

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

Lake Houston

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July 31, 2007

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Lake Houston were surveyed in 2006 using electrofishing and in 2007 using gill nets. Anglers were surveyed from June 2005 to May 2006 with a roving creel survey. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir description:** Lake Houston is a 12,240-acre reservoir constructed on the San Jacinto River by the City of Houston in 1954 to provide water for municipal and industrial purposes. Its location within the Houston metropolitan area results in heavy recreational use.
- **Management history:** All sport fisheries at Lake Houston are regulated under statewide length and bag limits. For a number of years palmetto bass were stocked annually, but it became evident that those stockings were ineffective at establishing a fishery, and the stockings were discontinued in 1999. Poor quality shallow-water habitat has impeded the expansion of many sport fish species, particularly largemouth bass. A combination of shoreline bulkhead construction and silt loading from improper sand and gravel mining techniques in the West Fork San Jacinto River have contributed to shallow-water habitat losses. Efforts to mitigate these losses have been unsuccessful to date.
- **Fish community**
 - **Prey species:** Gizzard and threadfin shad, bluegill, and longear sunfish are the predominant prey species in Lake Houston. Other less numerous prey fishes include bullhead minnow, blacktail shiner, inland silverside, warmouth, and redear sunfish.
 - **Catfishes:** Blue and channel catfish both occur in Lake Houston, but blue catfish are the dominant species. Catfish angling is an important segment of the Lake Houston fishery with 15% of all angling effort directed at catfish.
 - **White bass:** Gill net catches of white bass have declined in the past several years, but creel data indicates a significant level of white bass angler catch and harvest, despite a low level of directed angling pressure.
 - **Largemouth bass:** Electrofishing catch rates of largemouth bass have historically been low at Lake Houston. Degraded habitat due to silt loading and shoreline bulkheads limit the amount of available habitat for spawning and survival of juvenile bass. In spite of this, anglers seeking largemouth bass make up over 28% of all directed effort, and angler catches of largemouth bass account for approximately 7% of the total angler catch.
 - **Crappie:** Though both black and white crappie occur in Lake Houston, white crappie far outnumber black crappie, and crappie are the most sought after species in the fishery. No trap net survey was conducted in 2006, but previous surveys in 1998 and 2002 produced catches in excess of five fish/nn. Angler catch and harvest of crappie is very high at Lake Houston.
- **Management strategies:** Statewide length and bag limits will continue to be used to regulate sport fish harvest. Cooperative efforts with the City of Houston will continue to address water quality and habitat issues. Exotic vegetation will continue to be monitored and treated as needed. Efforts to address the sand and gravel dredging operations in the West Fork San Jacinto River will also continue with help from the City of Houston and other private interests.

INTRODUCTION

This document is a summary of fisheries data collected from Lake Houston 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 are presented with the 2006-2007 data for comparison.

Reservoir Description

Lake Houston is a 12,240-acre reservoir constructed on the San Jacinto River by the City of Houston in 1973 to provide water for municipal and industrial purposes. Its location within the Houston metropolitan area results in heavy recreational use. Lake Houston has a drainage area of approximately 2,600 square miles. Rainfall in the watershed averages 46.6 inches a year. Conservation pool elevation is 43.8 feet above mean sea level. Quarterly elevations are reported in Figure 1. The reservoir lies within the Piney Woods Vegetation Area and soil types are Aldine-Ozan/Nagatche-Voss-Kamen associations. Other physical characteristics of Lake Houston are presented in Table 1.

Management History

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

1. Lake Houston fisheries are marginal due to low productivity caused by excessive turbidity and littoral habitat degradation.
Action: TPWD is working with the City of Houston, the San Jacinto River Authority, private interests, and regulatory authorities to address sedimentation in the San Jacinto River and Lake Houston. A proposal is being prepared for a cooperative project between TPWD, The City of Houston, SJRA, Texas A&M University, the U.S. Army Corps of Engineers, and others to find solutions to the sedimentation problems at a watershed level. TPWD has distributed information concerning the sediment problems via the media including an article in the Texas Parks and Wildlife Magazine.
2. Crappie and catfish are the most abundant species for anglers at Lake Houston and should be promoted more aggressively.
Action: TPWD promoted these fisheries through media outlets highlighting positive information from creels and other management surveys.
3. The percentage of pure Florida largemouth bass was low in 2002 (12.8%). Florida largemouth bass have been stocked once, in 1990.
Action: A sample of age-1 largemouth bass was collected in spring of 2007 to estimate the genetic composition of the 2006 cohort.
4. Nuisance aquatic vegetation is abundant at Lake Houston periodically impeding access and navigation.
Action: TPWD continued support to SJRA and the City of Houston in their control of exotic vegetation.

Harvest regulation history: All sport fisheries are regulated under statewide length and bag limits (Table 2). Crappie have been managed under a 10-inch minimum length limit with a 25 fish bag since 1985. Channel and blue catfish were managed with a 9-inch minimum length limit and 25 fish bag until 1995 when the length limit was increased to 12 inches.

Stocking history: Soon after impoundment, channel catfish were stocked in Lake Houston. Beginning in 1979, palmetto bass were stocked over the next 20 years in 13 stockings that totaled 1.8 million fingerlings. No viable fishery was established and stockings were discontinued in 1999. Striped bass were also stocked in 1989 and 1990. Florida largemouth bass were stocked once in 1990. A complete stocking history is presented in Table 3.

Vegetation/habitat history: Lake Houston has very limited littoral habitat. Heavy silt loading in the upper reaches of the reservoir inhibits the growth of desirable aquatic vegetation. Considerable real estate development and bulkheading around the reservoir shoreline greatly diminishes quality littoral fish habitat.

Most of the Lake Houston shoreline is nondescript with areas of overhanging brush (Table 4). Bulkhead occurs along approximately 21 miles of shoreline, being most prevalent in the lower half of the reservoir.

Water hyacinth, water lettuce, and common salvinia are present in trace amounts. An infestation of Asian marshweed emerged in 2002, but was not noted in the 2006 survey. The City of Houston contracts out all of the vegetation control on Lake Houston on a monthly basis.

METHODS

Fishes were collected by electrofishing (2 hours at 24 5-min stations) and gill netting (15 net nights at 15 stations). Time constraints, due to ongoing intensive hydrilla surveys on Lake Conroe, necessitated the postponement of the trap net survey in 2006. 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 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).

A roving creel survey was conducted from June 2005 through May 2006. A total of 36 days were surveyed during the creel year, with the entire lake treated as one section. During the summer quarter (June through August 2005), the lake was sampled for four hours during each creel day chosen from four possible time periods. The time period and creel day were shortened during the remaining three quarters to account for the shorter day length. During these quarters, the lake was surveyed for three hours chosen from three possible time periods.

Sampling statistics (CPUE for various length categories), structural indices [Proportional Stock Density (PSD), Relative Stock Density (RSD)], and condition indices [relative weight (W_r)] were calculated for target fishes according to Anderson and Neumann (1996). Index of vulnerability (IOV) was calculated for gizzard shad (DiCenzo et al. 1996). Relative standard error ($RSE = 100 \times SE \text{ of the estimate/estimate}$) was calculated for all CPUE statistics and for creel statistics and SE was calculated for structural indices and IOV. Source for water level data was the United States Geological Survey (USGS).

RESULTS AND DISCUSSION

Habitat: A net increase of 1.5 miles of shoreline bulkhead was noted in 2006 in areas previously noted as nondescript. No native vegetation was noted in the 2006 survey, whereas previously, the only native vegetation was flooded terrestrial plants. Alligatorweed noted in 2002 was not seen in 2006, and the waterhyacinth and water lettuce observed in 2002 has been reduced to trace amounts in 2006. The Asian marshweed present in 2002 was not seen in 2006; however, a new infestation of common salvinia was noted in 2006, but was only present in trace amounts (Table 4).

Creel: Total angler effort declined from 120,655 angler-hours in 2002 to 61,003 angler-hours in 2005/2006. Anglers spent an estimated \$247,884 in 2002/2003 compared to \$175,844 in 2005/2006 (Table 6). The most sought after species in Lake Houston continues to be crappie. Anglers spent an estimated 15,900 hours seeking crappie (over 28% of total directed fishing effort), down from approximately 35,000 hours in 2002/2003 (44% of total directed effort). In 2005/2006, largemouth bass surpassed catfish as the second most popular sport fish. Directed effort for largemouth bass represented 28.5% of total directed effort; whereas, directed effort for catfish accounted for 15.0% of total directed effort, down from 26% in 2002. Directed effort for white bass was relatively low (1,900 angler-hours), yet

the angler catch rate was estimated to be 7.9/h, higher than for any other species (Table 5).

