138-acre reservoir constructed in 1965 on Waxahachie Creek, a tributary of the Trinity River, Texas, for flood control and as a water supply for municipal and industrial purposes. The reservoir is located in Ellis County and is operated and controlled by the U.S. Army Corps of Engineers. Lake Bardwell is classified as hyper-eutrophic with a Carlson's TCI chlorophyll [a] index of 58.04*;* ranking 77th highest of 102 Texas reservoirs (TCEQ 2008). Habitat consisted of featureless shoreline, eroded bank, and small amounts of native submersed and native emergent vegetation. Angler access and facilities are very good with five public access areas and one commercial marina. Watershed area is large and water level frequently fluctuates with significant flood events occurring in 2001, 2004, and 2007 (Figure 1). Other descriptive characteristics for Lake Bardwell are presented in Table 1.

Management History

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

1. Continue annual stockings of palmetto bass *(♀ Morone saxatilis* x *♂M. chrysops)* fingerlings at the current rate (10/acre); evaluate stocking success through additional gill netting in spring 2009.
   Action: Fingerlings were requested annually but were not available; fry stocking was conducted in 2010 at 615/acre. Gill netting was conducted as scheduled in 2009.
2. Provide lake-specific regulation posters to vendors of angling-oriented businesses serving Lake Bardwell. Maintain regulation signs previously posted at public boat ramps and private marina.
   Action: Regulation posters were created and distributed.
3. Consult controlling authority regarding native plant introduction and funding
   Action: Recommendations were made to the controlling authority but to date no action has been taken due to a lack of finances and manpower.

Harvest regulation history: All sport fishes in Lake Bardwell are managed with statewide harvest regulations (Table 2). Regulations have not changed since the last survey.

Stocking history: Lake Bardwell was first stocked with Florida strain largemouth bass (*Micropterus. salmoides. floridanus*) in 1992 and was restocked in 1998 (Table 3). Striped bass *(M. saxatillis)* were intermittently stocked from 1967 through 1983 then discontinued; palmetto bass were first stocked in 1975 with annual stockings from 1995-1998, 2002-2005, in 2007, and in 2010.

Vegetation/habitat history: Historically, the aquatic vegetation community at Lake Bardwell has been low in diversity and abundance. In previous surveys (when water levels remained stable) native emergent species covered <1% of the perimeter of the upper end of the reservoir. Hydrilla *(Hydrilla verticillata)* has been present in the past, increasing from trace amounts in 1997 to 15 acres in 2002 (Ott and Bister 2002), declining to <0.5 acres by 2006 (Beck and Ott 2007), and was not identified in the current survey. Physical habitat characteristics were reported by Ott and Bister (2002) and are not believed to have changed substantially since then. Because Lake Bardwell is managed by the U.S. Army Corps of Engineers commercial and residential shoreline development are not permitted.

Water transfer: Lake Bardwell is used primarily for flood control and as a water supply for municipal and industrial purposes. There are currently three permanent pumping stations on the reservoir which transfer water to or from other locations. The City of Waxahachie pumps water from the lake using 20-inch and/or 27-inch pipelines according to demand. Effluent from the City of Waxahachie waste-water treatment plant is returned to Lake Waxahachie. Overflow from Lake Waxahachie returns to Lake Bardwell via Waxahachie Creek. The City of Ennis pumps water from Lake Bardwell using two, 24-inch pipelines. Effluent from the City of Ennis waste-water treatment plant returned to Lake Bardwell via pipeline. SUEZ Energy's steam-electric plant draws cooling water through a 24-inch pipeline to the effluent from the City of Ennis waste-water treatment plant; a second 24-inch pipeline draws supplemental water from Lake Bardwell as needed. Discharge from the energy plant returns to the City of Ennis waste-water treatment plant via pipeline for eventual discharge into Lake Bardwell.

METHODS

Fishes were collected by electrofishing (1 hour at 12, 5-min stations), gill netting (5 net nights at 5 stations), and trap netting (5 net nights at 5 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 stations were randomly selected and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2009). A vegetation survey was conducted in August 2010; access and facilities were evaluated during the survey.

Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD), as defined by Guy et al. (2007)], and condition indices [relative weights (W_r)] were calculated for target fishes according to Anderson and Neumann (1996). Index of vulnerability (IOV) was calculated for gizzard shad *(Dorsoma cepedianum)*, (DiCenzo et al. 1996). Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE statistics and SE was calculated for structural indices and IOV. Water level data were obtained from the United States Geological Survey web site (USGS 2010). Carlson's TCI chlorophyll [a] data and relative ranking of trophic level were obtained from Texas Commission on Environmental Quality (2008).

RESULTS AND DISCUSSION

Habitat: A survey of aquatic vegetation in the littoral zone was conducted in August 2010. Native emergent and submerged vegetation identified in trace amounts were not widely distributed and species diversity was reduced from previous surveys (Beck and Ott 2007, Ott and Bister 2003). Pondweed *(Potamogeton spp.)* was the only native submerged species identified and area occupied was minimal (Table 4). Emergent vegetation was composed of American lotus *(Nelumbo lutea),* bull tongue *(Sagittaria lancifolia),* and cattail *(Typha spp.).* Collectively, area occupied was <0.1 acre. Fluctuating water level (Figure 1), turbidity, and wind action limit the expansion of the aquatic plant community in this reservoir. Hydrilla (reported in previous surveys) was not identified in the current survey.

Prey species: Electrofishing catch of gizzard shad *(Dorosoma cepedianum*) in 2010 (215/h) exhibited a general decline from previous surveys; 350/h in 2002 and 283/h in 2006 (Figure 2). Size distribution was good with an Index of Vulnerability of 94, meaning most gizzard shad were available as prey to most predators present. Threadfin shad (*D. petenense)* were abundant (283/h; Appendix A). Combined with gizzard shad, these two species provided adequate prey abundance.

Bluegill (*Lepomis macrochirus)* CPUE in 2010 (125/h) was high despite high turbidity and paucity of aquatic vegetation (Figure 3). Body condition (W_r) of bluegill was good ($\geq$100) for all size classes; however, no bluegill larger than 6 inches were collected. Historically, few anglers targeted or harvested bluegill (Beck and Ott, 2007). Longear sunfish (*Lepomis megalotis)* and green sunfish *(Lepomis cyanellus)* were each collected at 27/h (Appendix 1); these species provide supplemental prey to sport

fishes.

Catfishes: Channel catfish *(Ictalurus punctatus)* gill net catch rate in 2011 (5.6/nn) was approximately half the 2009 catch rate (10.4/nn), but was higher than the 2007 catch rate (3.8/nn) (Figure 5). Size distribution continued to be excellent (PSD-12 = 93). Channel catfish were collected up to 24 inches in length. The unusually high abundance of small (<12 inches) channel catfish observed in 2009 was likely due to inundation of terrestrial vegetation during summer floods in 2007 (Figure 1), resulting in high survival and recruitment of young channel catfish. Lower water levels from 2009-2011 were not as conducive to production of young channel catfish. Body condition for most size classes was moderate (W_r = 85-95) and is indicative of adequate prey availability.

