PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

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FEDERAL AID PROJECT F-30-R-30

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2005 Survey Report

Inks Reservoir

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Inks Reservoir were surveyed in 2005 using electrofishing and in 2006 using gill nets. This report summarizes the results of the surveys and contains a fisheries management plan for the reservoir based on those findings.

- **Reservoir Description:** Inks Reservoir is a 768-acre impoundment of the Colorado River. It was constructed in 1938 by the Lower Colorado River Authority (LCRA) for purposes of hydroelectric power, recreation and water supply. The reservoir lies within the Edwards Plateau eco-region, and its shoreline length is 20.5 miles. Inks Lake State Park borders the reservoir and provides access to approximately 30 percent of the shoreline. A significant portion of the shoreline has been developed by private property owners or is under control by the LCRA.

- **Management History:** Important sport fish include white bass, striped bass, largemouth bass, and catfish species. The management plans for 2001 and 1996 were to continue monitoring populations under existing regulations. The Florida subspecies of largemouth bass was stocked in the reservoir in the late 80s and early 90s to increase Florida largemouth bass genetic influence in the population. Adult channel catfish have been stocked on when available by the Inks Dam National Fish Hatchery through an agreement with the LCRA. White bass were managed under a 12-inch minimum length limit. The regulation was rescinded in September 2004 after an analysis indicated environmental factors, not angler harvest, were probably more influential in determining white bass population density.

- **Fish Community**
  - **Prey species:** Gizzard shad, threadfin shad, bluegill, and redbreast sunfish were the predominant sources of forage. Threadfin shad were more abundant in this survey than previously recorded.

  - **Catfishes:** Channel catfish were present in low – moderate density. Blue catfish and flathead catfish were also present in the reservoir, but provide only a marginal fishery.

  - **Temperate basses:** White bass presence was good. Striped bass were present in low densities. Emigration from Lake Buchanan through water releases is probably maintaining the striped bass presence in Inks Reservoir.

  - **Black basses:** Presence of largemouth bass was moderate. Twenty-two percent of adults in the 2005 sample were greater than or equal to 14 inches. Largemouth bass growth continued to improve in 2005. Inks Reservoir also contains Guadalupe bass, which are slow growing.

  - **Management Strategies**

  The reservoir should continue to be managed with existing fishing regulations. The largemouth bass and sunfish fisheries should be promoted. Furthermore, fish attractors should be installed at the state park fishing piers to increase catch rates for pier anglers. Conduct general monitoring with gill nets and electrofishing surveys in 2009 – 2010. Conduct aquatic vegetation survey in 2009.

INTRODUCTION

This document is a summary of fisheries data collected from Inks Reservoir in 2005 and 2006. The purpose of the document is to provide fisheries information and make fisheries 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 species and important prey species. Fisheries management strategies are included to address existing problems or opportunities. Historical data is presented with the 2005 and 2006 data for comparison.

Reservoir Description

Inks Reservoir is a 768-acre impoundment of the Colorado River. It was constructed in 1938 by the Lower Colorado River Authority (LCRA) for purposes of hydroelectric power, recreation, and water supply. The reservoir lies within the Edwards Plateau eco-region, and its shoreline length is 20.5 miles. Inks Lake State Park borders the reservoir and provides access to approximately 30 percent of the shoreline. A significant portion of the shoreline has been developed by private property owners or is under control by the LCRA. Habitat at the time of sampling consisted of boulder, bulkhead/boat docks, rock bank, rock bluff, sand, terrestrial grasses, and native emergent vegetation. Native aquatic emergent plants present were bulrush, cattail, and water willow, occupying 6.09 acres (< 1% coverage). Inks is a stable level reservoir (Figure 1). Boat access consisted of one public boat ramp located at the state park. Public bank access was restricted to the shoreline and 2 fishing piers at the state park. Other descriptive characteristics for Inks Reservoir are in Table 1.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Tennant and Magnelia 2002) included:

1. Continue to manage fish populations with existing fishing regulations and survey schedule.
   Action: A four-year survey cycle was sufficient to monitor fish populations in this reservoir.
2. Promote the Inks Reservoir largemouth bass and sunfish fishery.
   Action: News releases were prepared and sent to media regarding these fisheries.