Prey species: Gizzard and threadfin shad, bluegill, and longear sunfish make up the majority of the available forage in Lake Houston. IOV for gizzard shad was 90.8, indicating plenty of fish available as prey. The total catch rates of both shad species was 289.5/h (368.5/h in 2002), for bluegill 117.5/h (107.0/h in 2002), and for longear sunfish 179.5/h (151.5/h in 2002). Other available prey species present included bullhead minnow, pugnose minnow, inland silverside, brook silverside, warmouth, and redear sunfish (Figures 2, 3, and 4).

Catfish: Both blue and channel catfish occur in Lake Houston, with blue catfish the dominant species. The gill net CPUE of blue catfish in 2007 was 11.7/nn, down from 34.3/nn in 2003 (Figure 5). Though the catch rate was lower, the sample size distribution was still optimal. PSD was 28 and RSD-12 was 100. Fish up to 31 inches in length were captured in gill nets. Gill net CPUE of channel catfish was 10.6/nn, up slightly from 7.5/nn in 2003 (Figure 7). The sample length frequency distribution indicated an excellent size distribution for channel catfish. PSD in 2007 was 17 and RSD-12 was 88. Body condition of both blue and channel catfish is good. Mean Wrs for blue catfish are ≥ 90 , and for channel catfish ≥ 85 in all inch groups.

Though more abundant, angler harvest of blue catfish was estimated to be 1,695 fish compared to the estimated 4,536 channel catfish harvested (Figures 6 and 8). This indicates that anglers are not targeting blue catfish, suggesting an under-exploited fisheries resource available to anglers. Blue catfish up to 28 inches in length and channel catfish to 18 inches were observed in angler creels during the 2005-2006 creel period (Tables 7 and 8).

Flathead catfish also occur in Lake Houston, but the data suggests that they are not an important sport fish. Gill net catches are low and no flathead catfish were observed in the creel survey during 2005/2006.

White bass: Gill net catch rates of white bass were very low in 2007 (0.2/nn) and have never been considered high (Figure 10). The total angling effort directed at white bass was low compared to other sport fish, but the angler catch rate was the highest at 7.94/h (Table 9). Anglers harvested an estimated 10,384 white bass during the 2005/2006 creel period. Forty-seven percent of all legal-sized fish (≥ 10 inches) caught were released, possibly indicating a significant number of anglers targeting white bass for sport only (Table 9). White bass up to 16 inches were observed during the 2005-2006 creel survey (Figure 11). Body condition of white bass is good with mean Wrs at or above 90 in most inch groups.

Largemouth bass: Electrofishing catches of largemouth bass at Lake Houston have never been high due to habitat degradation. The electrofishing CPUE in 2006 was 23.0/h, similar to previous years (Figure 12). Size structure is typical for populations under a 14-inch minimum length limit. Fish up to 17 inches in length were captured in the fall sample. Body condition of largemouth bass is good with mean Wrs at or about 90 in all inch groups. During the period from June 2005 through May 2006, anglers spent an estimated 12,877 hours seeking largemouth bass (Table 10). During that same period, anglers harvested an estimated 2,343 largemouth bass. Only 18.7% of legal-sized fish caught were released, much lower than in 2002-2003. Largemouth bass up to 20 inches were observed during the creel survey in 2005-2006 (Figure 13). No Florida genotypes were detected in the sub-sample from the 2006 year class and the Florida allele frequency was only 12.2%. Fifty-three percent of the sample were pure northern genotypes and the remainder were Florida x northern hybrids (Table 11).

Crappie: Both black and white crappie are present in Lake Houston, though white crappie are far more numerous (Webb and Henson 2003). No trap net survey was conducted in 2006. Anglers harvested an estimated 33,615 white crappie and 4,300 black crappie during the 2005-2006 creel period. Anglers released very few legal-sized fish (3.5% for white crappie, 0% for black crappie) indicating a highly harvest-oriented fishery (Table 12). Black crappie up to 13 inches and white crappie up to 17 inches were observed during the creel survey in 2005-2006 (Figure 15).

Fisheries management plan for Lake Houston, Texas

Prepared—July 2007.

ISSUE 1: The primary issue facing Lake Houston continues to be sedimentation caused largely by gravel dredging in the San Jacinto River and its tributaries upstream of the reservoir. The suspended and dissolved solids in the water column prevent primary productivity due to suppression of sunlight penetration leading to a decrease in rooted macrophytes and phytoplankton. The subsequent loss of productivity and habitat affects water quality and fish production.

MANAGEMENT STRATEGY

1. Continue to provide information to the City of Houston, other agencies, and the media concerning these issues.
2. Present a plan to the City of Houston stating possible solutions and cooperators to bring about those solutions.

ISSUE 2: Florida largemouth bass influence has been low in Lake Houston. Genetics analysis indicated no FLMB genotypes and only 12% FLMB allele frequency.

MANAGEMENT STRATEGY

1. Request stocking of Florida largemouth bass for Lake Houston in 2008 and 2009.
2. Continue to monitor largemouth bass population every four years with fall electrofishing survey.

ISSUE 3: Floating exotic aquatic vegetation (primarily waterhyacinth and water lettuce) continues to be a problem at Lake Houston.

MANAGEMENT STRATEGIES

1. Provide logistical support to the San Jacinto River Authority and the City of Houston regarding exotic vegetation treatment.
2. Conduct annual vegetation surveys.

SAMPLING SCHEDULE JUSTIFICATION:

Vegetation surveys are conducted annually at Lake Houston. Creel surveys, electrofishing surveys, trap netting, and gill netting are conducted once every four years to monitor trends in this fishery. If mitigation and watershed management plans are put in place to reduce sedimentation and improve water quality at Lake Houston, the sampling schedule will be re-evaluated.

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- 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.
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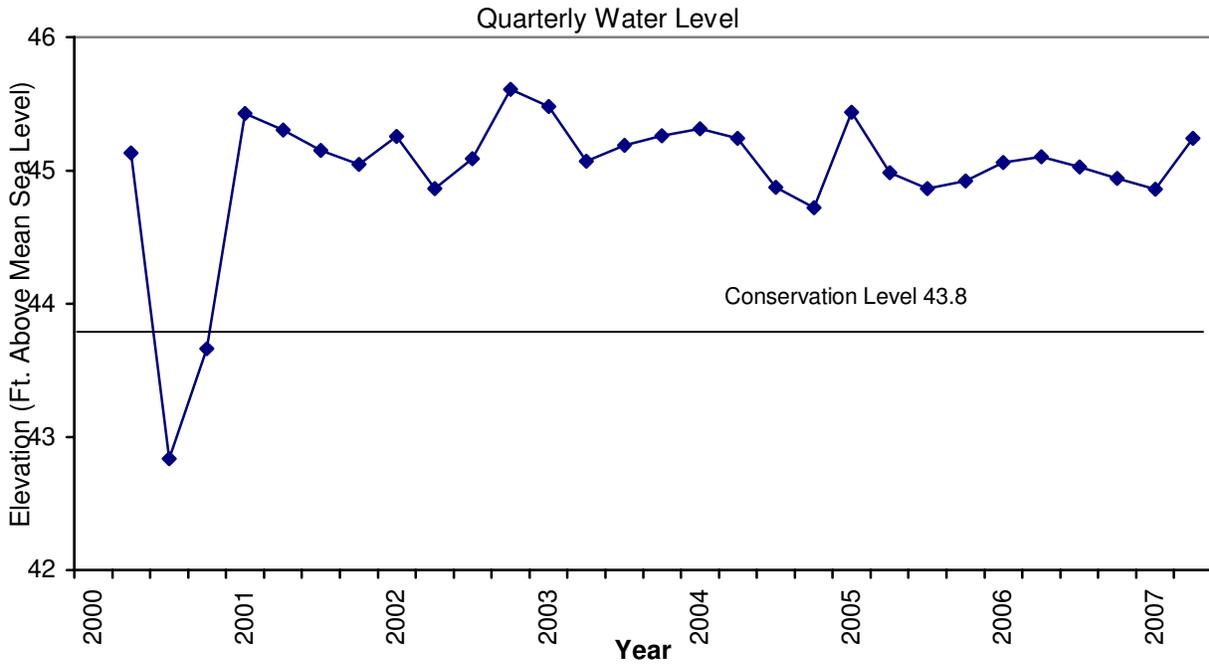


Figure 1. Quarterly water level elevations in feet above mean sea level (MSL) recorded for Lake Houston, Texas, 2000-2007.