Blue catfish *(I. furcatus)* have been less abundant than channel catfish. In 2011, blue catfish gill net catch rate was 1.0/nn (Figure 4) and within the range exhibited by previous surveys (0.4/nn, 2009; 1.8/nn, 2007). Large ($\geq$ 20 inches) fish were absent in the 2011 survey. Body condition was good ($W_r \geq 95$) and indicated adequate prey availability.

Temperate basses: The gill net catch rate of white bass (2.6/nn) declined from 2007 (13.4/nn) and 2009 (14.4/nn) (Figure 7). Moderate increases in springtime water levels occurred in 2007 and 2008 (Figure 1), but water levels remained below conservation pool over the past three years. Springtime reservoir water inflows have proven to positively correlate with white bass reproductive success in reservoirs. An insufficient white bass sample size precluded any meaningful age and growth analyses in 2011; however previous analysis indicated the average age at 10 inches to be 2.3 years (Beck and Ott 2007). Body condition was excellent ($W_r \geq 95$).

No palmetto bass were collected in the 2011 gill net sample (Figure 8), despite nearly 2 million fry stocked in 2010. Palmetto bass fingerlings have not been stocked in Lake Bardwell since 2007. Consistent annual stockings will be necessary to revive and maintain this fishery.

Largemouth bass: Electrofishing catch rate of largemouth bass (44/h) was low but within the historical range (84/h, 2002; 21/h, 2006) (Figure 9). Electrofishing CPUE of stock-length ($\geq$8 inches) largemouth bass (17/h) was similar to the 2006 survey but less than the 2002 survey. Higher 2002 catch rate was likely related to greater aquatic vegetation coverage (3% of the reservoir area) (Ott and Bister 2002). The peak of sub-stock-size fish suggests an abundant 2010 year class is present in the population (Figure 9). This age class is likely to contribute largely to the fishery over the next few years. Overall size distribution (PSD = 47) was within the target range of 40-70 for a balanced fish community (Anderson 1980) Body condition (W_r) varied by size, ranging from 85-112. Growth analysis was not conducted due to insufficient sample size.

Crappie : Trap net CPUE of white crappie (4.0/nn) declined from previous surveys in 2002 (17.4/nn) and 2006 (10.0/nn) (Figure 10). Size distribution was indicative of a balanced population (PSD = 70); however, only 30% of the stock-length ($\geq$5 inches) fish were available for harvest. Body condition (W_r) was >95 for all length groups, indicating adequate prey availability. Growth analysis was not conducted due to insufficient sample size.

One black crappie was collected during the survey (Figure 11).

Fisheries management plan for Lake Bardwell, Texas

Prepared – July 2011

ISSUE 1: Insufficient littoral aquatic vegetation and structure exist in the reservoir to provide adequate fish habitat. The controlling authority has shown renewed interest in improving habitat to benefit the fish community.

MANAGEMENT STRATEGIES

1. Seek additional opportunities to implement habitat introduction projects at Lake Bardwell.
2. Due to turbidity and frequent water level fluctuations emergent species are most likely to successfully colonize Lake Bardwell's shoreline. Request appropriate plant species from the East Texas Woods and Waters Native Plant Nursery at Texas Freshwater Fisheries Center which may be established in Lake Bardwell.
3. Investigate the possibility of partnering with local fishing organizations to construct and mark structural fish attractors utilizing natural materials such as brush or bamboo.

ISSUE 2: Blue catfish size distribution has shown a general decline in quality over the past two gill net surveys.

MANAGEMENT STRATEGIES

1. Request blue catfish fingerlings at 100/acre in 2012 and 2013.
2. Continue monitoring blue catfish abundance and size distribution through a supplemental gill net survey in 2013 and standard sampling in 2015.
3. Consult with USACOE staff about the possibility of excessive exploitation of large blue catfish.

ISSUE 3: Palmetto bass fingerling stockings in Lake Bardwell have not occurred since 2007 despite presence of suitable habitat and prey availability, Although nearly 2 million palmetto bass fry were stocked in 2010, no evidence of survival was documented in the 2011 gill net survey.

MANAGEMENT STRATEGIES

1. Continue requesting palmetto bass fingerlings based on a 10 fish/acre annual stocking rate. Maintain communication with USACOE to advise them of delivery schedule.
2. Continue monitoring success of palmetto bass stockings through a supplemental gill net survey in 2013 and standard sampling in 2015.

ISSUE 4: Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels (*Dreissena polymorpha*) can multiply rapidly and attach themselves to any available hard structure, restricting water flow in pipes, fouling swimming beaches and plugging engine cooling systems. Hydrilla has been detected at Lake Bardwell in the past it and other invasive vegetation species such as giant salvinia (*Salvinia molesta*) can form dense mats, interfering with recreational activities like fishing, boating, skiing and swimming. The financial costs of controlling and/or eradicating these types of invasive species are significant. Additionally, the potential for invasive species to spread to other river drainages and reservoirs via watercraft and inter-basin transfer of water is a serious threat to all public waters of the state.

MANAGEMENT STRATEGIES

1. Coordinate with USACOE to post appropriate signage at access points around the reservoir.
2. Contact and educate the marina operator about invasive species, and provide posters, literature, etc… so that they can in turn educate their customers.
3. Educate the public about invasive species through the use of media and the internet.

4. Make a speaking point about invasive species when presenting to constituent and user groups.
5. Keep track of (i.e., map) existing and future inter-basin water transfers to facilitate potential invasive species responses.
6. Conduct a quantitative assessment of the aquatic plant community during routine habitat survey in 2014.

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule includes standard monitoring in 2014-2015 and a supplemental gill netting survey in spring 2013 to monitor the blue catfish and palmetto bass populations (Table 5).

LITERATURE CITED

Anderson, R. O. 1980. Proportional stock density (PSD) and relative weight (W*r*): interpretive indices for fish populations and communities. Pages 27-33 *in* S. Gloss and B. Shupp, editors. Practical fisheries management: more with less in the 1980's . Workshop proceedings, New York chapter, American fisheries Society, Ithica, NY.

Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Beck, P. A. and R. A. Ott. 2007. Statewide freshwater fisheries monitoring and management program survey report for Lake Bardwell 2006. Texas Parks and Wildlife Department, Federal Aid Report F-30-R-32, Austin. 30 pp.

DiCenzo, V. J., M. J. Maceina, and M. R. Stimpert. 1996. Relations between reservoir trophic state and gizzard shad population characteristics in Alabama reservoirs. North American Journal of Fisheries Management 16:888-895.

Gabelhouse, D. W. 1984. A Length-Categorization System to Assess Fish Stocks. North American Journal of Fisheries Management. 4:273-285.

Guy, C. S., R. M. Neumann, D. W. Willis, and R. O. Anderson. 2007. Proportional Size Distribution (PSD): A Further Refinement of Population Size Structure Index Terminology. Fisheries 32(7):348.

Ott, R. A. and T. J. Bister. 2003. Statewide freshwater fisheries monitoring and management program survey report for Lake Bardwell 2002. Texas Parks and Wildlife Department, Federal Aid Report F-30-R-28, Austin. 27 pp.

Texas Commission on Environmental Quality. 2008. Trophic Classification of Texas Reservoirs: 2008 Texas water quality inventory and 303 (d) list. 15 pp.

