PERFORMANCE REPORT

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FEDERAL AID PROJECT F-221-M-2

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2011 Survey Report

H-4 Reservoir

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SURVEY AND MANAGEMENT SUMMARY

H-4 Reservoir was surveyed in the fall 2007, 2009, and 2011 and spring 2009 and 2012 using electrofishing, fall 2005, 2007, 2009, 2010, and 2011 using trap nets, and spring 2004, 2008, and 2012 using gill nets. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir description:** H-4 is a 696-acre reservoir on the Guadalupe River in Gonzales County and is controlled by the Guadalupe-Blanco River Authority (GBRA). The reservoir was impounded in 1931 to provide water for a hydroelectric plant and recreational uses. The substrate is composed primarily of silt, sand, clay, and some gravel and rock. Angler and boat access was limited to only one pay-to-use boat ramp. There were no handicap-specific facilities. At the time of sampling, the habitat was composed of boat docks, stumps, native floating-leaved vegetation, native submersed and emergent vegetation, hydrilla, East Indian hygrophila, and water hyacinth.

- **Management history:** Important sport fish species include channel catfish, largemouth bass, and crappie. Anglers have reported catching white, palmetto and striped bass from this reservoir but these species were not collected in gill-net surveys. Palmetto and striped bass migrate downstream from a stocked upstream reservoir (Canyon Lake). Flathead catfish were present in the reservoir, and blue catfish have been stocked in this reservoir but have yet to become the dominant catfish species as seen in other reservoirs throughout Texas. The 2008 management plan focused on working with GBRA on the control of water hyacinth, monitoring water lettuce and East Indian hygrophila, and conducting spring electrofishing surveys to assess perceived spawning and recruitment limitations of largemouth bass. Water hyacinth and water lettuce were chemically treated with herbicides annually and GBRA lowered the water level of the reservoir twice during extended periods of below freezing weather. These management practices were effective in the control of water hyacinth and allowed native aquatic vegetation to flourish. TPWD monitored water lettuce and East Indian hygrophila, yet neither plant became established. Spring electrofishing surveys were conducted and the data showed both spawning and recruitment were no longer a concern, probably a result of more habitat due to the control of water hyacinth and expansion of native vegetation.

- **Fish Community**

  - **Prey species:** Gizzard shad, threadfin shad, and several sunfish species were the primary forage species available to predators. Relative abundance of gizzard and threadfin shad have decreased while sunfish relative abundance has increased.

  - **Catfishes:** Blue, channel, and flathead catfish were present in the reservoir with channel catfish being the predominant species. About half of channel catfish collected were legal-size (≥ 12-inches) with a few fish over 20-inches in total length.

  - **Black basses:** Largemouth, Guadalupe, spotted, and smallmouth bass were present in the reservoir with largemouth bass being the most abundant. Recruitment of largemouth bass increased as a result of the improved habitat, brought about by the control of water hyacinth.

  - **Crappie:** White and black crappie were present in the reservoir with white crappie being the most abundant and robust population.

- **Management strategies:** Continue managing fish populations under current regulations. Continue to work with GBRA on controlling water hyacinth and hydrilla, enhance habitat, and monitor the spread and colonization of East Indian hygrophila. Introductions of native aquatic vegetation will be explored and implemented once water hyacinth is controlled.

INTRODUCTION

This document is a summary of fisheries data collected from H-4 Reservoir in 2011-2012. 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. Management strategies are included to address existing problems or opportunities. Historical data is presented with the 2011-2012 data for comparison.

Reservoir Description

H-4 is a 696-acre mainstream reservoir on the Guadalupe River in Gonzales County and is controlled by GBRA. The reservoir was impounded in 1931 to provide water for a hydroelectric plant and recreational uses. The substrate is composed primarily of silt, sand, clay, and some gravel and rock. The reservoir is relatively shallow with the exception of the river channel. Angler and boat access was limited to one pay-to-use ramp. There were no handicap-specific facilities at this ramp. Public bank access was non-existent due to private property surrounding the reservoir. Littoral habitat consisted of native aquatic vegetation (coontail, spatterdock, and American lotus), fallen trees, piers, and boat docks. Exotic vegetation (water hyacinth, water lettuce, and East Indian hygrophila) was present in the reservoir with water hyacinth being the most abundant. The GBRA lowered reservoir water level during extended periods of below freezing temperatures and hired a private contractor to conduct herbicide treatments to help control water hyacinth. Other descriptive characteristics for H-4 Reservoir are in Table 1.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Findeisen and Binion 2008) included:

1. Work with GBRA on control of water hyacinth, treatment surveys, stakeholders meetings concerning aquatic vegetation control, update the nuisance aquatic vegetation management plan, and assist with cost-share funding.
   Action: TPWD assisted GBRA with the control of water hyacinth by reviewing vegetation treatment proposals and providing recommendations. We provided GBRA with water hyacinth surveys prior to treatment, attended stakeholders meetings to discuss treatment of water hyacinth, modified the nuisance aquatic vegetation management plan to include things such as water level drawdowns during extended periods of below freezing temperatures, and provided GBRA with fund matching.

2. Monitor water lettuce and East Indian hygrophila and work with GBRA on controlling these nuisance aquatic species before becoming problematic.
   Action: Water lettuce and East Indian hygrophila colonies were noted on all vegetation surveys and water lettuce was treated simultaneously with water hyacinth.

3. Conduct spring electrofishing surveys to address perceived poor largemouth bass recruitment and survival .
   Action: Spring electrofishing surveys were conducted in 2009 and 2012. Results of these surveys and standard fall electrofishing surveys indicated recruitment and survival are no longer issues in this reservoir. This may be attributed to an increase in desirable habitat, primarily native aquatic vegetation, that occurred shortly after water hyacinth coverage was reduced from 85 acres to 4 acres.

Harvest regulation history: Sport fish in H-4 Reservoir are currently managed with statewide harvest regulations (Table 2).

Stocking history: No stockings have occurred since the previous report. A complete stocking history is in Table 3.

Vegetation/habitat management history: Water hyacinth has been a problematic species for years. Prior to 1998, TPWD controlled water hyacinth on this reservoir using herbicide. After 2001, the GBRA began herbicide treatments through a contractor to only treat specific problematic sections of the reservoir, however, the herbicide treatments have been expanded out to the entire reservoir. Chemical control efforts, in conjunction with lowering water level during extended periods of below freezing temperatures, have been effective in the control of water hyacinth and water lettuce. Water hyacinth weevils, *Neochetina eichorniae* and *Neochetina bruchi*, were both present but provided little control of this plant. Water lettuce, while present, has not been as problematic as water hyacinth. Water lettuce weevils, *Neohydronomous affinis*, were introduced on April 22, 1997 (N=280) and again on June 24, 1998 (N=1,400). Shortly after the 1998 weevil release, the reservoir experienced a 100-yr flood, flushing most of the water lettuce downstream. Hydrilla has been present around the boat ramp but has yet to create boater access problems. East Indian hygrophila was well-established in the boat ramp slough but has been replaced by native submersed aquatic vegetation.

Water Transfer: H-4 Reservoir is primarily used for hydro-electric generation and recreation to a lesser extent. Currently, there are no plans to build a pump station on this reservoir.

METHODS

Fishes were collected by electrofishing (1.0 hour at 12 5-minute stations), trap nets (7 net nights at 7 stations), and gill nets (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 trap and gill nets as the number of fish caught in one net set overnight (fish/nn). Random and fixed trap net surveys were used in 2005 to collect white crappie for and age and growth analysis. Electrofishing and gill net survey sites were randomly selected and trap net survey sites were subjectively selected based on previous surveys. Access, littoral habitat, and aquatic vegetation surveys were conducted in August 2011. All surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2011).

Genetic data of largemouth bass was collected using micro-satellite analysis to determine genotype of individual fish and was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2011).

Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD) for various length categories, as defined by Guy et el. (2007)]] and condition indices [relative weight (W_r)] were calculated for target fishes according to Anderson and Neumann (1996). The Index of Vulnerability (IOV) was calculated for gizzard shad according to 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. Otoliths were collected from largemouth bass (N=13; range 330-381mm total length) and white crappie (N=115) for age and growth analysis. Growth parameters for white crappie were estimated using the Von Bertalanffy growth equation utilizing non-linear least squares methodology (Haddon 2001). Mean length-at-age was described by: $L_a = L\infty\ (1-e^{-K(t-to)})$; where L_a = length-at-age, $L\infty$ = average asymptotic length, K = metabolic growth coefficient, and t_o = hypothetical age where the fish has a length of zero.