Table 1. Characteristics of Lake Houston, Texas.

Characteristic	Description
Year constructed	1973
Controlling authority	City of Houston
County	Harris (location of dam)
Reservoir type	Main stream
Shoreline Development Index (SDI)	10.1
Conductivity	310 umhos/cm

Table 2. Harvest regulations for Lake Houston.

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, 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 Houston, Texas. Size Category is FGL = 1-3 inches.

Species	Year	Number	Size
Channel catfish	1972	132,724	FGL
	1973	35,000	FGL
	Total	167,724	
Striped bass	1989	246,000	FGL
	1990	122,879	FGL
	Total	368,879	
Palmetto bass	1979	123,200	FGL
	1981	135,638	FGL
	1983	122,459	FGL
	1984	362,450	FGL
	1986	361,015	FGL
	1991	134,600	FGL
	1992	103,180	FGL
	1994	62,000	FGL
	1995	187,650	FGL
	1996	122,416	FGL
	1997	61,351	FGL
	1998	63,236	FGL
Total	1,839,195		
Florida largemouth bass	1990	306,965	FGL
	Total	306,965	

Table 4. Survey of littoral zone and physical habitat types, Lake Houston, Texas, 2006. A linear shoreline distance (miles) was recorded for each habitat type found. Surface area (acres) and percent of reservoir surface area were determined for each type of aquatic vegetation found.

Shoreline habitat type	Shoreline Distance		Surface Area	
	Miles	Percent of total	Acres	Percent of reservoir surface area
Overhanging brush	4.87	3.2		
Eroded bank	2.88	1.9		
Indescript	1.41	0.9		
Rip rap	1.33	0.8		
Bulkhead	20.70	13.9		
Concrete	1.56	1.0		
Nondescript/overhanging brush	110.39	74.5		
Nondescript/eroded bank	5.03	3.3		
Floating waterhyacinth			trace	<0.1
Waterlettuce			trace	<0.1
Common salvinia			trace	<0.1

Table 5. Percent directed angler effort by species for Lake Houston, Texas, 2002-2003 and 2005-2006.

Species	Year	
	2002/2003	2005/2006
Catfishes	26.2	15.0
White bass	1.8	4.2
Sunfishes		0.6
Largemouth bass	22.5	28.5
Crappies	44.4	35.3
Anything		16.3

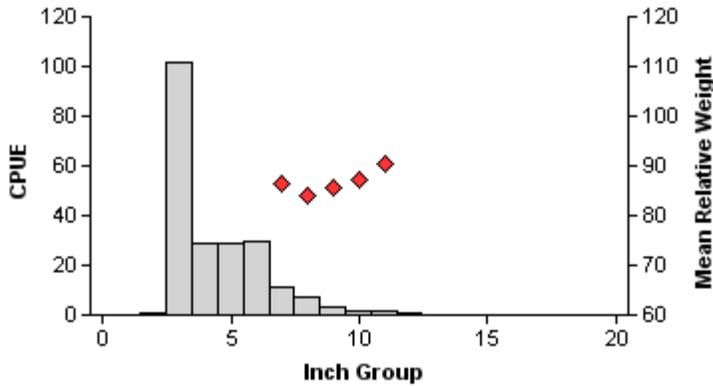
Table 6. Total fishing effort (h) for all species and total directed expenditures at Lake Houston, Texas, 2002-2003 and 2005-2006.

Creel Statistic	Year	
	2002/2003	2005/2006
Total fishing effort	120,655	61,003
Total directed expenditures	\$247,884	\$175,844

Gizzard Shad

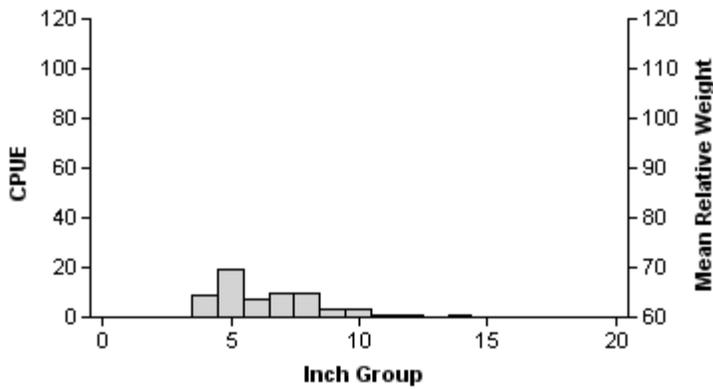
1998

Effort = 2.0
 Total CPUE = 216.0 (21; 432)
 PSD = 10 (5.7)
 IOV = 93.29 (2.5)



2002

Effort = 2.0
 Total CPUE = 64.5 (20; 129)
 PSD = 9 (4.2)
 IOV = 70.54 (7.4)



2006

Effort = 2.0
 Total CPUE = 174.5 (28; 349)
 PSD = 12 (5.8)
 IOV = 90.83 (3.2)

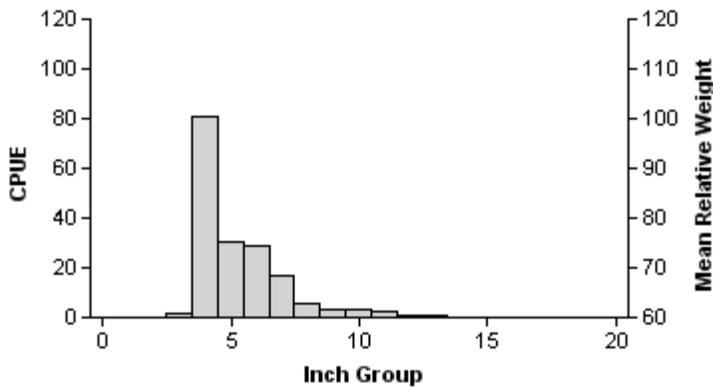
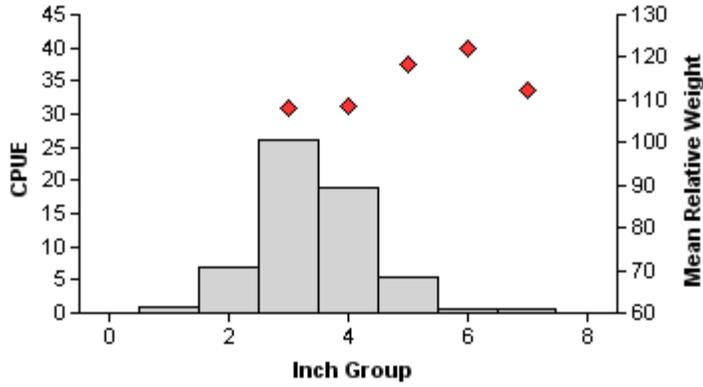


Figure 2. Number of gizzard shad caught per hour (CPUE), mean relative weight (W_r , diamonds), and population indices (RSE and N for CPUE and SE for size structure and IOV are in parentheses) for fall electrofishing surveys, Lake Houston, Texas, 1998, 2002, and 2006. Relative weight was not recorded for 2002 and 2006.