United States Geological Survey. 2010. *Real-time Data for Texas lakes and Reservoirs* http://waterdata.usgs.gov/tx/nwis/uv/?site_no=08063590&

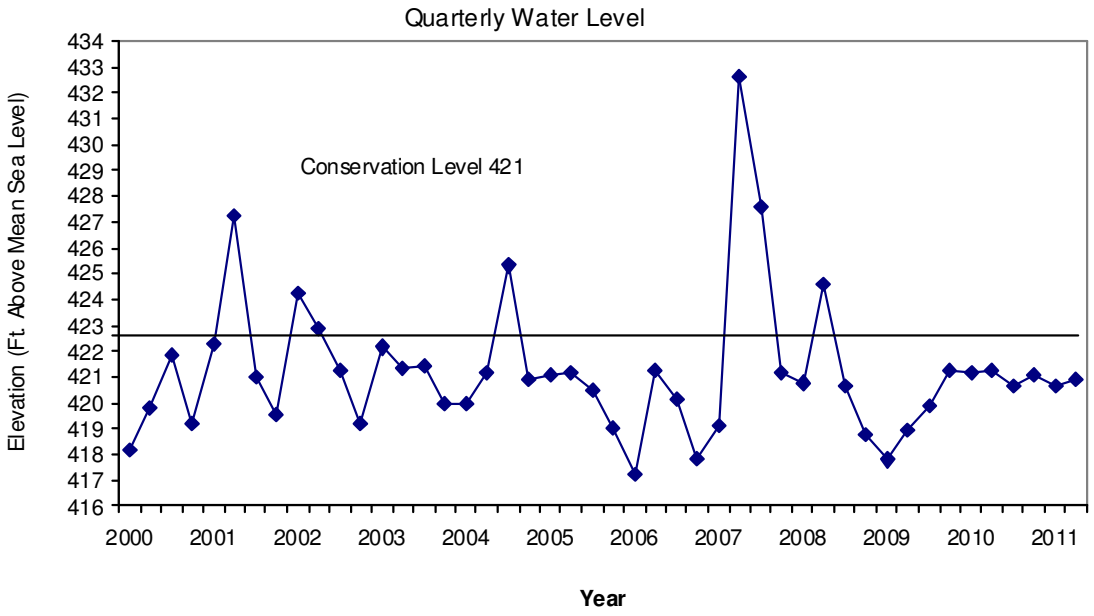


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Lake Bardwell, Texas. Horizontal line represents conservation level.

Table 1. Characteristics of Lake Bardwell, Texas.

Characteristic	Description
Year constructed	1965
Controlling authority	U.S. Army Corps of Engineers
County	Ellis
Reservoir type	Tributary
Shoreline development index (SDI)	2.9
Conductivity	330 umhos/cm

Table 2. Harvest regulations for Lake Bardwell.

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	14 – No Limit
Crappie: white and black crappie, their hybrids and subspecies	25 (in any combination)	10 – No Limit

Table 3. Stocking history of Lake Bardwell, Texas. Size Categories are: FRY =<1 inch; FGL = 1-3 inches.

Species	Year	Number	Size
Blue catfish	1966	7,000	FGL
		7,000	
Channel catfish	1966	22,000	FGL
	1972	2,000	FGL
		24,000	
Striped bass	1967	300,000	FRY
	1968	15,150	FGL
	1969	20,470	FGL
	1970	23,400	FGL
	1981	35,023	FGL
	1983	35,950	FGL
		429,993	
Palmetto bass	1975	20,000	
	1995	61,700	FGL
	1996	53,600	FGL
	1997	53,692	FGL
	1998	41,017	FGL
	2002	35,909	FGL
	2003	47,000	FGL
	2004	47,338	FGL
	2005	47,610	FGL
	2007	32,098	FGL
	2010	1,930,469	FRY
		2,447,985	
Green x redear sunfish	1966	3,400	FGL
	1972	1,000	FGL
		4,400	
Largemouth bass	1966	670,000	FGL
		670,000	
Florida largemouth bass	1992	178,111	FGL
	1998	178,500	FGL
		357,500	

Table 4. Vegetation survey was conducted in 2010. Surface area (acres) and percent of reservoir surface area was determined for each type of aquatic vegetation found.

Shoreline habitat type	Surface area	
	Acres	Percent of reservoir surface area
Native emergent		
American lotus	<0.1	trace
Bull tongue	<0.1	trace
Cattail	<0.1	trace
Native submerged		
Pondweed	<0.1	trace

.