Harvest Regulation History: Sport fish in Inks Reservoir are currently managed with statewide regulations (Table 2). The white bass minimum length limit was reduced to 10 inches in September 2004 as analyses suggested that population densities were probably determined by environmental factors rather than angler harvest.

Stocking History: Inks Reservoir has not been stocked since 2000 (channel catfish). The Inks Dam National Fish Hatchery provided annual adult channel catfish stockings upon availability in an agreement with LRCA from 1994 to 2000. Largemouth bass were introduced in 1966, and Florida largemouth bass in 1989 and 1991 to increase Florida largemouth bass genetic influence. Blue catfish were introduced in 1968. The complete stocking history is in Table 3.

Aquatic Vegetation/habitat history: Inks Reservoir had very low aquatic vegetation coverage (Table 4). Most of the shoreline habitat was comprised of rock, bulkhead, and terrestrial grasses. Three native species of aquatic emergent vegetation (cattail, water willow, and bulrush) accounted for only 6.09 acres (< 1% coverage). This coverage was similar to the 2001 survey. Inks Reservoir's water level is stable, therefore change in aquatic habitat tends to be minimal.

METHODS

Fishes were collected by electrofishing (1.0 hour at 12 stations) and gill 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 netting as the number of fish caught in one net set overnight (fish/nn). All survey sites were randomly selected and all surveys were conducted according to the Texas Parks and Wildlife Department Inland Fisheries Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2002). Trap netting for white crappie was not performed due to historically low catch rates and high cost/benefit ratio associated with collecting these data.

Sampling statistics (CPUE for various length categories) and structural indices [Proportional Stock Density (PSD), Relative Stock Density (RSD)], and condition indices [relative weights (Wr)] were calculated for target fishes according to Anderson and Neumann (1996). The Index of Vulnerability (IOV) was used to determine the percentage of gizzard shad vulnerable to predation (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. Ages were determined for LMB using otoliths from 13 fish between 330 and 381mm (category 2 age analysis for 14-inch LMB; TPWD Procedures Manual 2004). Largemouth bass electrophoresis samples were collected according to the Texas Parks and Wildlife Department Inland Fisheries Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2002).

RESULTS AND DISCUSSION

Habitat: Littoral zone habitat consisted primarily of rocks, bulkhead, and terrestrial grasses (Table 4).

Prey species: Electrofishing catch rates of gizzard shad**,** threadfin shad, bluegill, and redbreast sunfish were 226/hour, 127/hour, 114/hour, and 348/hour, respectively. Index of Vulnerability (IOV) for gizzard shad was poor, indicating that only 9.73% of gizzard shad were vulnerable to existing predators. This was lower than the IOV estimates from 2001 (Figure 2). Total CPUE of gizzard shad was considerably higher in 2005 compared to the 2001 survey (Figure 2). Total CPUE for threadfin shad was (127/h). Total CPUE of bluegill in 2005 was lower than total CPUE from surveys in 2001 and 1996, and size structure continued to be dominated by small individuals (Figure 3). Total CPUE of redbreast sunfish in 2005 was lower than total CPUE from surveys in 2001 and 1996, and size structure continued to show presence of quality-size individuals (≥ 7 inches), which are a large enough to support a sport fishery (Figure 4).

Channel catfish: The gill net catch rate of channel catfish was 3.2/nn in 2006. The channel catfish population continued to show low relative abundance, with most individuals within the 11- to 16-inch length range (Figure 5).

Blue catfish: The gill net catch rate of blue catfish was 1.4/nn in 2006. The blue catfish population continued to show low relative abundance, with a population structure dominated by fish larger than 15 inches. (Figure 6).

Flathead catfish: The gill net catch rate of flathead catfish was 0.8/nn in 2006. The flathead catfish population continued to show low relative abundance, with a population structure dominated by large individuals (Figure 7).

White bass: The gill net catch rate of white bass was 6.2/nn in 2006. Catch rates indicated that white bass had a strong presence, approaching the historical high catch rate established in the 1999 survey (Figure 8). Furthermore, all individuals sampled were of legal harvest size, and most of them were of preferred size (RSD-P = 97%). The appearance of memorable-size individuals in the sample in 2006 was also encouraging; all signs of a healthy white bass population.