RESULTS AND DISCUSSION

Habitat: Shoreline habitat consisted of eroded bank, bulkhead, and concrete and non-vegetative habitat consisted of piers and boat docks adjacent to shoreline (Table 4). Numerous fallen trees and overhanging limbs created large woody habitat. Vegetation consisted of native floating vegetation (American lotus and spatterdock), native emergent vegetation (water willow), native submersed vegetation (American pondweed, coontail, and water stargrass) and exotic (water hyacinth and hydrilla) (Table 4). Rooted stands of East Indian hygrophila and water lettuce, noted during the August 2007 habitat/vegetation survey and January 2008 vegetation survey, were not observed during the 2011 vegetation survey (Table 4). Coverage of native aquatic vegetation more than doubled (164.1 acres) in

2011 compared to the 2007 vegetation survey (78.2 acres). Native floating-leaved vegetation increased from 76.8 acres in 2007 to 132.4 acres in 2011 and native submersed vegetation, primarily coontail, increased from 0.8 acres in 2007 to 30.9 acres in 2011. Native emergent vegetation coverage in 2011 was similar to 2007. The increase in native vegetation was attributed to the decrease in exotic vegetation as a result of herbicide applications and water level decreases during extended periods of below freezing temperatures. Overall coverage of exotic vegetation decreased from 85.3 acres (12.2%) in 2007 to 3.9 acres (<1%) in 2011. Hydrilla, seen sporadically in the reservoir, was the only exotic plant species to expand from non-detected in 2007 to 0.8 acres in 2011.

Prey species: The 2011 electrofishing catch rate of gizzard and threadfin shad was 52.0/h and 55.0/h, respectively. The gizzard shad catch rate and Index of Vulnerability (IOV) decreased from previous years (Figure 1). The IOV for gizzard shad was 37, indicating 37% of the gizzard shad collected were less than eight inches total length and available to most predators. Threadfin shad relative abundance in 2011 was substantially less than in 2009 but similar to other years (Figure 2).

The 2011 electrofishing catch rate for bluegill and redear sunfish was 276.0/h and 101.0/h, respectively. The bluegill catch rate increased substantially from 2007 (88.0/h) and 2009 (101.0/h) (Figure 3). Most bluegill were available (< 6 in) to predators. Redear sunfish catch rates also increased substantially from 2007 (35.0/h) and 2009 (58.0/h) (Figure 4). Most redear sunfish were also available to predators. Increased native aquatic vegetation coverage may explain the shift from a once predominant shad forage base to a predominant sunfish forage base.

Channel catfish: The 2012 gill net catch rate of channel catfish was 7.6/nn, similar to the 2008 catch rate (9.6/nn) but substantially lower than in 2004 (30.8/nn) (Figure 5). The 2004 size structure for channel catfish was predominantly smaller sized fish (PSD=12) while the 2008 and 2012 size structure was comprised of larger size classes (PSD=73 and 67, respectively), indicating good recruitment. Channel catfish of stock size and greater exhibited good body condition, as mean relative weights were generally at or over 100.

Largemouth bass: The 2011 electrofishing catch rate of largemouth bass was 55.0/h, similar to the 2009 catch rate (46.0/h) but higher than in 2007 (13.0/h) (Figure 6). Mean relative weights of fish greater than stock size were good and averaged near, or above, 100 for most inch classes. Proportional size distribution was similar for all years and indicated a high proportion of fish less than12-inches in the population. Largemouth bass reached 14 inches total length in 2.9 years. Genetic analysis indicated a 47% frequency of Florida largemouth bass alleles, with no individuals having the pure Florida largemouth bass genotype. In the previous report, poor habitat was thought to be contributing to low survival and poor recruitment of largemouth bass (Findeisen and Binion 2008). However, spring and fall electrofishing data (Figures 6 and 7) collected since the 2008 report have shown increases in survival and recruitment. These improvement are likely attributed to the expansion of native aquatic vegetation types in the reservoir.

White crappie: Historically, random sampling sites have produced lower white crappie catch rates (Figure 8) as compared to biologist-selected sampling sites (Figure 9). Consequently, biologist-selected sites have been used as the standard for monitoring crappie populations in H-4 reservoir since 2009. The 2011 trap net catch rate was 25.7/nn, which was comparable to estimates in 2009 (18.2/nn) and 2010 (38.0/nn) (Figure 9). Mean relative weight values were below average (~90) for most inch classes, notably in the larger size classes. Based on von Bertalanffy growth model, white crappie reach legal size (10-inches)t by age-2 (Linf = 12.8 and K = 0.57) (APPENDIX G).

Fisheries management plan for H-4 Reservoir, Texas.

Prepared – July 2012

ISSUE 1: 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. Giant Salvinia (*Salvinia molesta*) and other invasive vegetation species 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 other means is a serious threat to all public waters of the state. Water hyacinth has been problematic on this reservoir and recently rooted colonies of hydrilla were found in the reservoir. Additionally, water lettuce and East Indian hygrophila are present in the reservoir but have yet to become problematic species.

MANAGEMENT STRATEGIES

1. Cooperate with the controlling authority to post appropriate signage at access points around the reservoir.
2. Contact and educate marina owners about invasive species, and provide them with 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. Continue to assist GBRA in acquiring cost-share funding.

ISSUE 2: The effective control of water hyacinth has resulted in abundant growth of native aquatic vegetation in the reservoir, primarily spatterdock. The fisheries and aquatic life in this reservoir would benefit from increased diversification of the aquatic plant community. Proven methods are available to accomplish this task.

MANAGEMENT STRATEGIES

1. Submit a habitat enhancement proposal to GBRA.
2. Create a vegetation poly-culture through introduction of native aquatic plant species.

ISSUE 3: Sport fish populations have increased since the last report and provide anglers with excellent fishing opportunities away from crowded, larger lakes.

MANAGEMENT STRATEGIES

1. Write and distribute press releases to media outlets concerning the excellent angling opportunities available in this reservoir.

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule includes electrofishing and trap netting surveys in the fall 2013 and electrofishing, trap netting, and gill netting in 2015-2016 (Table 6). Electrofishing surveys are necessary to monitor largemouth bass, sunfish, and shad. Non-random trap net surveys will be used to monitor crappie populations. Gill net surveys are only necessary once every four years to monitor catfish species. A Federal Aid report will be prepared in 2016.

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Table 1. Characteristics of H-4 Reservoir, Texas.

Characteristic	Description
Year constructed	1931
Controlling authority	Guadalupe-Blanco River Authority
County	Gonzales
Reservoir type	Mainstream
Shoreline Development Index	2.91
Conductivity	
Access: Boat	Adequate – one pay-to-use ramp
Bank	Inadequate – no public bank access
Handicapped	Inadequate – no handicapped access

Table 2. Harvest regulations for H-4 Reservoir, Texas.

Species	Bag Limit (per person)	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, striped	5	18 – No Limit
Bass, palmetto	5	18 – No Limit
Bass, smallmouth	5	14 – No Limit
Bass, largemouth	5	14 – No Limit
Bass, spotted and Guadalupe	(in any combination)	No Limit – No Limit
Crappie: white and black crappie, their hybrids and subspecies	25 (in any combination)	10 – No Limit

Table 3. Stocking history of H-4 Reservoir, Texas. Sizes categories are: FGL = 1-3 inches and ADL = adult (sexually mature fish).