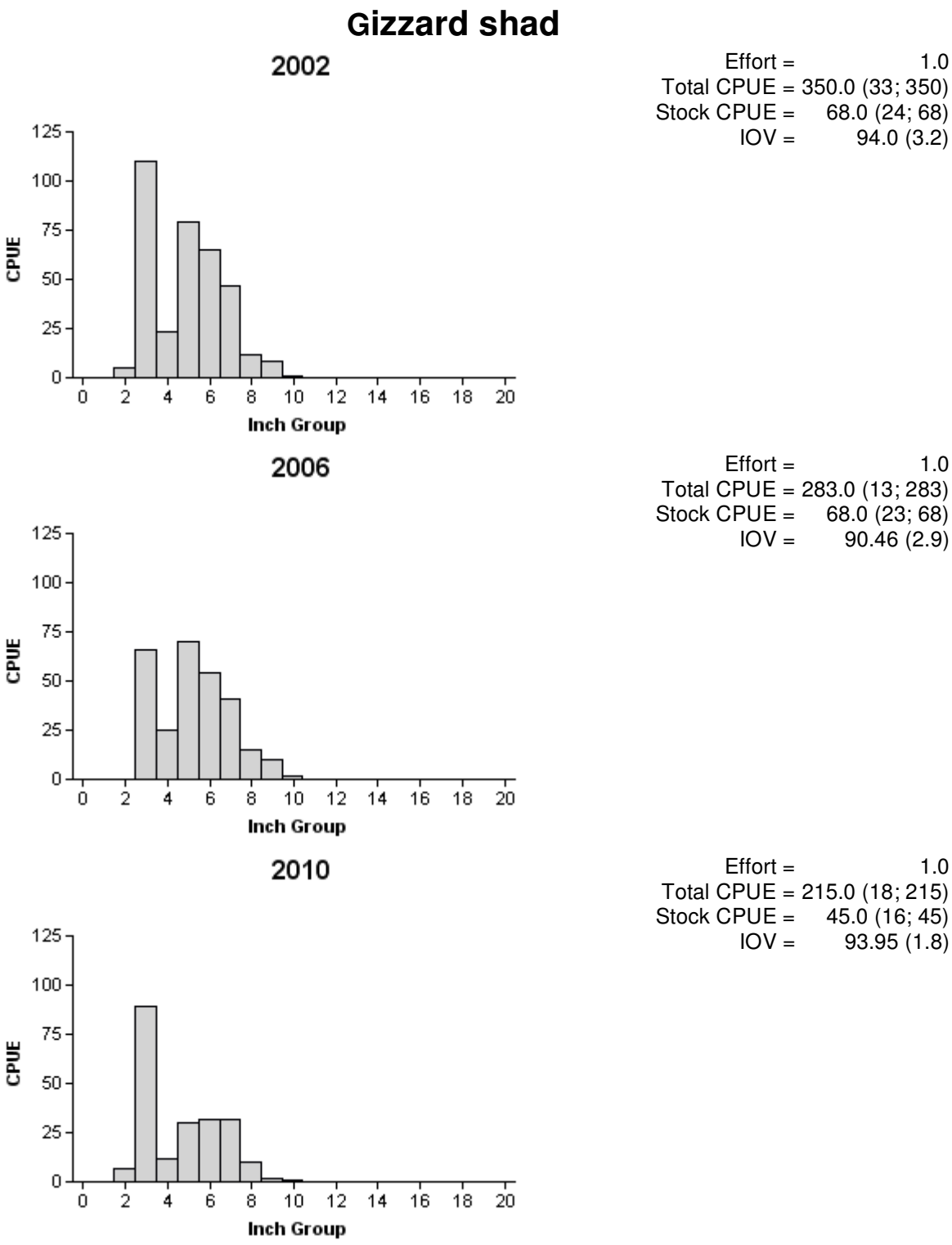


Figure 2. Number of gizzard shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Lake Bardwell, Texas, 2002, 2006, and 2010.

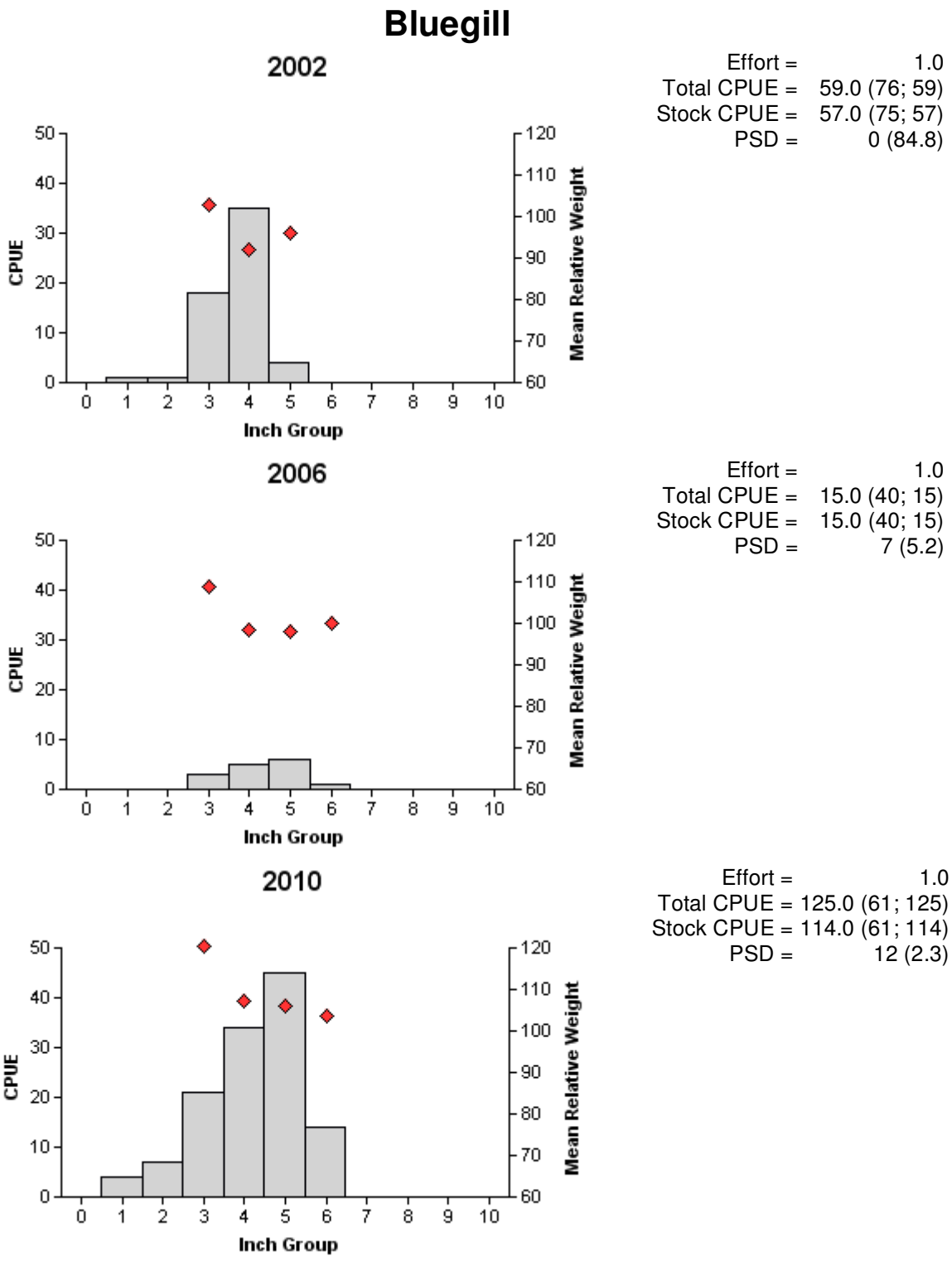
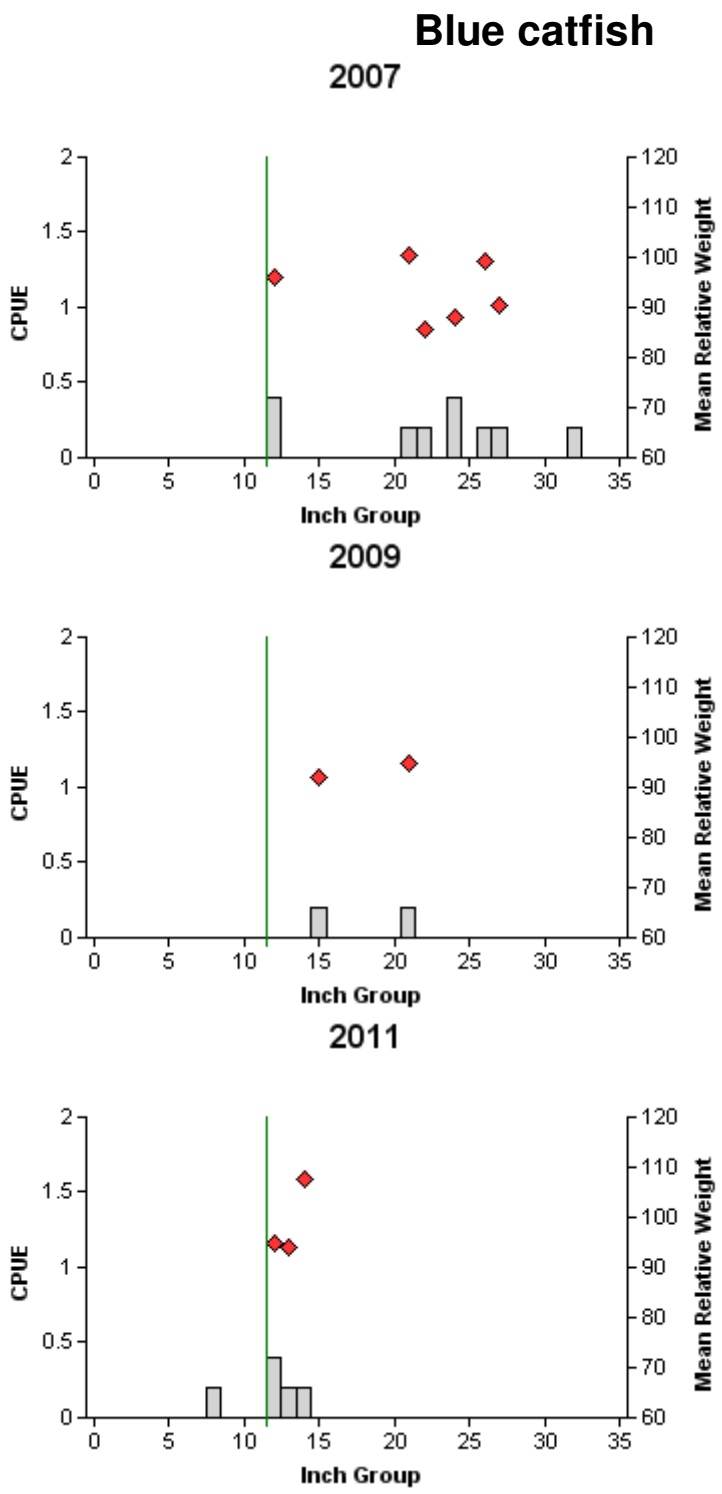