Striped bass: The gill net catch rate of striped bass was 0.4/nn in 2006. The striped bass population continued to show low relative abundance (Figure 9). Individuals found in the reservoir have most likely emigrated from Lake Buchanan.

Largemouth bass: The electrofishing catch rate of stock-length largemouth bass was 27/h in 2005, lower than the 76/h in 2001. Size structure improved from previous surveys as PSD increased to 59% (Figure 10). Growth of largemouth bass in Inks Reservoir was good; average age at 14 inches of length was 2 years (N = 19; range = 1 – 2 years) (Figure 11). Body condition in 2005 was good (relative weights over 90) for nearly all size classes of fish, and was similar to body condition in previous surveys (Figure 10). Florida largemouth bass influence has remained relatively constant since 1999 as Florida alleles have ranged from 60.8% to 75.0%, and percentage of pure Florida bass has ranged from 13.8 to 23.3% (Table 5).

Fisheries management plan for Inks Reservoir, Texas

Prepared - July 2006.

ISSUE 1: Aquatic vegetation has historically been present in limited abundance. Reservoir habitat surveys have shown a lack of quality black bass habitat. Inks Reservoir is a constant level reservoir. Planting additional native aquatic vegetation may improve black bass habitat.

MANAGEMENT STRATEGY

1. If results from current native aquatic plant restoration projects in other Texas reservoirs are successful, plant native aquatic vegetation in areas of the reservoir where there is a high probability for success.

ISSUE 2: Good bank access for anglers is available within Inks State Park. Electrofishing and gill net surveys have shown availability of predators and quality-size (> 7 inches) sunfish. Attracting these species to specific fishing areas should improve angler catch rates.

MANAGEMENT STRATEGY

1. Enhance fishing opportunities for sunfish and largemouth bass along state park fishing piers by installing fish attracting devices (e.g. gravel beds).

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule will constitute mandatory sampling in 2009/2010 (Table 6). Mandatory sampling every 4 years has been sufficient to monitor fish populations at Inks Reservoir.

LITERATURE CITED

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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.

Tennant, M.A. and S.J. Magnelia. 2002. Statewide freshwater fisheries monitoring and management program survey report for Inks Reservoir, 2001. Texas Parks and Wildlife Department, Federal Aid Report F-30-R, Austin.