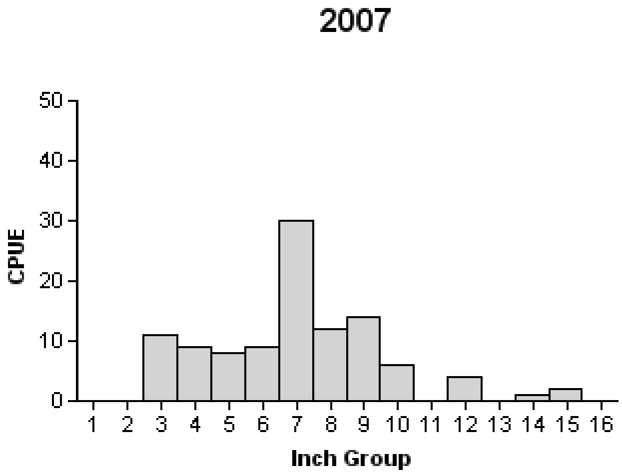
Year	Number	Size
Blue catfish		
1985	7,040	FGL
1986	7,000	FGL
1988	16	ADL
1994	114,199	FGL
1995	69,602	FGL
1997	69,600	FGL
Species Total	267,457	
Channel catfish		
1972	53,000	FGL
1991	77	ADL
Species Total	53,077	
Striped bass		
1978	6,650	FGL
Species Total	6,650	
Florida largemouth bass		
1978	27,900	FGL
1990	69,754	FGL
1991	69,722	FGL
Species Total	167,376	
Triploid grass carp*		
1995	25	ADL
1996**	5	ADL
1996**	6	ADL
Species Total	36	

* Radio-tagged fish
** Replace dead radio-tagged fish

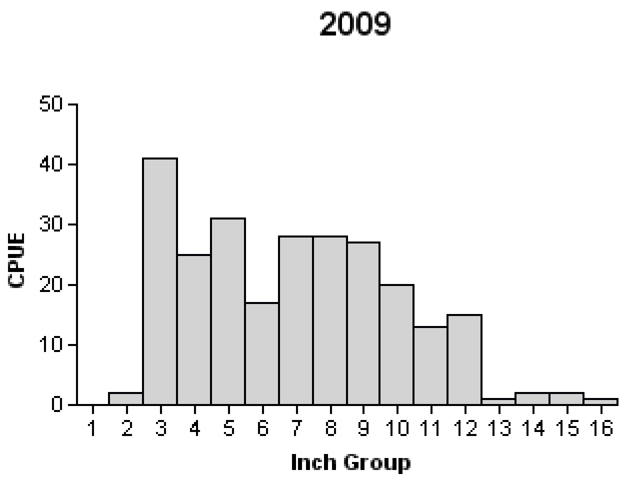
Table 4. Survey of littoral zone and physical habitat types, H-4 Reservoir, Texas, 2007. A linear shoreline distance (miles) was recorded for each habitat type found. A vegetation survey was conducted in 2011. Surface area and percent of reservoir surface acre were determined for each type of aquatic vegetation found. Surface area estimates are based on the acreage of water containing a specific vegetation type not the total acreage of vegetation.

Habitat type	Shoreline Distance		Surface Area of Water with Vegetation	
	Miles	Percent of total	Acres	Percent of reservoir surface area
Shoreline habitat				
Overhanging brush	17.2	69.8		
Eroded bank	6.1	24.7		
Bulkhead	0.8	3.4		
Non-descript	0.3	1.4		
Concrete	0.2	0.7		
Total	24.6	100		
Vegetation				
Native floating vegetation			132.4	19.0
American lotus			34.7	5.0
Spatterdock			97.7	14.0
Native submerged vegetation			30.9	4.4
American pondweed			0.1	<0.1
Coontail			30.7	4.4
Water stargrass			0.1	<0.1
Native emergent vegetation			0.8	0.1
Water willow			0.8	0.1
Exotic vegetation			3.9	0.6
Water hyacinth			3.1	0.4
Hydrilla			0.8	0.2
Adjacent to shoreline				
Piers and Boat docks	2.5	10.1		

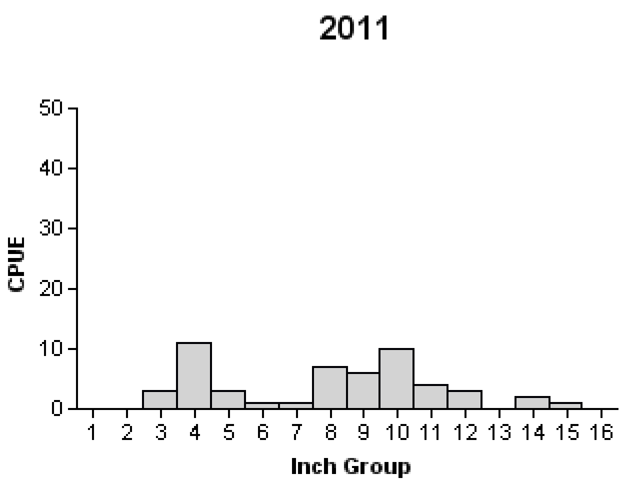
Gizzard shad



Effort = 1.0
Total CPUE = 106.0 (39; 106)
IOV = 63 (10)



Effort = 1.0
Total CPUE = 253.0 (24; 253)
IOV = 57 (10)



Effort = 1.0
Total CPUE = 52.0 (32; 52)
IOV = 37 (10)

Figure 1. Comparison of the number of gizzard shad caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, H-4 Reservoir, Texas, 2007, 2009, and 2011.

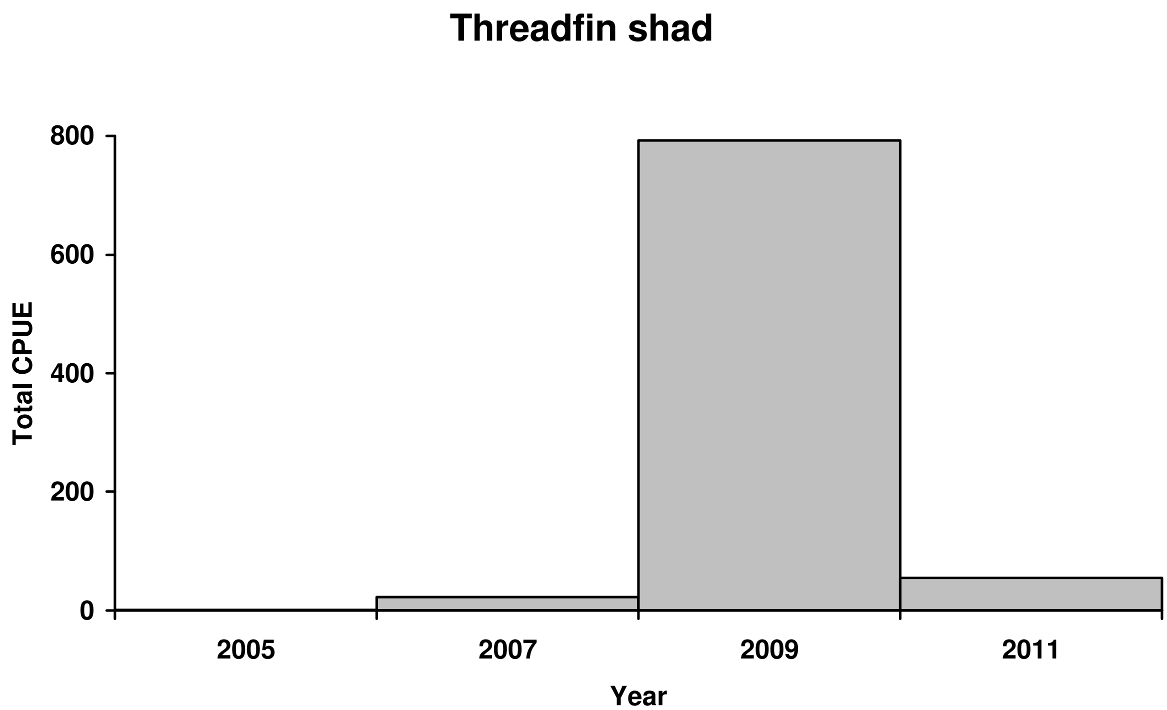
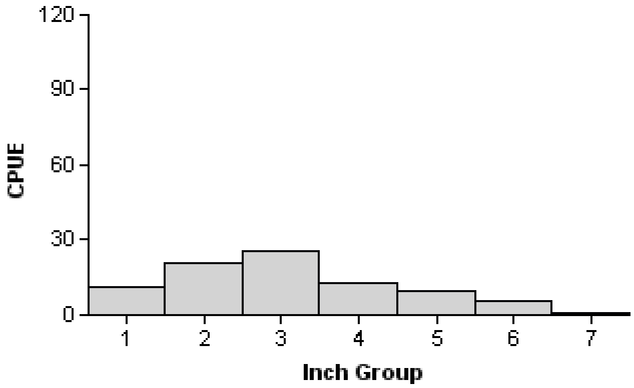


Figure 2. Total catch per unit effort for threadfin shad for fall electrofishing surveys, H-4 Reservoir, Texas, 2005, 2007, 2009, and 2011.