Bluegill

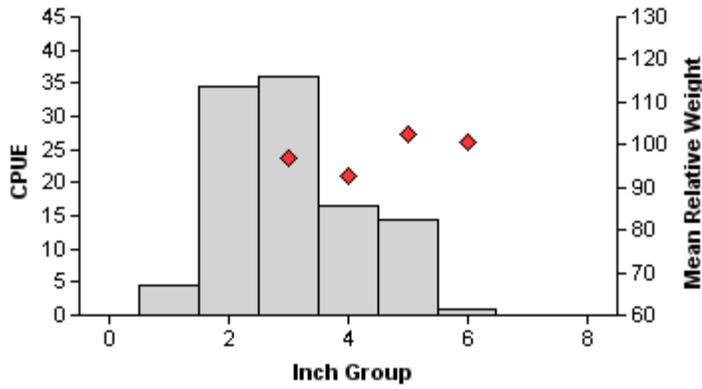
1998

Effort = 2.0
 Total CPUE = 59.5 (27; 119)
 PSD = 2 (1.4)



2002

Effort = 2.0
 Total CPUE = 107.0 (22; 214)
 PSD = 1 (1.0)



2006

Effort = 2.0
 Total CPUE = 117.5 (27; 235)
 PSD = 3 (1.5)

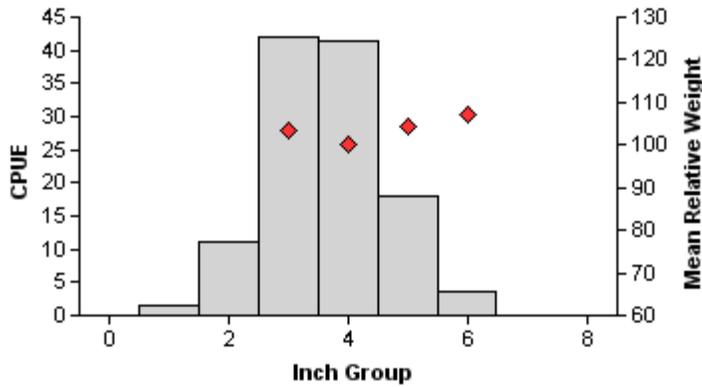
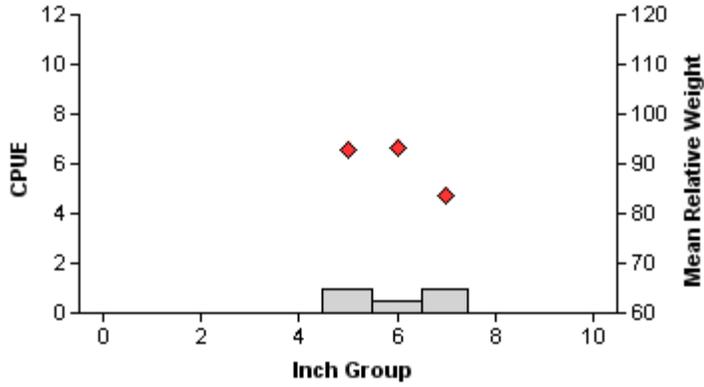


Figure 3. Number of bluegill caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Houston, Texas, 1998, 2002, and 2006.

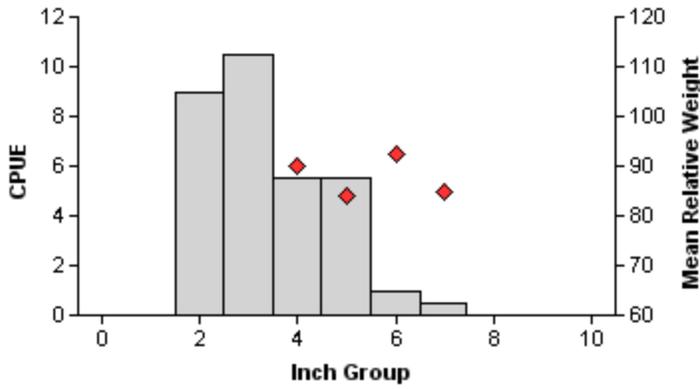
Redear Sunfish 1998

Effort = 2.0
 Total CPUE = 2.5 (50; 5)
 PSD = 40 (17.3)



2002

Effort = 2.0
 Total CPUE = 32.0 (83; 64)
 PSD = 4 (4.7)



2006

Effort = 2.0
 Total CPUE = 4.0 (47; 8)
 PSD = 12 (9.1)

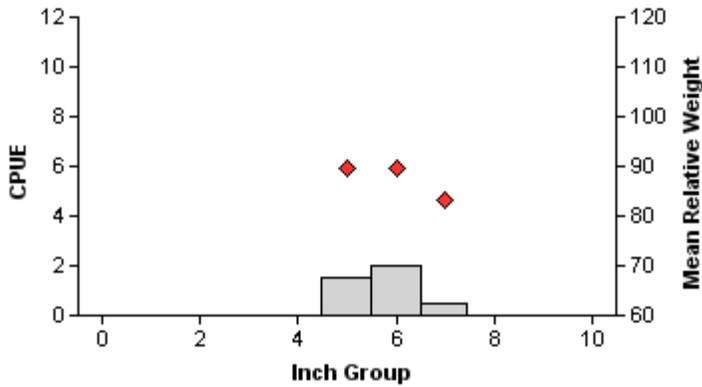
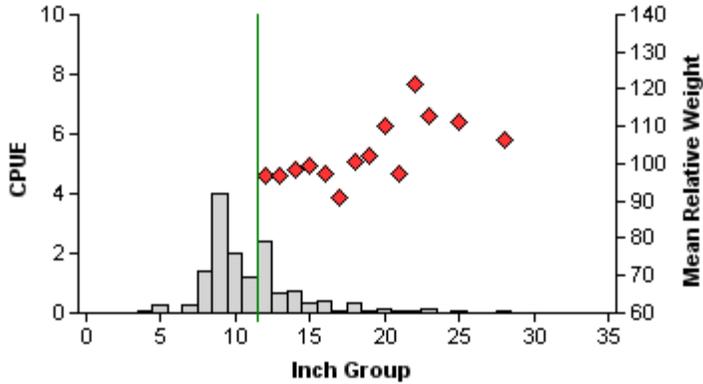


Figure 4. Number of redear sunfish caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Houston, Texas, 1998, 2002, and 2006.

Blue Catfish

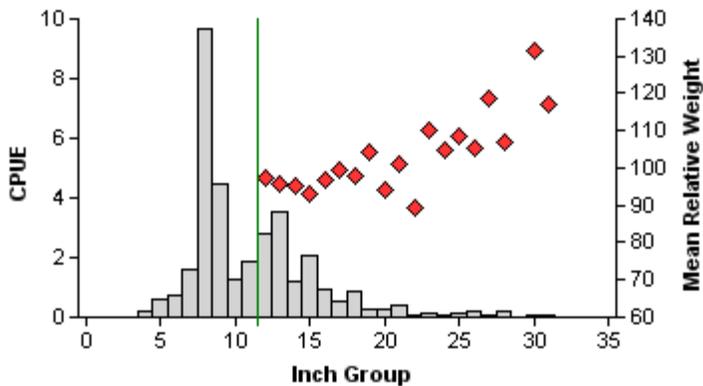
1998

Effort = 14.0
 Total CPUE = 14.9 (23; 209)
 PSD = 10 (2.9)
 RSD-12 = 100 (0)



2003

Effort = 15.0
 Total CPUE = 34.3 (17; 514)
 PSD = 12 (2.7)
 RSD-12 = 100 (0)



2007

Effort = 15.0
 Total CPUE = 11.7 (11; 176)
 PSD = 28 (5.5)
 RSD-12 = 100 (0)

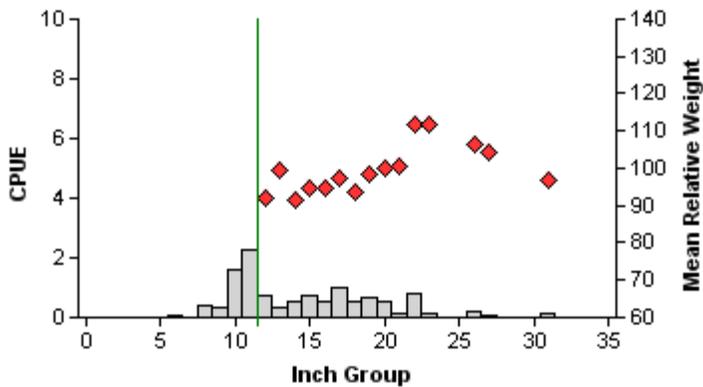


Figure 5. Number of blue catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Houston, Texas, 1998, 2003, and 2007. Vertical line is minimum length limit at time of survey.