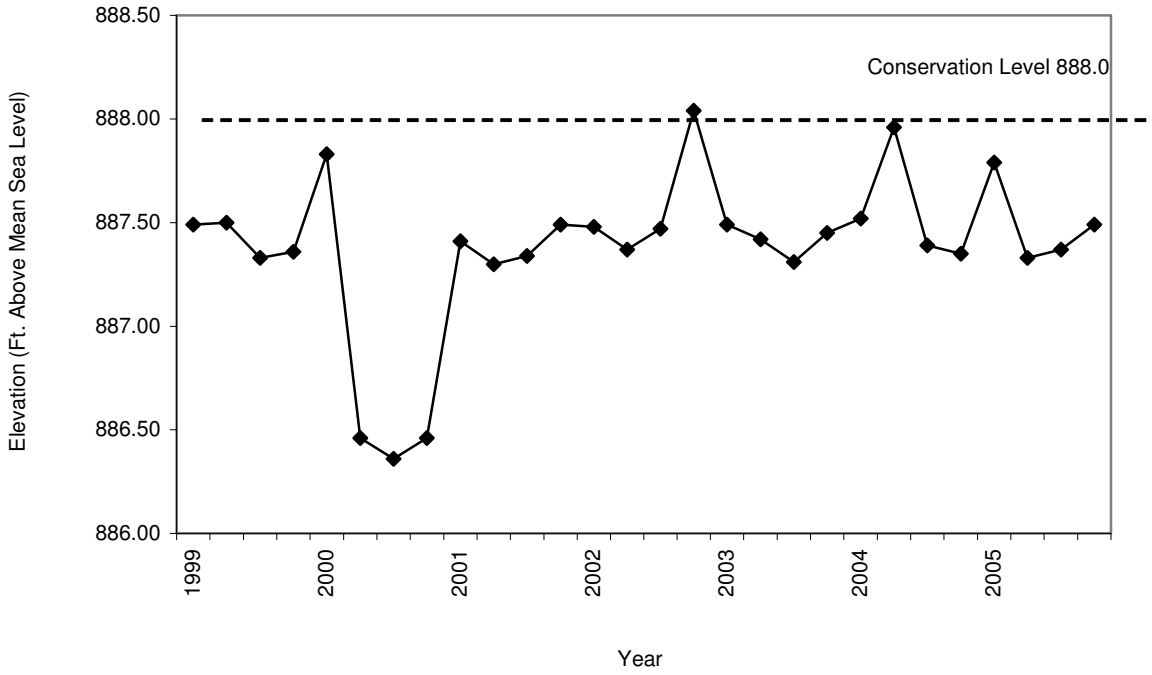


Figure 1. Mean quarterly water level elevations in feet above mean sea level (MSL) recorded for Inks Reservoir, Texas.

Table 1. Characteristics of Inks Reservoir, Texas

Characteristic	Description
Year constructed	1938
Controlling authority	LCRA
Counties	Burnet and Llano
Reservoir type	Mainstream river system: Colorado
Shoreline development index (SDI)	10.1
Conductivity	950 umhos/cm

Table 2. Harvest regulations for Inks Reservoir.

Species	Bag limit	Length limit (inches)
Bass: largemouth	5*	14 minimum
Bass: Guadalupe	5*	No minimum limit
Striped bass	5	18 minimum
White bass	25	10 minimum**
Flathead catfish	5	18 minimum
Catfish: channel and blue catfish	25 (in any combination)	12 minimum

*Five largemouth and Guadalupe bass in any combination.
**Changed from 12 to 10 inches on September 1, 2004.

Table 3. Stocking history of Inks Reservoir, Texas. Size categories are: FRY = smaller than 1 inch, FGL = 1-3 inches, and ADL = Adult.

Species	Year	Number	Size
Rainbow Trout	1974	4,293	FGL
Coho Salmon	1974	1,245	FGL
Northern Pike	1974	4,212	FGL
Muskellunge	1976	70	FGL
Blue catfish	1968	4,000	FGL
Channel catfish	1969	45,100	FGL
	1971	28,000	FGL
	1984	5,487	FGL
	1986	12,448	FGL
	1987	1,957	FGL
	1994	3,080	ADL
	1995	3,000	ADL
	1996	8,198	ADL
	1997	5,400	ADL
	1998	3,190	ADL
	1999	7,572	ADL
	2000	1,250	ADL
		92,992	
Striped bass	1983	8,010	FGL
	1991	120,450	FGL
		128,460	
Palmetto bass	1978	4,950	FGL
	1980	12,350	FGL
	1984	16,148	FGL
	1986	32,105	FGL
		65,553	
Largemouth bass	1966	200,000	FRY
	1968	25,000	FGL
		225,000	

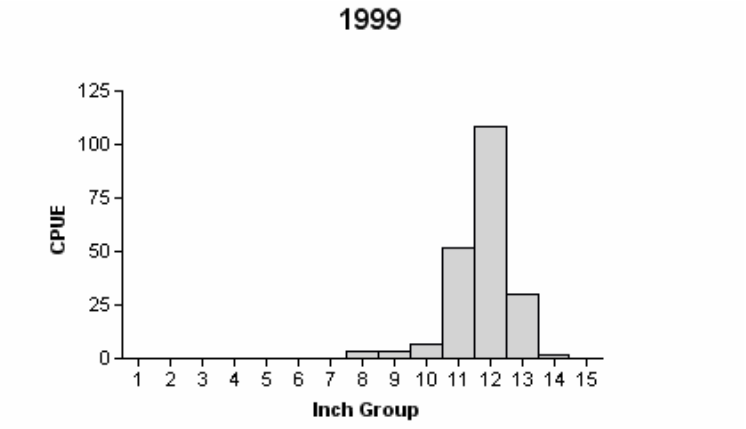
Table 3 (Cont.). Stocking history of Inks Reservoir, Texas. Size categories are: FRY = smaller than 1 inch, FGL = 1-3 inches, and ADL = Adult.