Bluegill

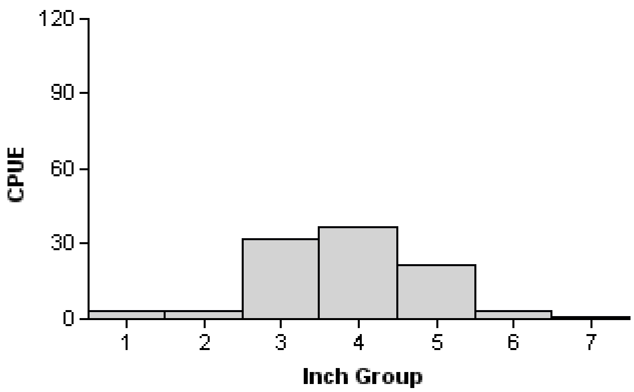
2007

Effort = 1.0
Total CPUE = 88.0 (20; 88)
PSD = 12 (6)



2009

Effort = 1.0
Total CPUE = 101.0 (30; 101)
PSD = 4 (2)



2011

Effort = 1.0
Total CPUE = 276.0 (18; 276)
PSD = 2 (1)

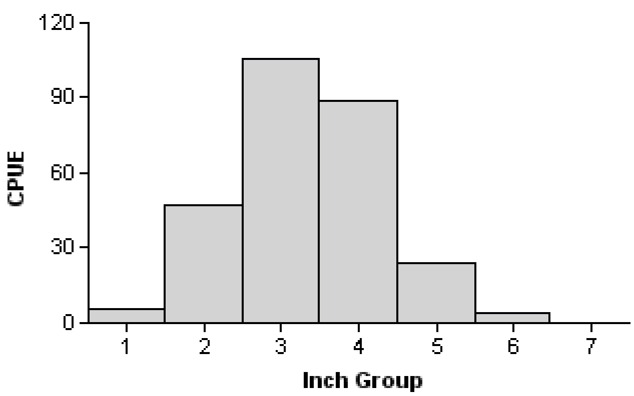
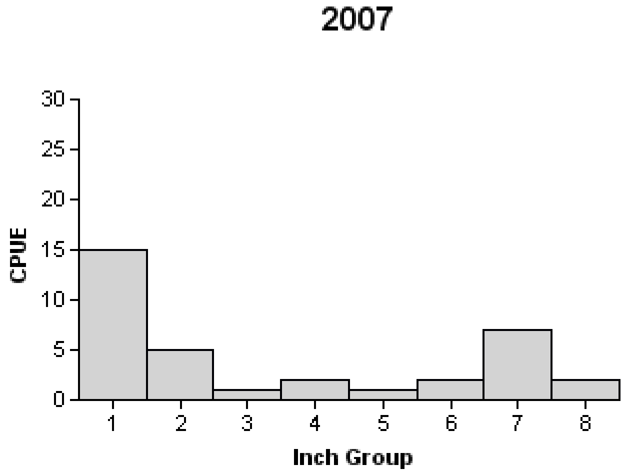
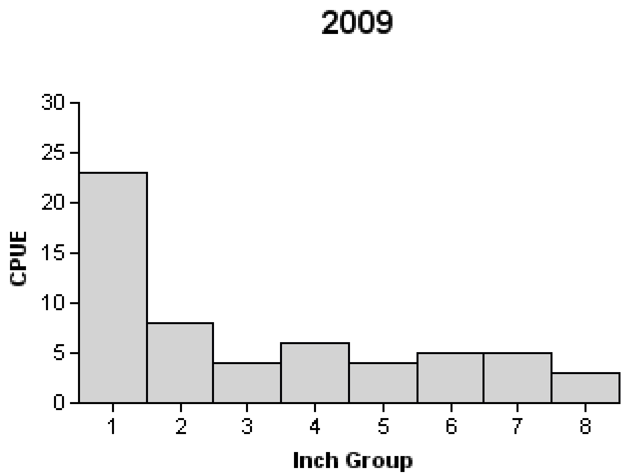


Figure 3. Comparison of the number of bluegill caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, H-4, Reservoir, Texas, 2007, 2009, and 2011.

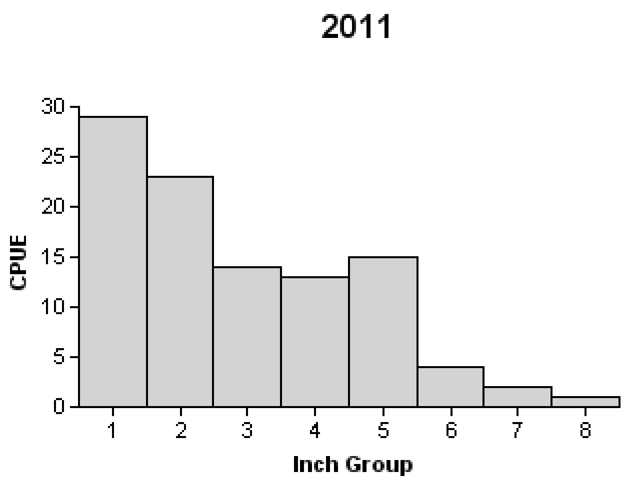
Redear sunfish



Effort = 1.0
Total CPUE = 35.0 (34; 35)
PSD = 64 (12)



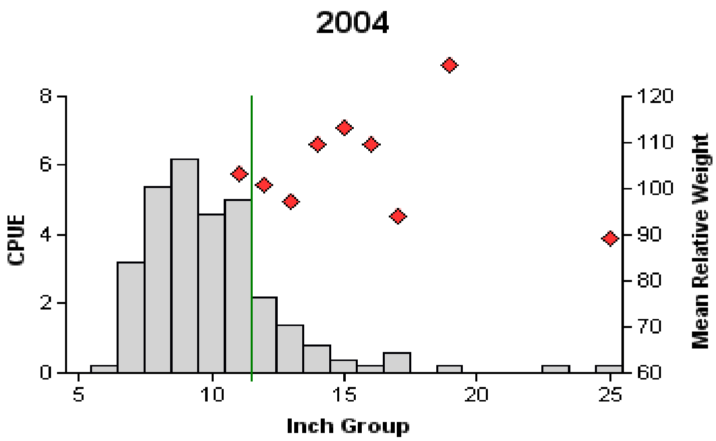
Effort = 1.0
Total CPUE = 58.0 (41; 58)
PSD = 35 (10)



Effort = 1.0
Total CPUE = 101.0 (21; 101)
PSD = 9 (6)

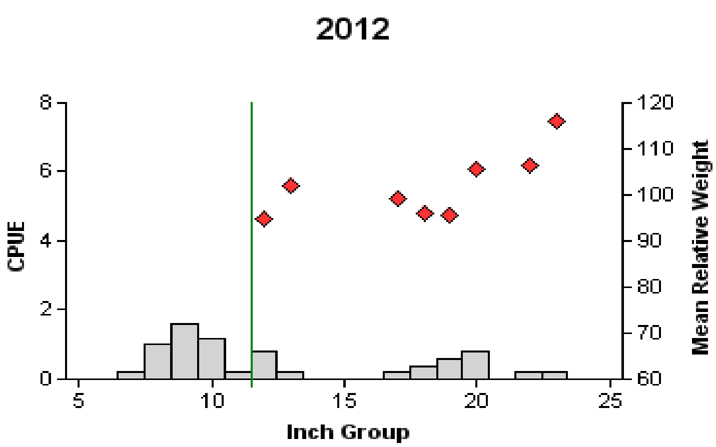
Figure 4. Comparison of the number of redear sunfish caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, H-4 Reservoir, Texas, 2007, 2009, and 2011.