Blue Catfish

Table 7. Creel survey statistics for blue catfish at Lake Houston from June 2002 through May 2003 and June 2005 through May 2006, where total catch per hour is for anglers targeting catfish (species combined) and total harvest is the estimated number of blue catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year	
	2002/2003	2005/2006
Directed effort (h)	20,283 (15)	6,785 (26)
Directed effort/acre	1.66 (15)	0.55 (26)
Total catch per hour	0.58 (39)	0.82 (28)
Total harvest	1,958 (132)	1,695 (58)
Harvest/acre	0.16 (132)	0.14 (58)
Percent legal released	0	3.0

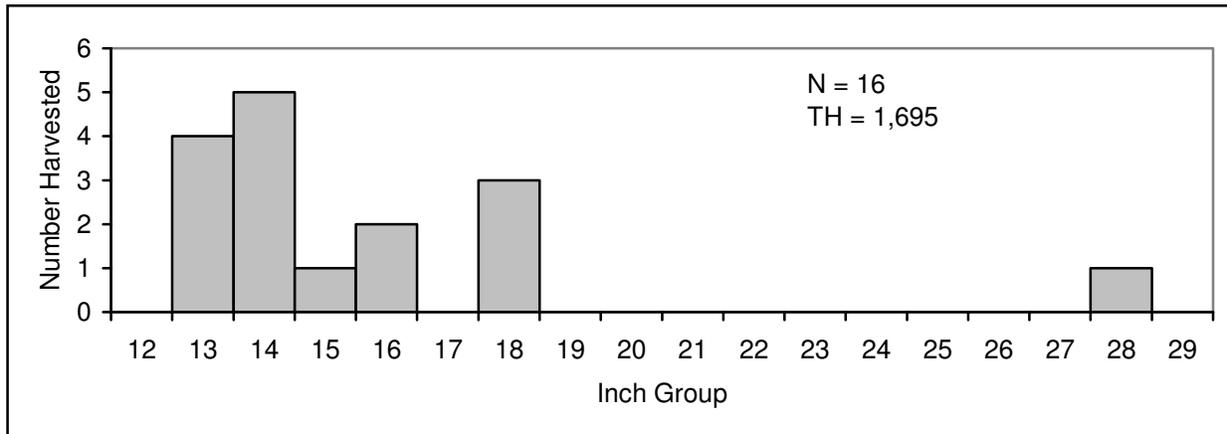


Figure 6. Length frequency of harvested blue catfish observed during creel surveys at Lake Houston, Texas, June 2005 through May 2006, all anglers combined. N is the number of harvested blue catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

Channel Catfish

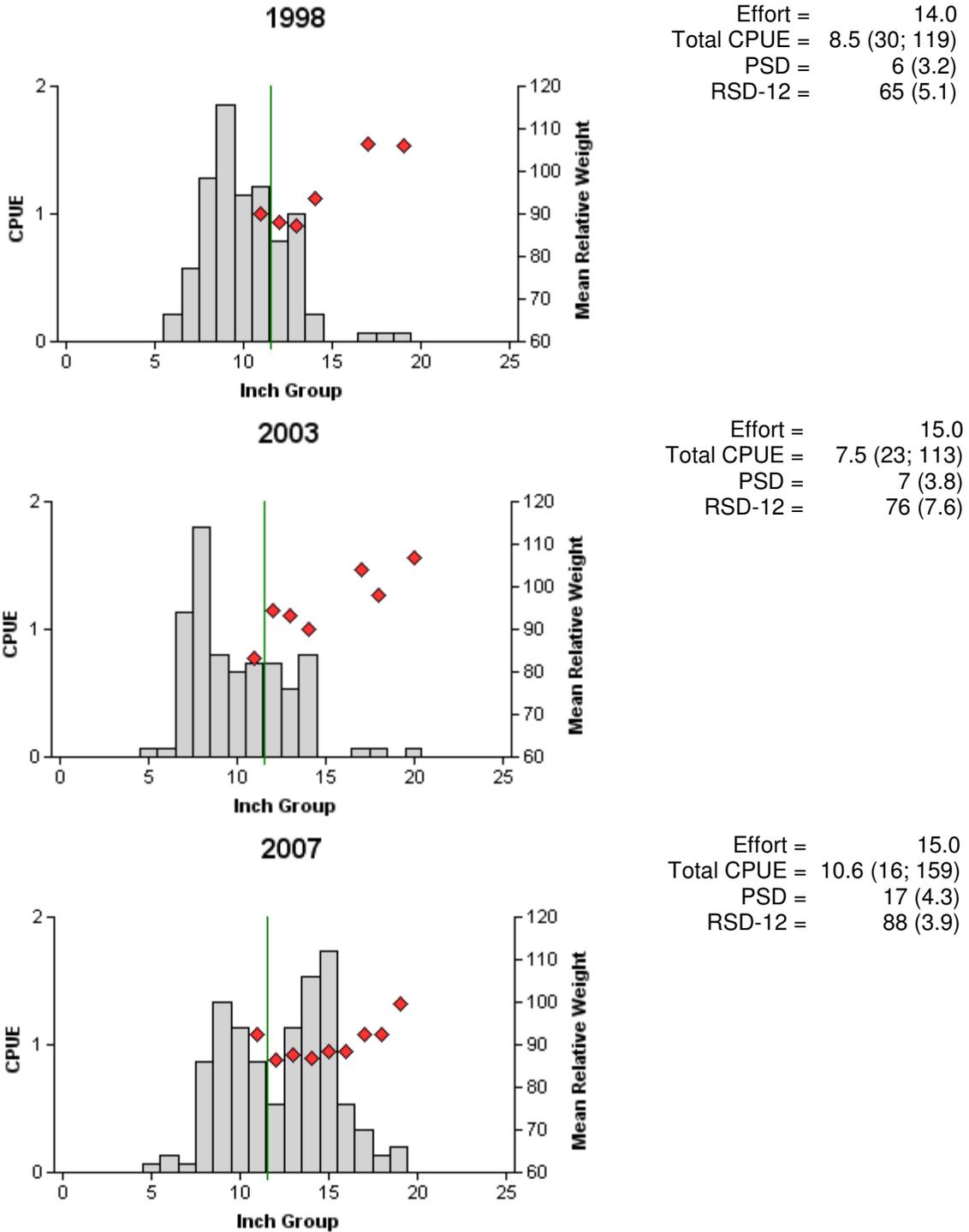


Figure 7. Number of channel catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Houston, Texas, 1998, 2003, and 2007. Vertical line is minimum length limit at time of survey.

Channel Catfish

Table 8. Creel survey statistics for channel catfish at Lake Houston from June 2002 through May 2003 and June 2005 through May 2006 where total catch per hour is for anglers targeting catfish (species combined) and total harvest is the estimated number of channel catfish harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year	
	2002/2003	2005/2006
Directed effort (h)	20,283 (15)	6,786 (26)
Directed effort/acre	1.66 (15)	0.55 (26)
Total catch per hour	0.58 (39)	0.82 (26)
Total harvest	1,070 (321)	4,536 (68)
Harvest/acre	0.09 (321)	0.37 (68)
Percent legal released	47.3	4.2

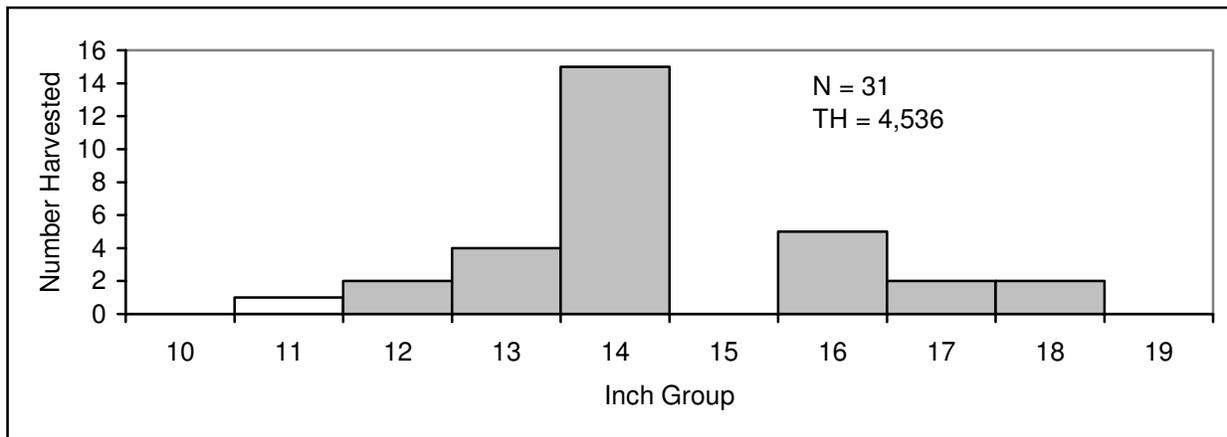


Figure 8. Length frequency of harvested channel catfish observed during creel surveys at Lake Houston, Texas, June 2005 through May 2006, all anglers combined. N is the number of harvested channel catfish observed during creel surveys, and TH is the total estimated harvest for the creel period.