Figure 3. Number of bluegill caught per hour (CPUE), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE are in parentheses) for fall electrofishing surveys, Lake Bardwell, Texas, 2002, 2006, and 2010.

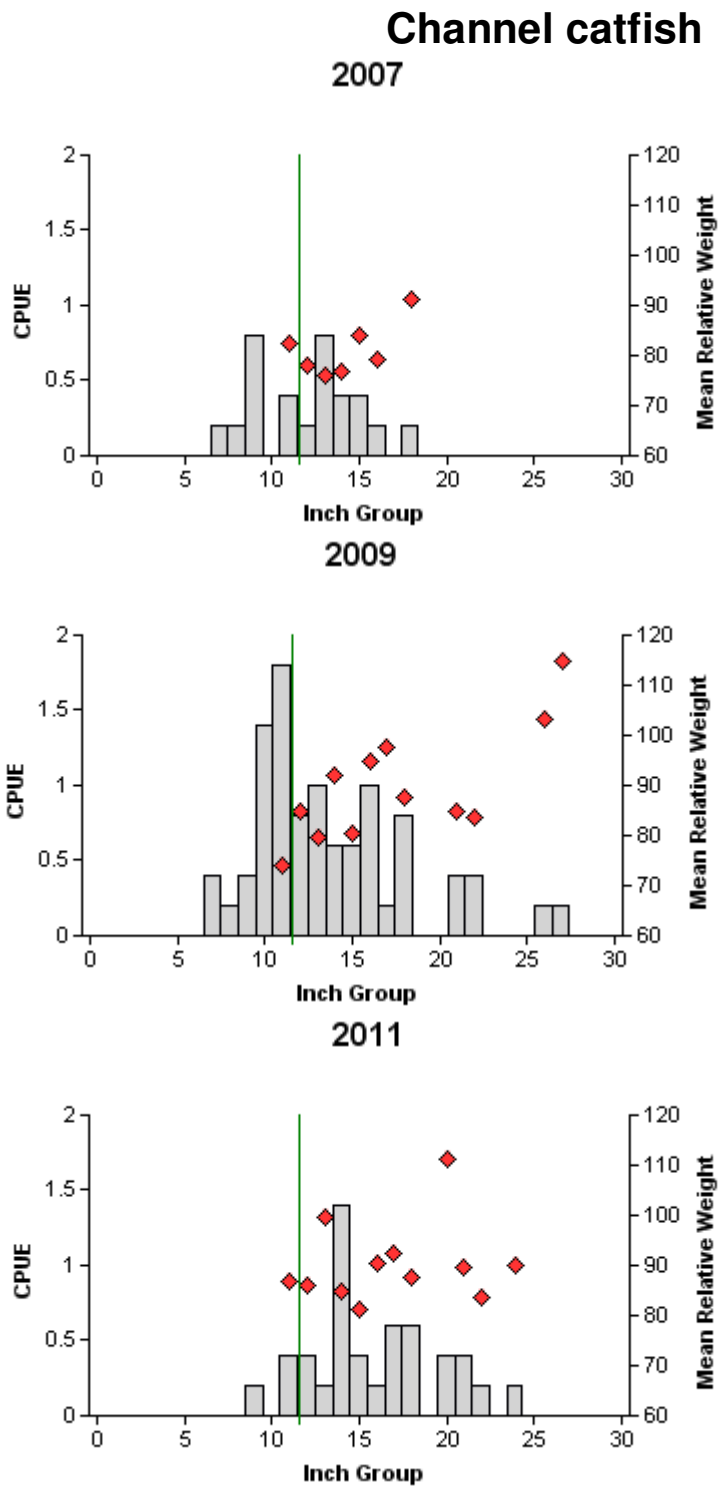


Effort = 5.0
Total CPUE = 1.8 (44; 9)
Stock CPUE = 1.8 (44; 9)
PSD = 78 (10.9)
PSD-12 = 100 (0)

Effort = 5.0
Total CPUE = 0.4 (61; 2)
Stock CPUE = 0.4 (61; 2)
PSD = 50 (39.5)
PSD-12 = 100 (0)

Effort = 5.0
Total CPUE = 1.0 (55; 5)
Stock CPUE = 0.8 (47; 4)
PSD = 0 (92.7)
PSD-12 = 100 (0)

Figure 4. Number of blue catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Bardwell, Texas, 2007, 2009, and 2011. Vertical lines represent length limit at time of survey.



Effort = 5.0
Total CPUE = 3.8 (15; 19)
Stock CPUE = 2.6 (20; 13)
PSD = 15 (13.5)
PSD-12 = 85 (10.1)

Effort = 5.0
Total CPUE = 10.4 (72; 52)
Stock CPUE = 8.0 (85; 40)
PSD = 40 (3.3)
PSD-12 = 78 (1.5)

Effort = 5.0
Total CPUE = 5.6 (27; 28)
Stock CPUE = 5.4 (25; 27)
PSD = 48 (9.6)
PSD-12 = 93 (6)

Figure 5. Number of channel catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Bardwell, Texas, 2007, 2009, and 2011. Vertical lines represent length limit at time of survey.