Channel catfish



Effort = 5.0
Total CPUE = 30.8 (55;
Stock CPUE = 154)
PSD = 11.2 (49; 56)
12 (5.2)

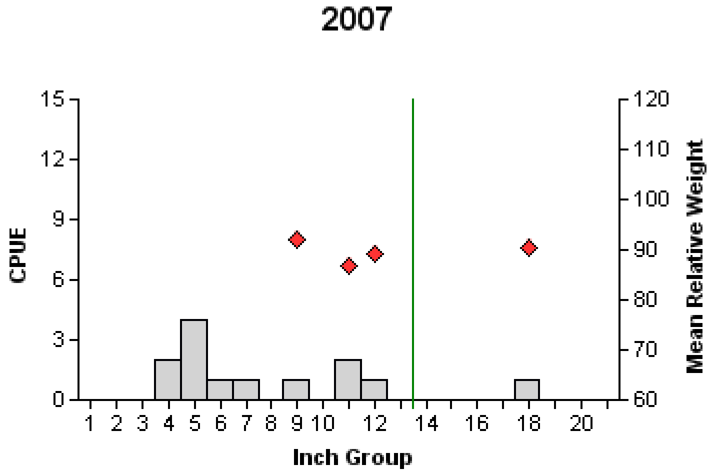
Effort = 5.0
Total CPUE = 9.6 (44; 48)
Stock CPUE = 6.0 (30; 30)
PSD = 73 (18.9)



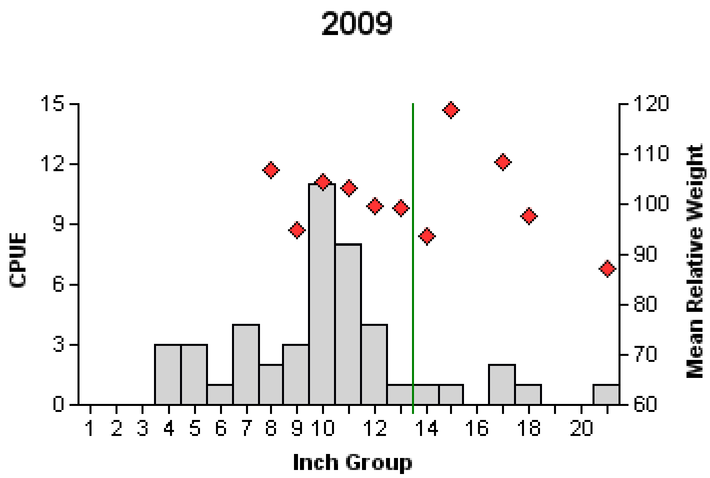
Effort = 5.0
Total CPUE = 7.6 (51; 38)
Stock CPUE = 3.6 (34; 18)
PSD = 67 (15.8)

Figure 5. Comparison of the 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, H-4 Reservoir, Texas, 2004, 2008, and 2012. Vertical lines denote 12-inch minimum length limit.

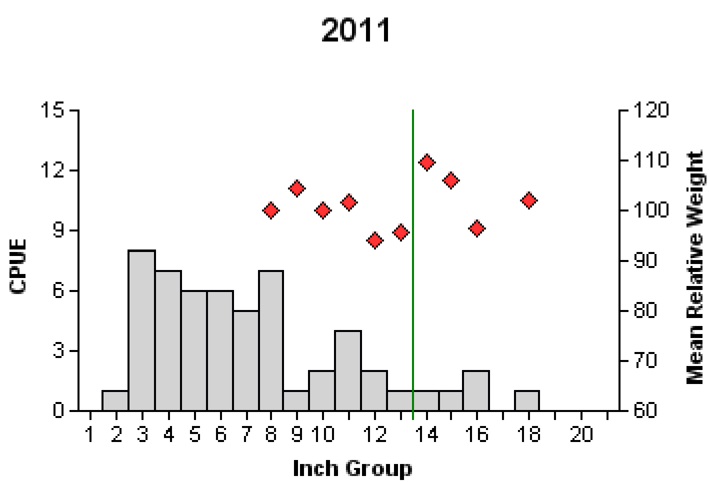
Largemouth bass



Effort = 1.0
Total CPUE = 13.0 (42; 13)
Stock CPUE = 5.0 (62; 5)
PSD = 40 (20.5)



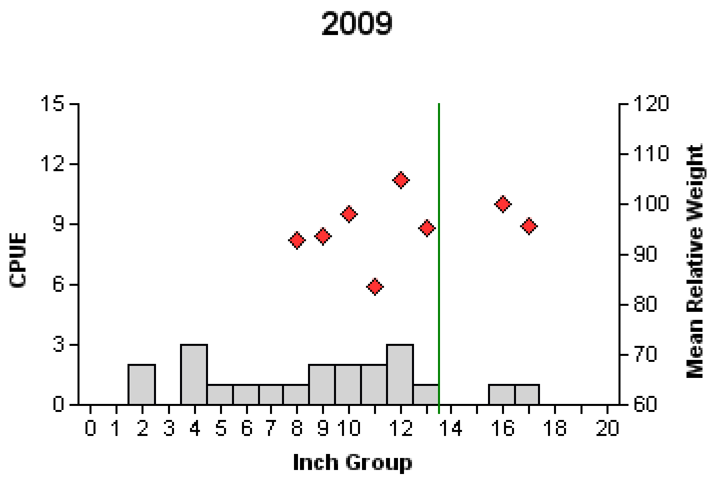
Effort = 1.0
Total CPUE = 46.0 (50; 46)
Stock CPUE = 35.0 (64; 35)
PSD = 31 (8.1)



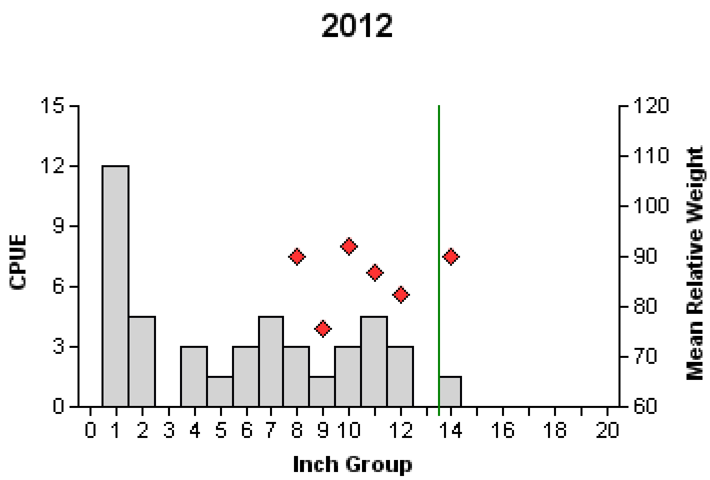
Effort = 1.0
Total CPUE = 55.0 (22; 55)
Stock CPUE = 22.0 (30; 22)
PSD = 36 (12)

Figure 6. Comparison of the number of largemouth bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, H-4 Reservoir, Texas, 2007, 2009, and 2011. Vertical lines denote 14-inch minimum length limit.

Largemouth bass



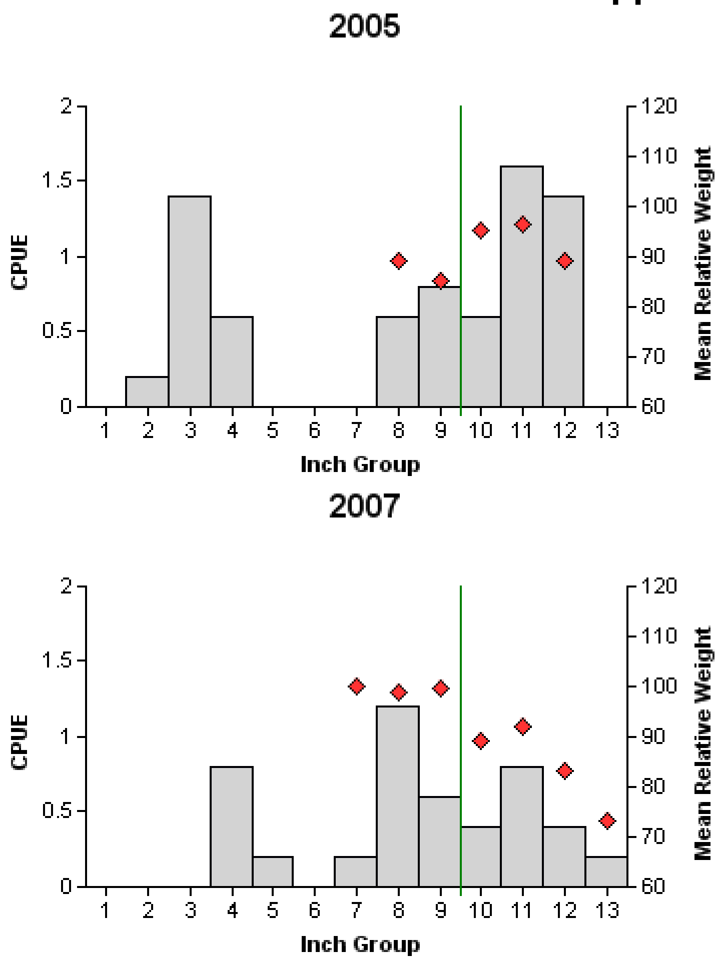
Effort =	1.0
Total CPUE =	21.0 (16;
Stock CPUE =	21)
PSD =	13.0 (27;
	13)
	46 (17)



Effort =	0.7
Total CPUE =	45.0 (36;
Stock CPUE =	30)
PSD =	16.5 (40;
	11)
	27 (17.8)

Figure 7. Comparison of the number of largemouth bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring electrofishing surveys, H-4 Reservoir, Texas, 2009, and 2012. Vertical lines denote 14-inch minimum length limit.