Flathead Catfish

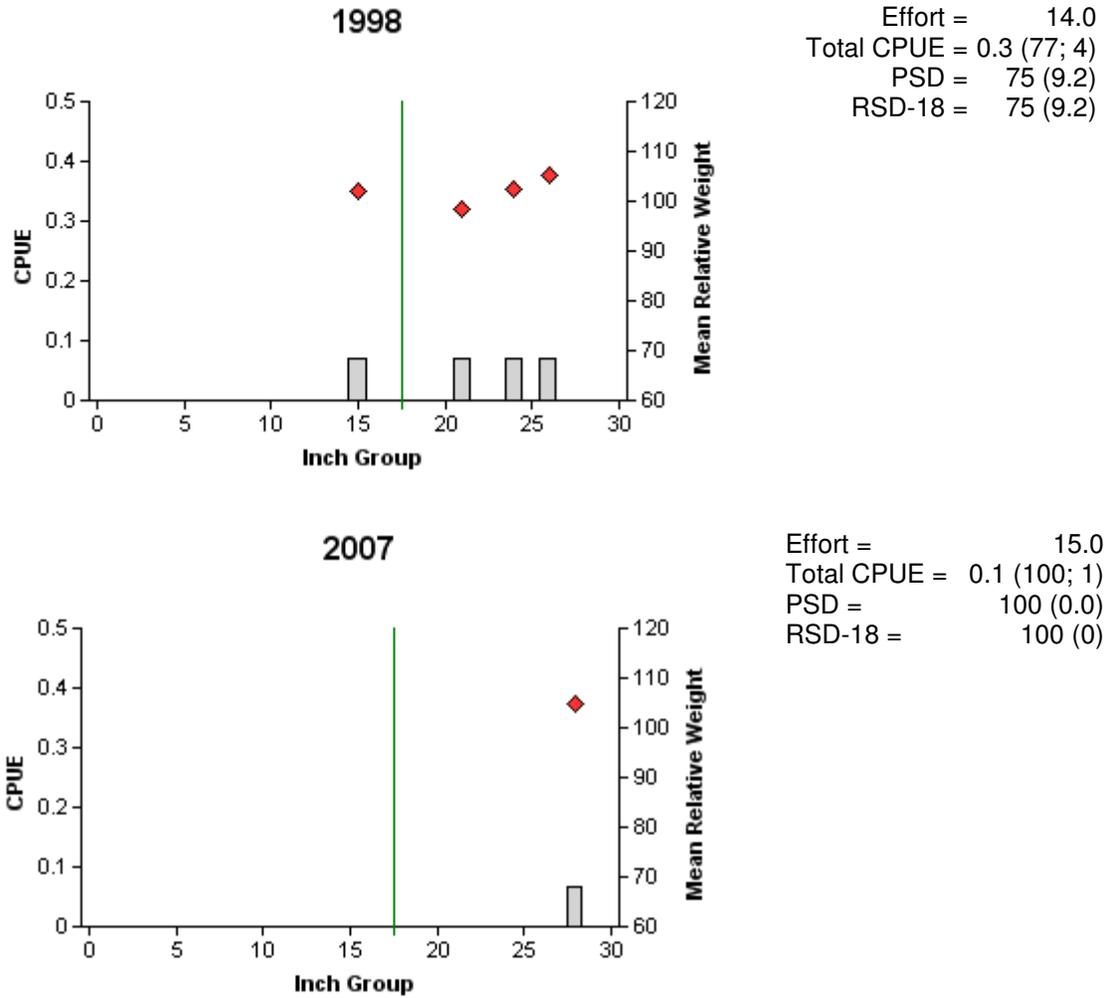
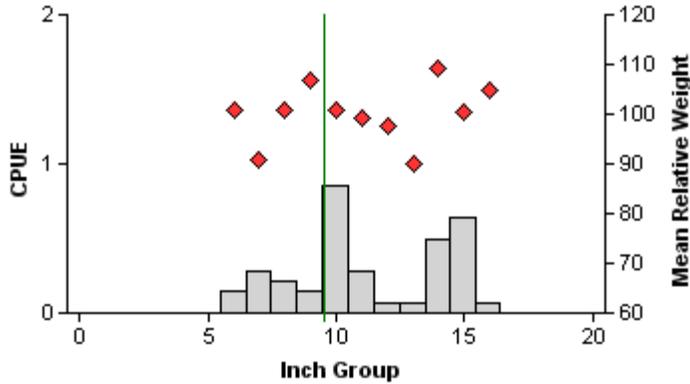


Figure 9. Number of flathead catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Lake Houston, Texas, 1998 and 2007. No flathead catfish were captured in the 2003 survey. Vertical line represents minimum length limit at time of survey.

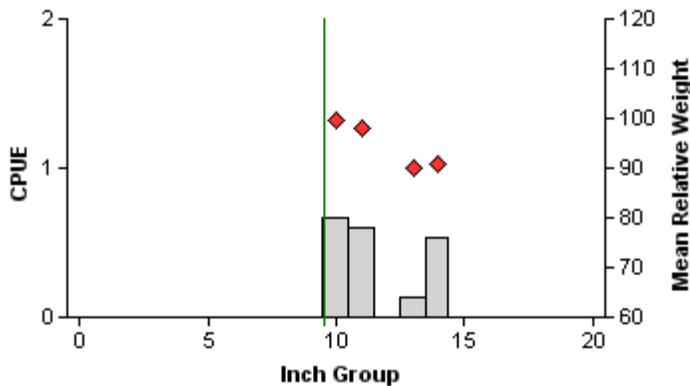
White Bass

1998



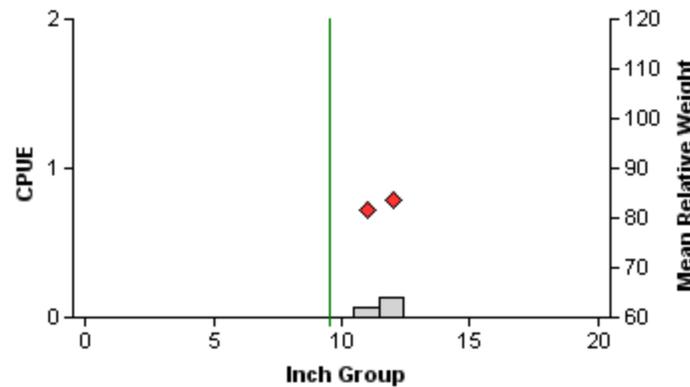
Effort = 14.0
 Total CPUE = 3.3 (60; 46)
 PSD = 80 (3)
 RSD-10 = 76 (1.8)

2003



Effort = 15.0
 Total CPUE = 1.9 (67; 29)
 PSD = 100 (0.0)
 RSD-10 = 100 (0)

2007



Effort = 15.0
 Total CPUE = 0.2 (53; 3)
 PSD = 100 (0)
 RSD-10 = 100 (0)

Figure 10. 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 Houston, Texas, 1998, 2003, and 2007. Vertical line represents minimum length limit at time of survey.