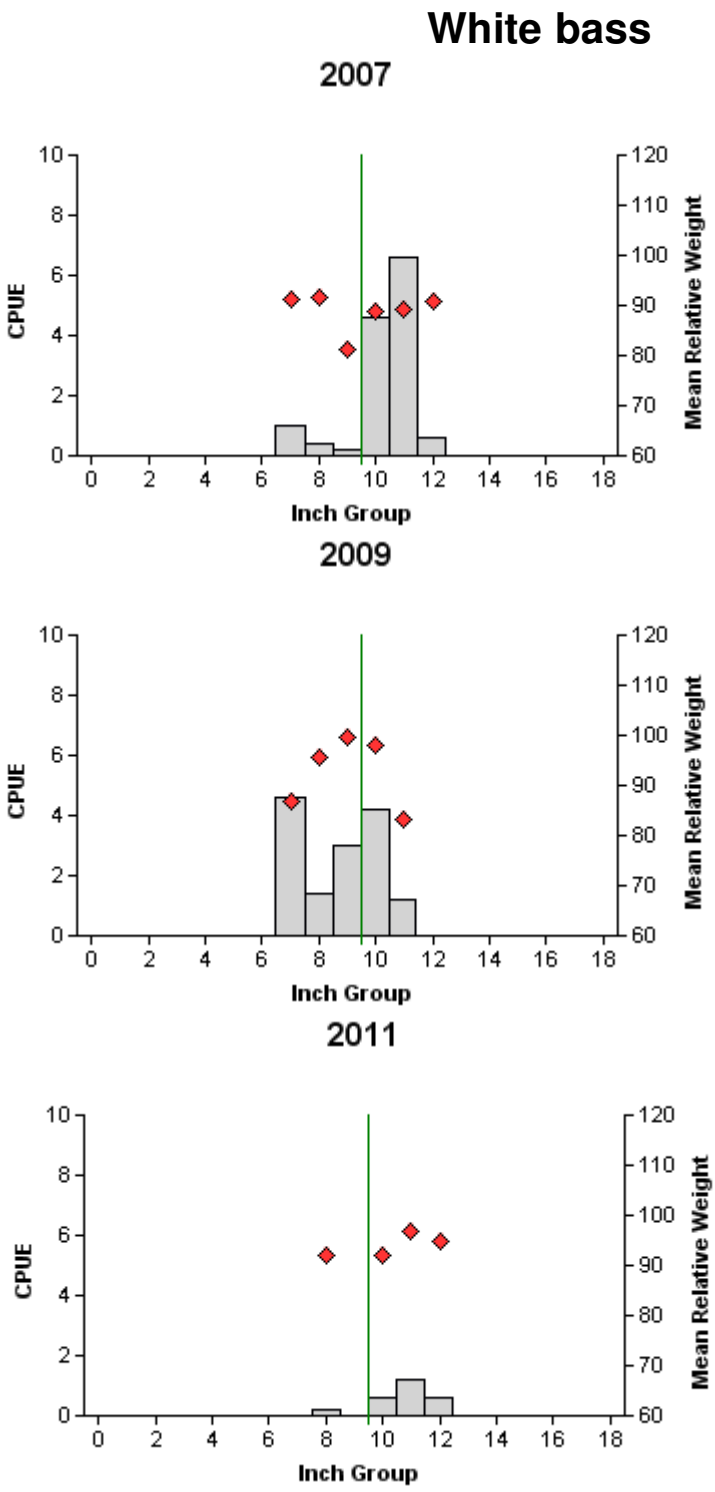
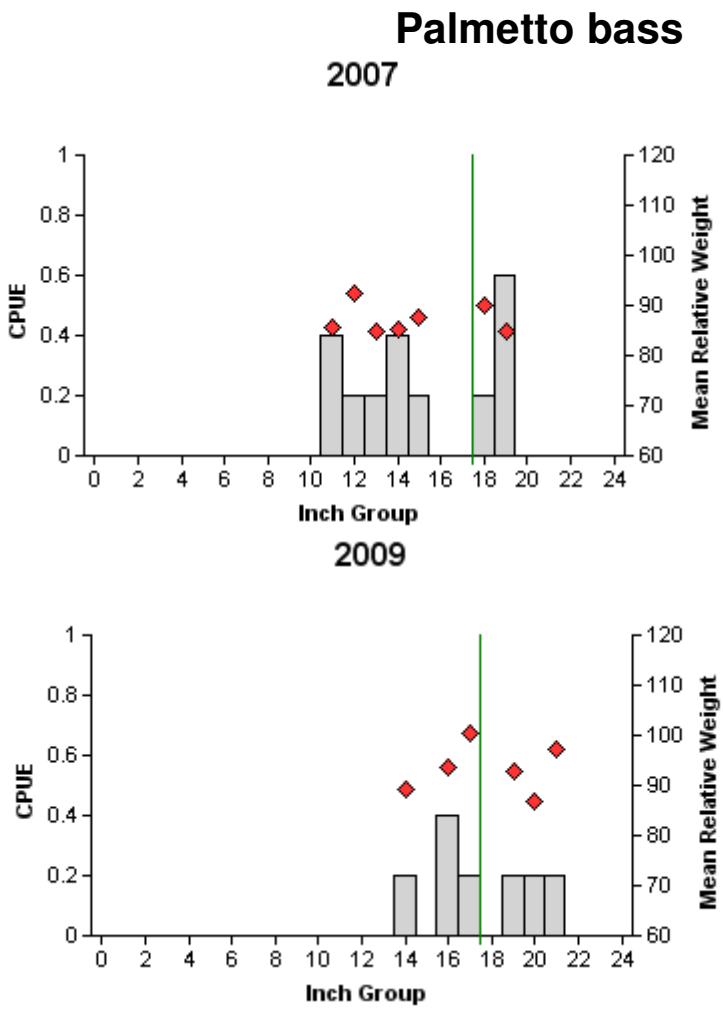


Figure 6. Number of white bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Bardwell, Texas, 2007, 2009, and 2011. Vertical lines represent length limit at time of survey.



Effort = 5.0
Total CPUE = 2.2 (89; 11)
Stock CPUE = 2.2 (89; 11)
PSD = 82 (2.7)
PSD-18 = 36 (8.9)

Effort = 5.0
Total CPUE = 1.4 (83; 7)
Stock CPUE = 1.4 (83; 7)
PSD = 100 (0)
PSD-18 = 43 (13)

Figure 7. Number of palmetto bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Bardwell, Texas, 2007, 2009; no palmetto bass were caught in 2011. Vertical lines represent length limit at time of survey.