White crappie

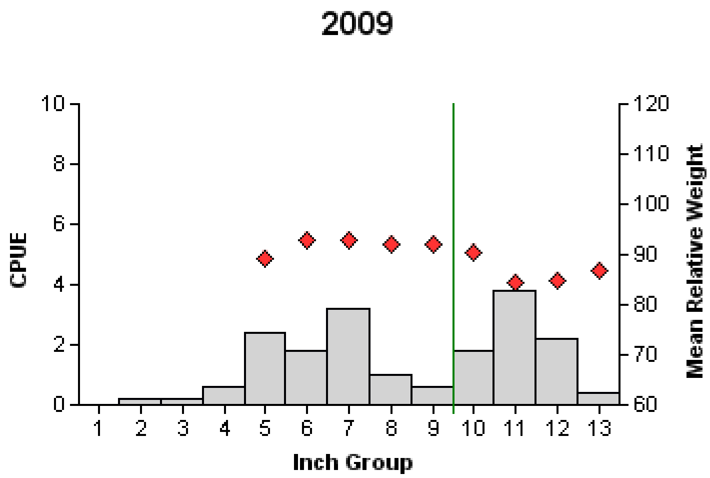


Effort = 5.0
Total CPUE = 7.2 (64; 36)
Stock CPUE = 5.0 (68; 25)
PSD = 100 (0)

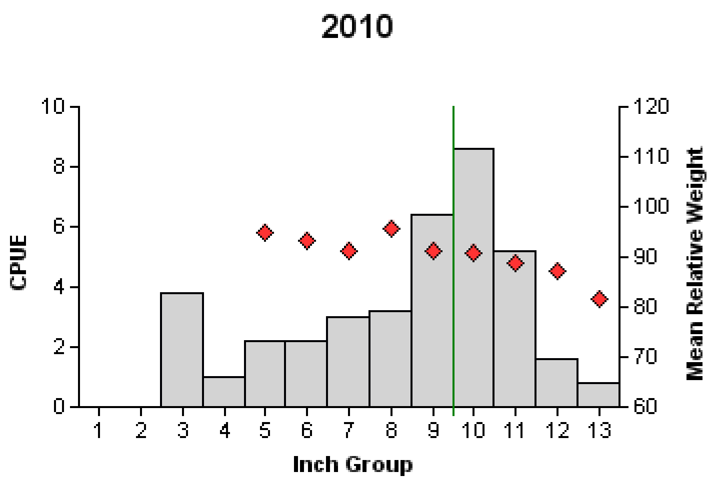
Effort = 5.0
Total CPUE = 4.8 (63; 24)
Stock CPUE = 4.0 (57; 20)
PSD = 90 (5)

Figure 8. Number of white crappie 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 fall trap net survey at random selected sites, H-4 Reservoir, Texas, 2005 and 2007. Vertical line denotes 10-inch minimum length limit.

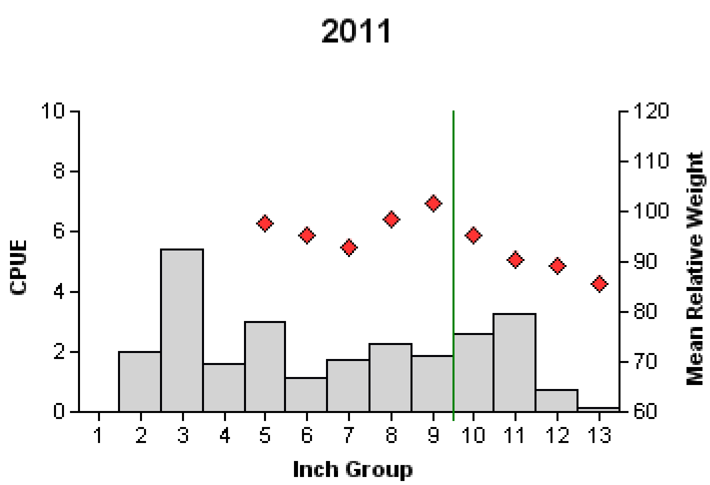
White crappie



Effort = 5.0
Total CPUE = 18.2 (52; 91)
Stock CPUE = 17.2 (51; 86)
PSD = 57 (13)



Effort = 5.0
Total CPUE = 38.0 (44; 190)
Stock CPUE = 33.2 (42; 166)
PSD = 78 (2)



Effort = 7.0
Total CPUE = 25.7 (37; 180)
Stock CPUE = 16.7 (39; 117)
PSD = 65 (5)

Figure 9. Comparison of the number of white crappie 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 selected fall trap net surveys, H-4 Reservoir, Texas, 2009, 2010, and 2011. Vertical lines denote 10-inch minimum length limit.

Table 5. Proposed survey schedule for H-4 Reservoir, Texas. Trap net and electrofishing surveys are conducted in the fall and the gill net survey is conducted in the spring. Standard surveys are denoted by S and additional surveys are denoted by A.

Survey Year	Electro-fishing	Trap Netting	Gill Netting	Vegetation Survey	Access Survey	Report
Fall 2012-Spring 2013						
Fall 2013-Spring 2014	A	A*				
Fall 2014-Spring 2015						
Fall 2015-Spring 2016	S	S*	S	S	S	S

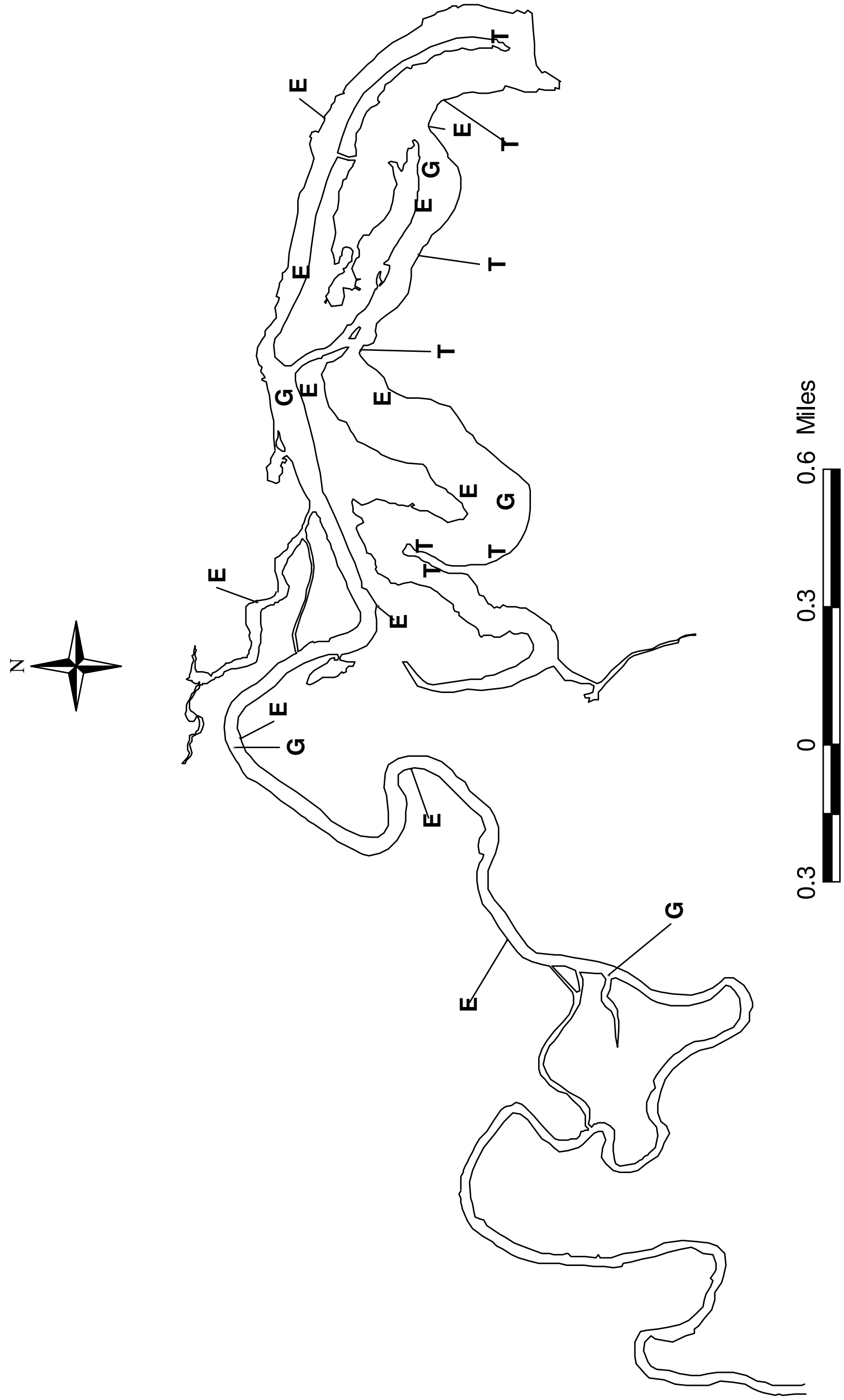
* Denotes non-random site selection.