White Bass

Table 9. Creel survey statistics for white bass at Lake Houston from June 2002 through May 2003 and June 2005 through May 2006 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	Year	
	2002/2003	2005/2006
Directed effort (h)	429 (117)	1,911 (46)
Directed effort/acre	0.03 (117)	0.16 (46)
Total catch per hour	5.71 (13)	7.94 (71)
Total harvest	4,948 (71)	10,384 (76)
Harvest/acre	0.40 (71)	0.85 (76)
Percent legal released	0	47.0

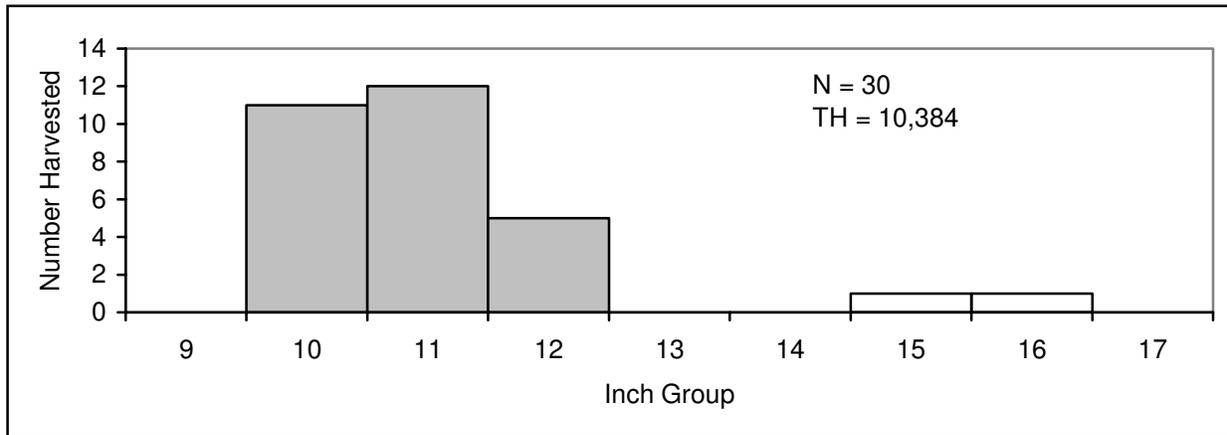


Figure 11. Length frequency of harvested white bass observed during creel surveys at Lake Houston, Texas, June 2005 through May 2006, all anglers combined. N is the number of harvested white bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

Largemouth Bass

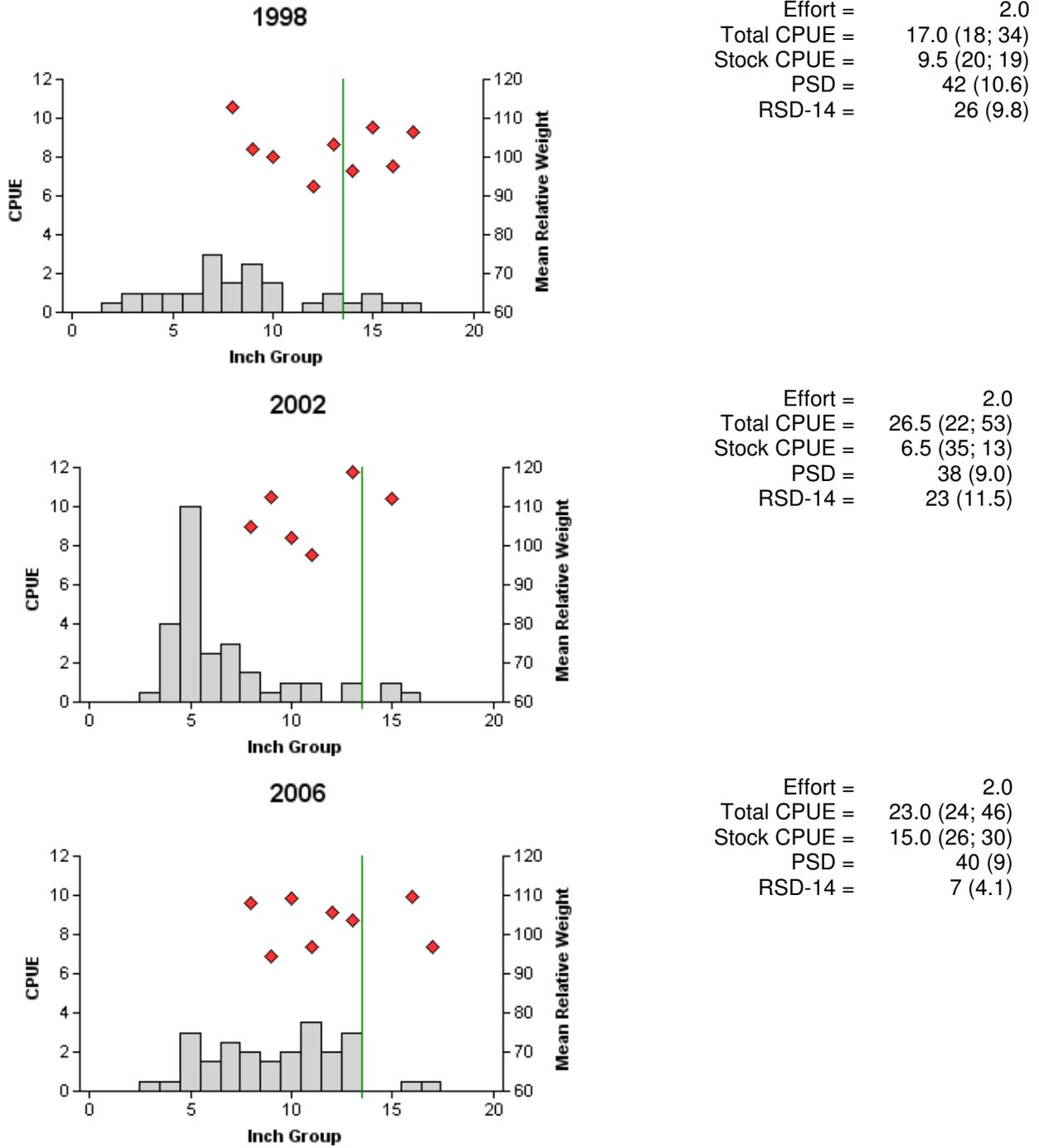


Figure 12. Number of largemouth bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Lake Houston, Texas, 1998, 2002, and 2006. Vertical line represents minimum length limit at time of survey.

Largemouth Bass

Table 10. Creel survey statistics for largemouth bass at Lake Houston from June 2002 through May 2003 and June 2005 through May 2006 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	Year	
	2002/2003	2005/2006
Directed effort (h)	17715 (19)	12,877 (19)
Directed effort/acre	1.44 (19)	1.05 (19)
Total catch per hour	0.58 (25)	0.33 (29)
Total harvest	2,466 (78.3)	2,343 (67)
Harvest/acre	0.20 (78.3)	0.19 (67)
Percent legal released	34.0	18.7

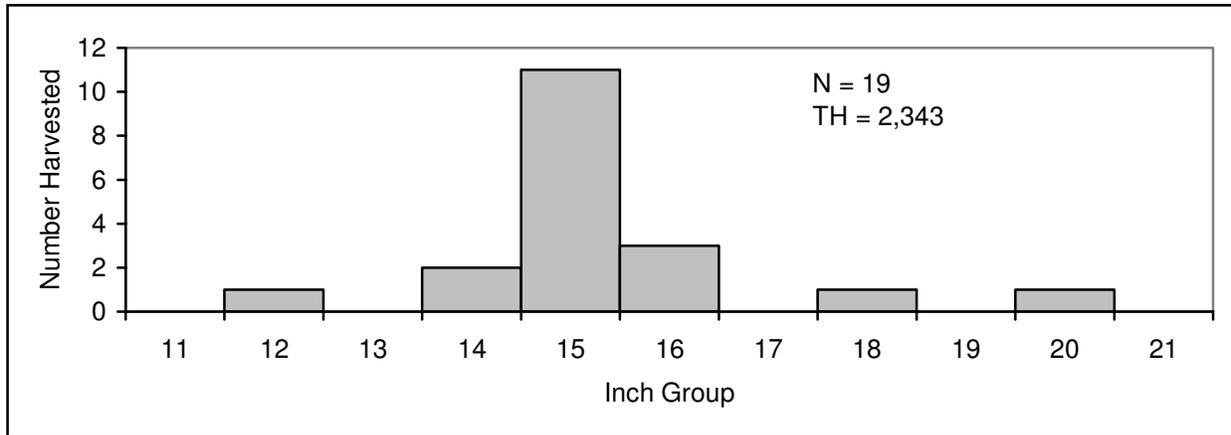


Figure 13. Length frequency of harvested largemouth bass observed during creel surveys at Lake Houston, Texas, June 2005 through May 2006, all anglers combined. N is the number of harvested largemouth bass observed during creel surveys, and TH is the total estimated harvest for the creel period.

Table 11. Results of genetic analysis of largemouth bass collected by fall electrofishing, Lake Houston, Texas, 1992, 1993, 1995, 1998, 2002, and 2006, and spring electrofishing in 2007. FLMB = Florida largemouth bass, NLMB = Northern largemouth bass, F1 = first generation hybrid between a FLMB and a NLMB, Fx = second or higher generation hybrid between a FLMB and an NLMB.