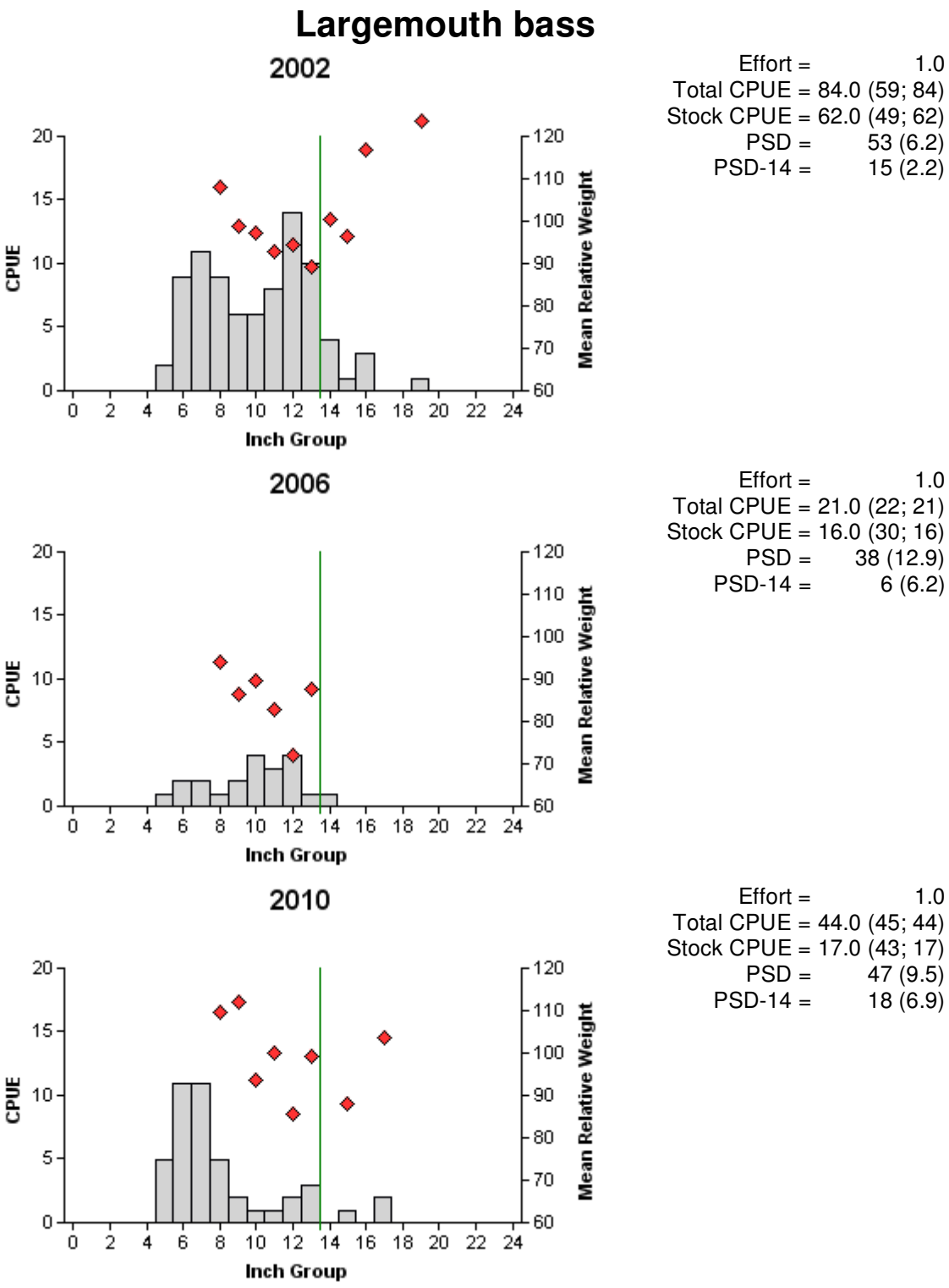


Figure 8. Number of largemouth bass caught per hour (CPUE), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE are in parentheses) for fall electrofishing surveys, Lake Bardwell, Texas, 2002, 2006, and 2010. Vertical lines indicate the length limit at time of survey.

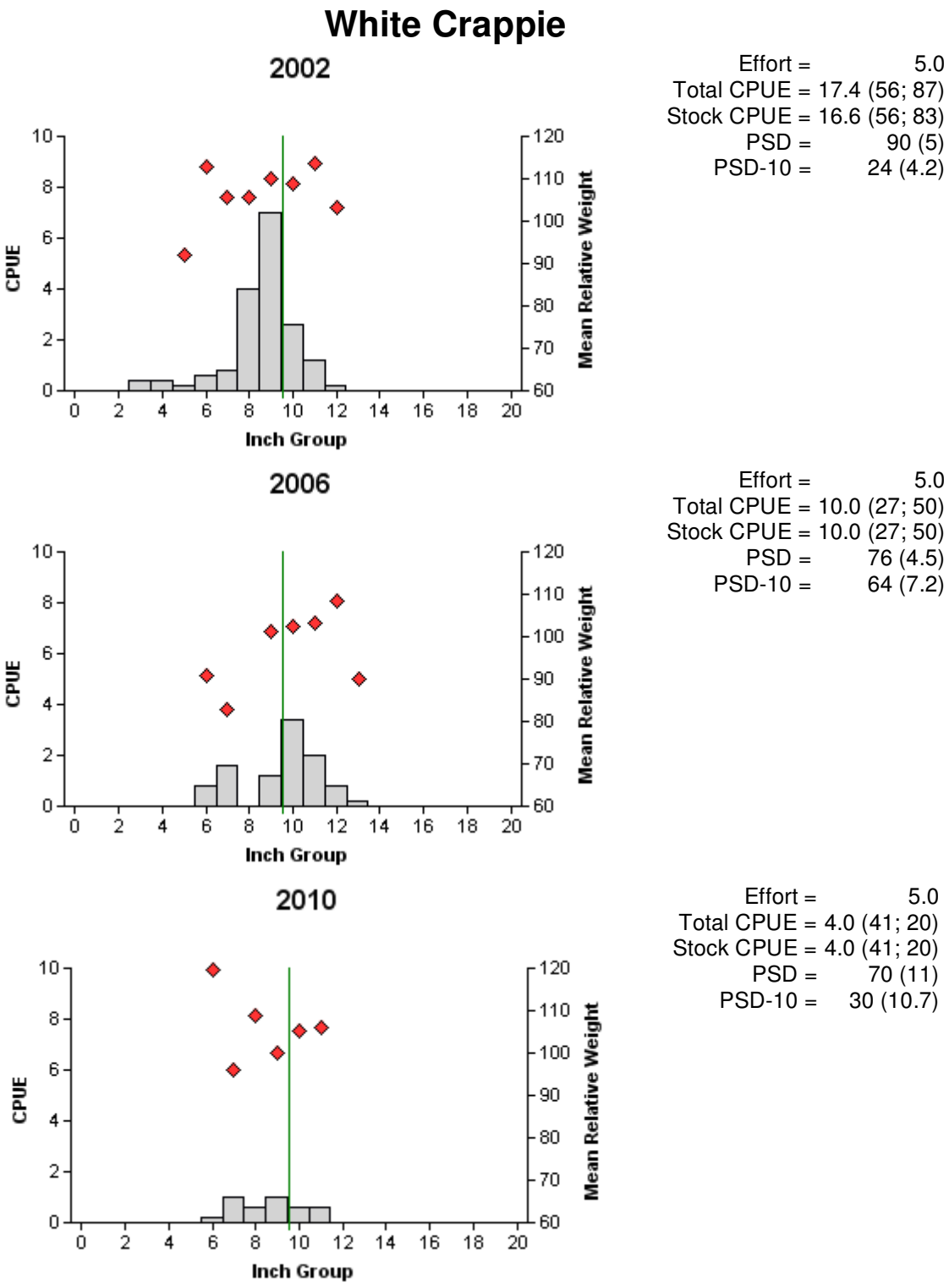


Figure 9. Number of white crappie caught per net night (CPUE, bars), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap net surveys, Lake Bardwell, Texas, 2002, 2006, and 2010. Vertical lines represent length limit at time of survey.