APPENDIX A

Number (N) and catch rate (CPUE) of all species collected from all gear types from H-4 Reservoir, Texas, 2010-2011.

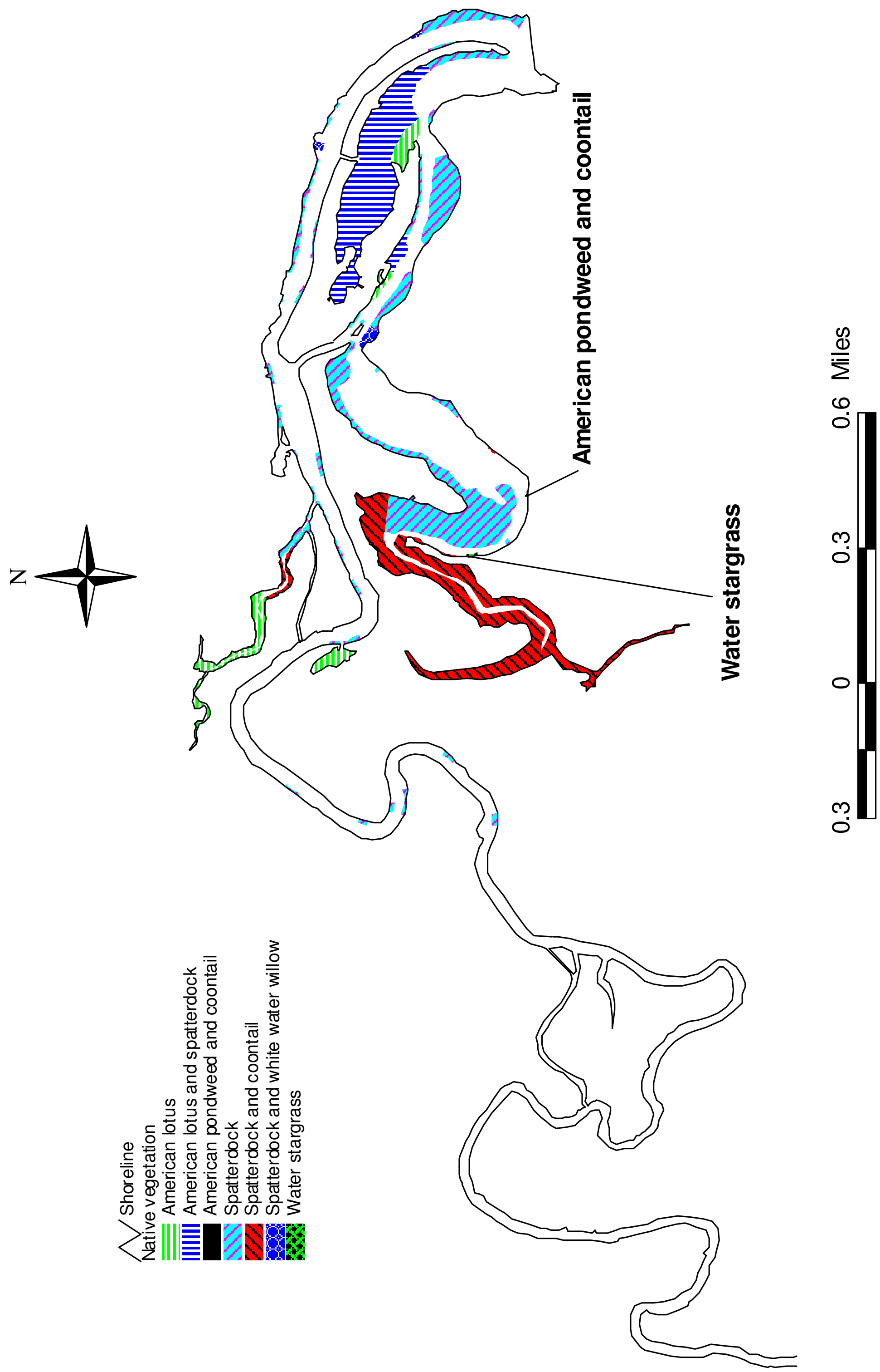
	Electrofishing		Trap Netting		Gill netting	
Species	N	CPUE	N	CPUE	N	CPUE
Spotted gar					3	0.6
Gizzard shad	52	52.0	6	0.9	118	23.6
Threadfin shad	55	55.0	15	2.1	1	0.2
Common carp					1	0.2
Golden shiner	23	23.0	6	0.9		
Bullhead minnow	17	17.0				
Inland silverside	1	1.0				
Smallmouth buffalo					15	3.0
Gray redhorse					2	0.4
Blue catfish					2	0.4
Channel catfish					38	7.6
Flathead catfish					4	0.8
Mexican tetra	6	6.0				
Redbreast sunfish	2	2.0				
Warmouth	15	15.0	1	0.2	1	0.2
Bluegill	276	276.0	160	22.9		
Longear sunfish	99	99.0	11	1.6		
Redear sunfish	101	101.0	63	9.0	1	0.2
Spotted bass	5	5.0				
Largemouth bass	55	55.0			8	1.6
White crappie	9	9.0	180	25.7	18	3.6
Black crappie	1	1.0	25	3.6		
Logperch	3	3.0				
Rio Grande cichlid	8	8.0				

APPENDIX B



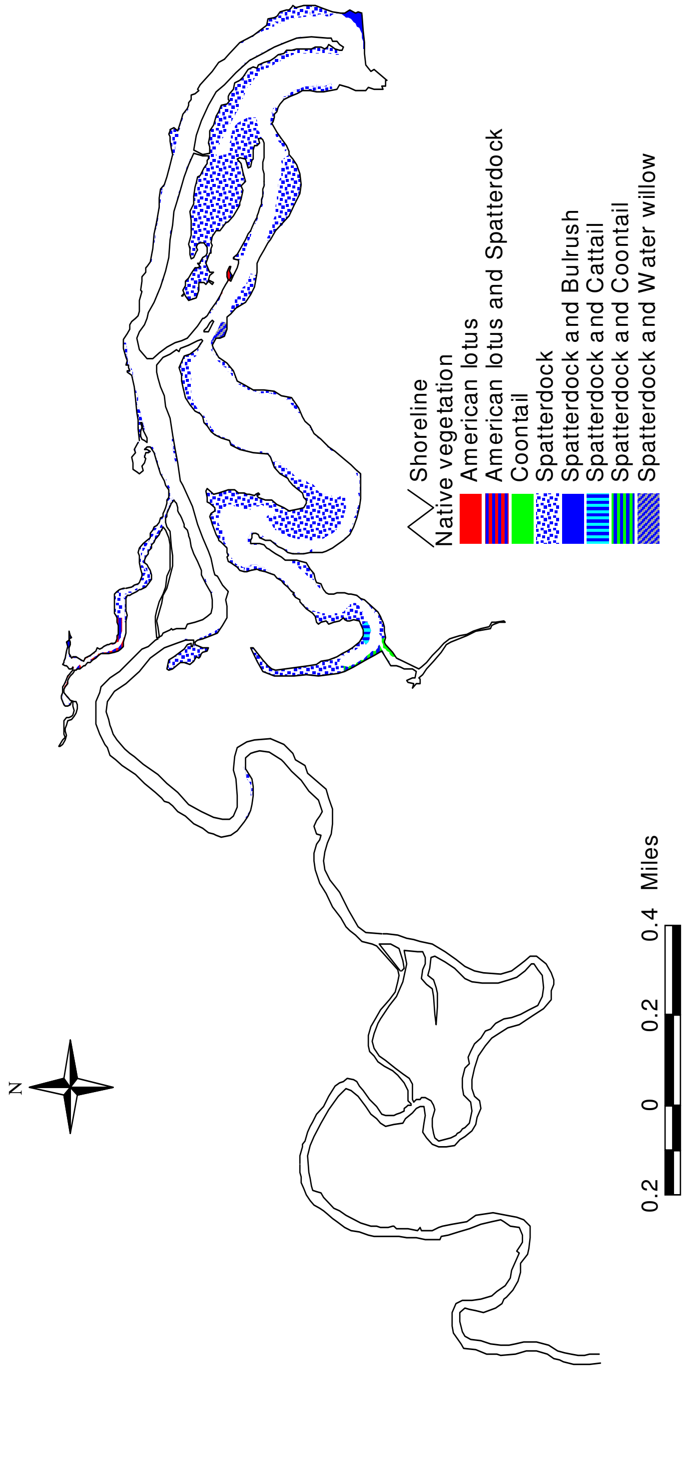
Location of sampling sites, H-4 Reservoir, Texas, 2011-2012. Electrofishing, trap net, and gill net stations are indicated by E, T, and G respectively.