Year	Sample size	Genotype				% FLMB alleles	% pure FLMB
		FLMB	F1	Fx	NLMB		
1992	9	0	0	0	9	0.0	0.0
1993	31	0	1	5	25	0.0	0.0
1995	28	0	0	6	22	0.0	0.0
1998	15	3	1	4	7	46.6	20.0
2002	39	5	4	16	14	35.8	12.8
2007	33	0			17	12.2	0.0

Crappie

Table 12. Creel survey statistics for crappie at Lake Houston from June 2002 through May 2003 and June 2005 through May 2006 where total catch per hour is for anglers targeting crappie (species combined) and total harvest is the estimated number of black and white crappie harvested by all anglers. Relative standard errors (RSE) are in parentheses.

Creel Survey Statistic	Year	
	2002/2003	2005/2006
Directed effort (h)	34,376 (14)	15,933 (20)
Directed effort/acre	2.81 (14)	1.30 (20)
Total catch per hour	1.22 (21)	1.71 (42)
Total white crappie harvested	3,489 (114)	33,615 (63)
White crappie harvest/acre	0.29 (114)	2.75 (63)
Percent legal white crappie released	3.8	3.5
Total black crappie harvested		4,320.00 (102)
Black crappie harvest/acre		0.35 (102)
Percent legal black crappie released		0

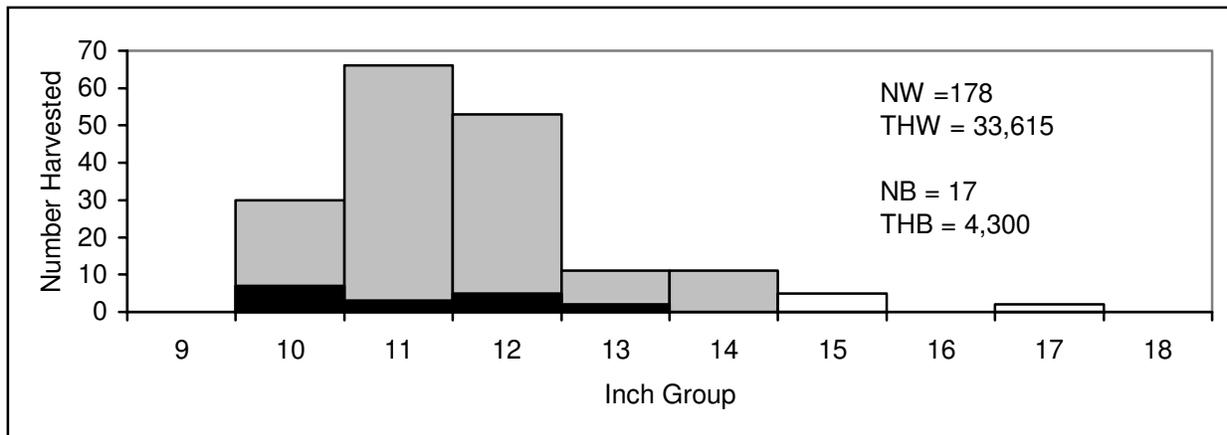


Figure 15. Length frequency of harvested black crappie (black bars) and white crappie (gray bars) observed during creel surveys at Lake Houston, Texas, June 2005 through May 2006, all anglers combined. NB and NW are the number of harvested black and white crappie, respectively, observed during creel surveys, and THB and THW are the total estimated harvest of black and white crappie, respectively, for the creel period.

Table 13. Proposed sampling schedule for Lake Houston, 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.

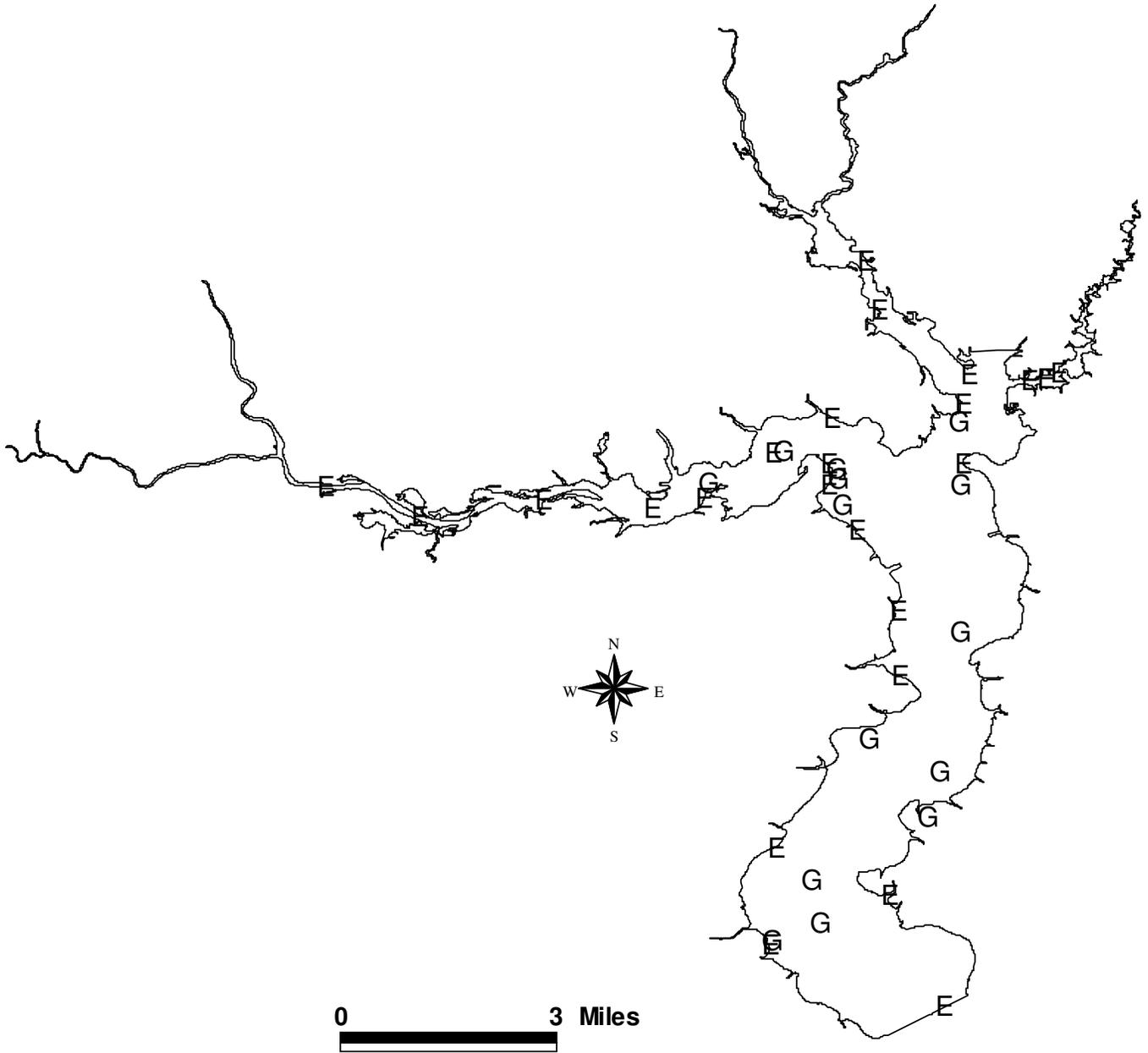
Survey Year	Electrofisher	Trap Net	Gill Net	Creel Survey	Vegetation/Habitat	Report
Fall 2007-Spring 2008					A	
Fall 2008-Spring 2009					A	
Fall 2009-Spring 2010					A	
Fall 2010-Spring 2011	S	A	S	A	S	S

APPENDIX A

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

Species	Electrofishing		Gill Netting	
	N	CPUE	N	CPUE
Gizzard shad	349	174.5		
Threadfin shad	230	115.0		
Bullhead minnow	4	1.0		
Pugnose minnow	2	0.5		
Inland silverside	2	0.5		
Brook silverside	3	1.5		
Blue catfish			176	11.7
Channel catfish			159	10.6
Flathead catfish			1	0.1
White bass			3	0.2
Warmouth	10	5.0		
Bluegill	235	117.5		
Longear sunfish	359	179.5		
Redear sunfish	8	4.0		
Largemouth bass	46	23.0		
White crappie	30	15.0	3	0.2
Black crappie	6	3.0		
Blue tilapia	19	9.5		

APPENDIX B



Location of sampling sites, Lake Houston, Texas, 2006-2007. G and E indicate gill net and electrofishing stations, respectively. No trap net survey was conducted in 2006.