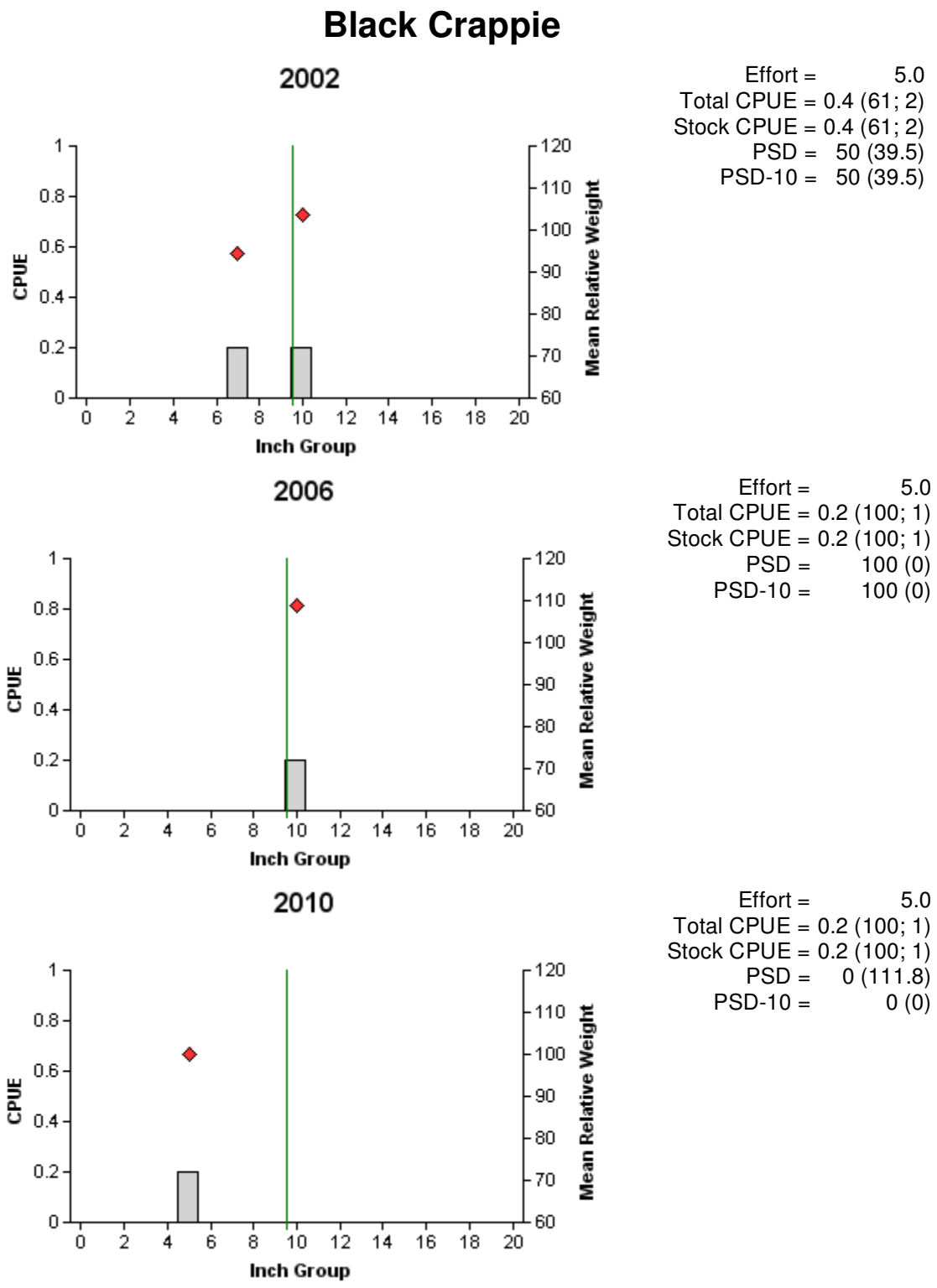


Figure 10. Number of black crappie caught per net night (CPUE, bars), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap net surveys, Lake Bardwell, Texas, 2002, 2006, and 2010. Vertical lines represent length limit at time of survey.

Table 5. Proposed sampling schedule for Lake Bardwell, 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.

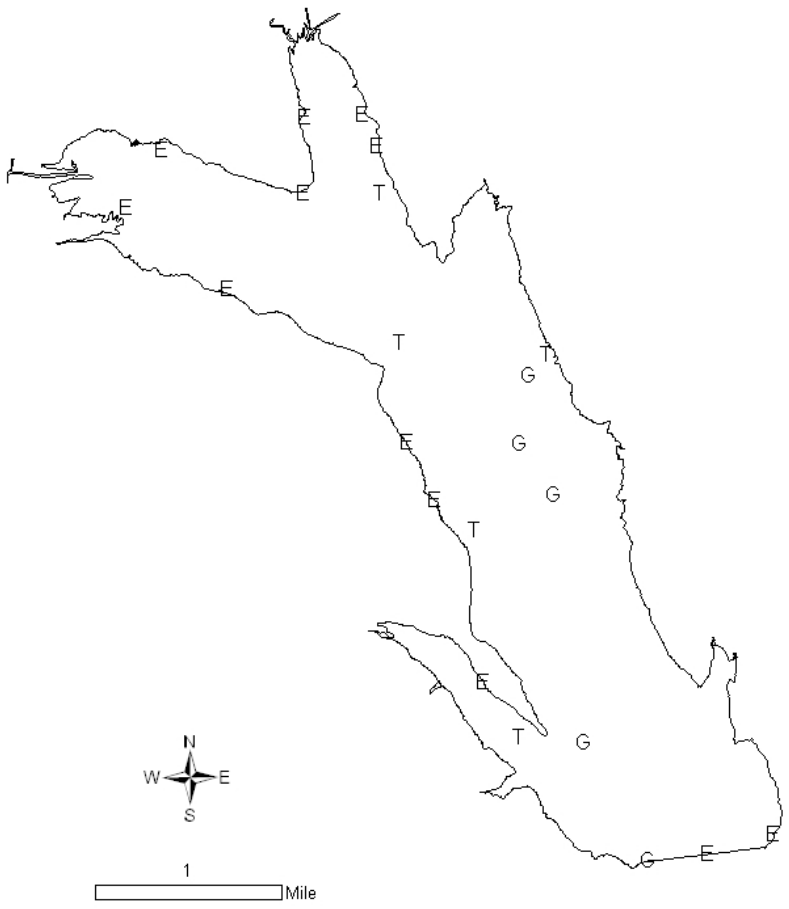
Survey Year	Electrofisher	Trap Net	Gill Net	Vegetation	Access	Report
2011-2012						
2012-2013			A			
2013-2014						
2014-2015	S	A	S	S	S	S

APPENDIX A

Number (N) and catch rate (CPUE) of all target species collected from all gear types from Lake Bardwell, 2010-2011.

Species	Gill netting		Trap netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Gizzard shad					215	2150
Threadfin shad					283	283.0
Mosquito fish					1	1.0
Blue catfish	5	1.0				
Channel catfish	28	5.6				
Flathead catfish	1	0.2				
White bass	13	2.6				
Green sunfish					27	27.0
Warmouth					3	3.0
Bluegill					125	125.0
Longear sunfish					27	27.0
Largemouth bass					44	44.0
White crappie			20	4.0		
Black crappie			1	0.2		

APPENDIX B



Location of sampling sites, Lake Halbert, Texas, 2010-2011. Trap netting, gill netting, and electrofishing stations are indicated by T, G, and E, respectively.