APPENDIX C



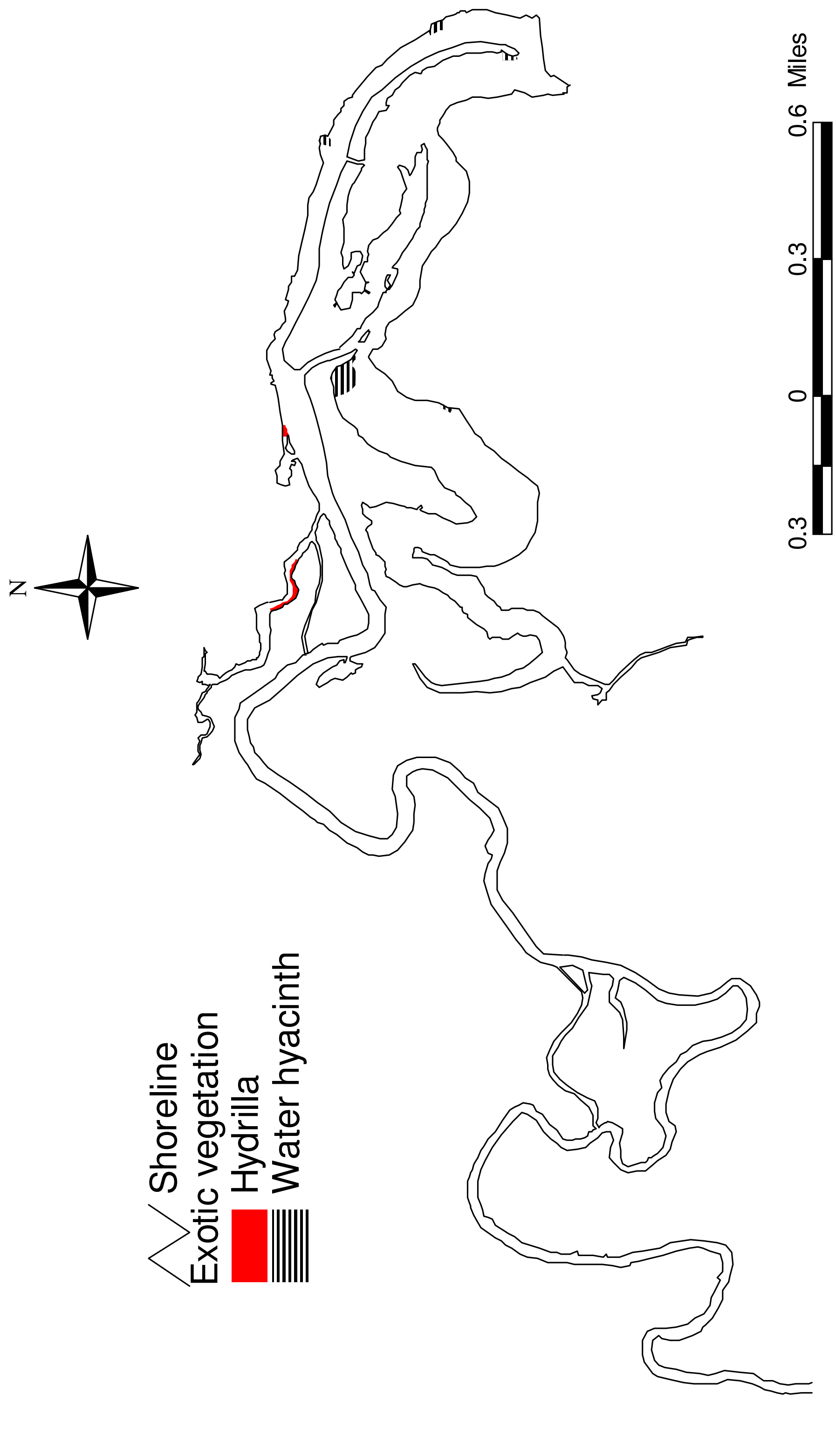
Native aquatic vegetation map for H-4 Reservoir, Texas, 2011.

APPENDIX D



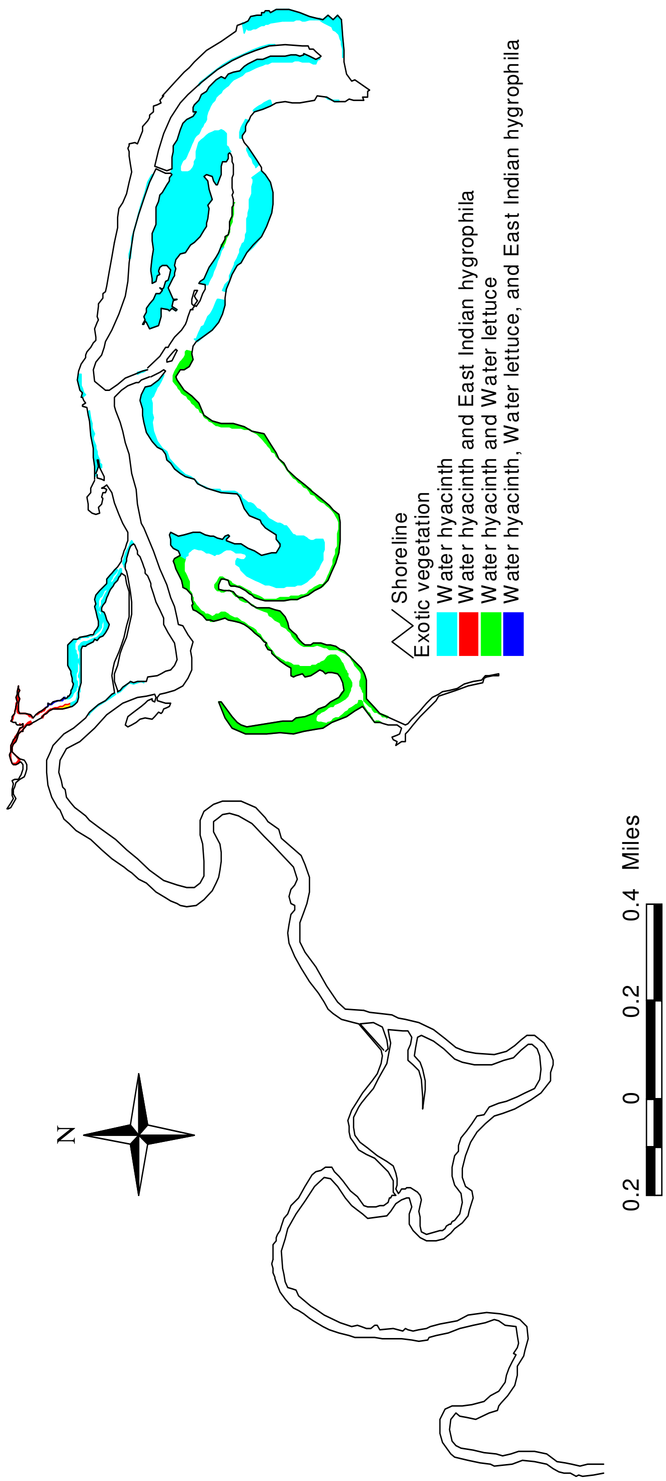
Native aquatic vegetation map for H-4 Reservoir, Texas, 2007.

APPENDIX E



Exotic vegetation map for H-4 Reservoir, Texas, 2011.

APPENDIX F



Exotic vegetation map for H-4 Reservoir, Texas, 2007.

APPENDIX G

Observed and predicted lengths-at-age from von Bertalanffy growth model, H-4 Reservoir, Texas, 2011. Growth model was generated with fish sampled from biologist selected sample sites.