Species	Year	Number	Size
Florida largemouth bass	1989	14,037	FGL
	1991	80,480	FGL
		94,517	
Walleye	1976	10,000	FGL
	1978	4,067,000	FRY
		4,077,000	

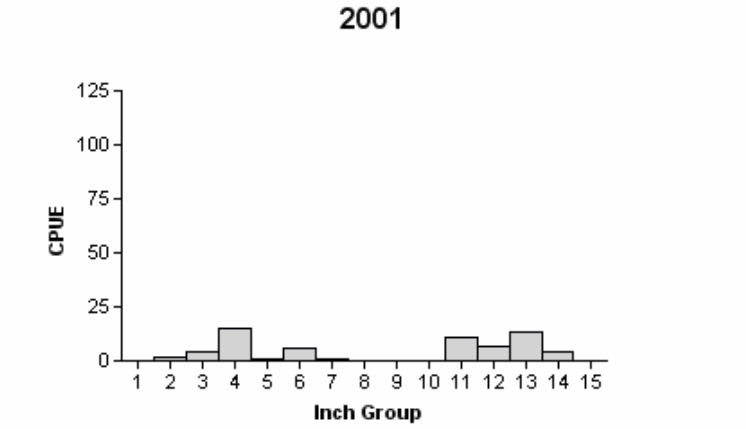
Table 4. Survey of littoral zone and physical habitat types, Inks Reservoir, Texas, 2005. A linear shoreline distance (miles) was recorded for each habitat type found. Surface area (acres) and percent of reservoir coverage were determined for each plant species found.

	Shoreline distance		Surface Area	
Shoreline habitat type	Miles	Percent of total	Acres	Percent of reservoir surface area
Concrete	0.3	1.5		
Boulder	4.4	21.2		
Bulkhead/boat dock	5.6	26.9		
Rock bank	0.4	2.1		
Rock bluff	1.2	6.1		
Sand	0.5	2.4		
Terrestrial grasses	8.2	39.4		
Bulrush			1.95	<1
Cattail			0.47	<1
Water willow			3.88	<1

Gizzard Shad



Effort = 1.0
Total CPUE = 205.0 (18; 205)
IOV = 0 (0.00)

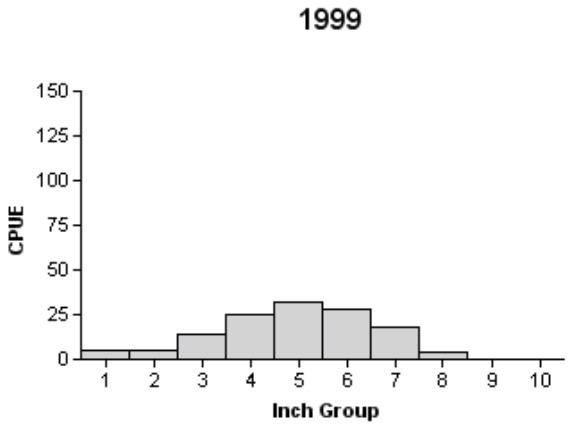


Effort = 1.0
Total CPUE = 64.0 (23; 64)
IOV = 39.19 (0.12)

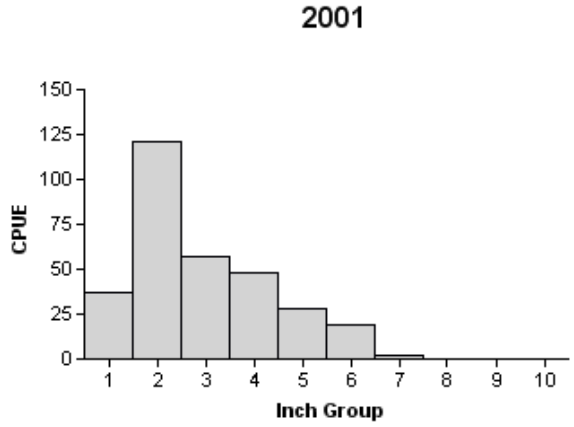
Effort = 1.0
Total CPUE = 226.0 (10; 226)
IOV = 9.73 (0.05)

Figure 2. Number of gizzard shad caught per hour (CPUE) population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Inks Reservoir, Texas, 1999, 2001 and 2005.

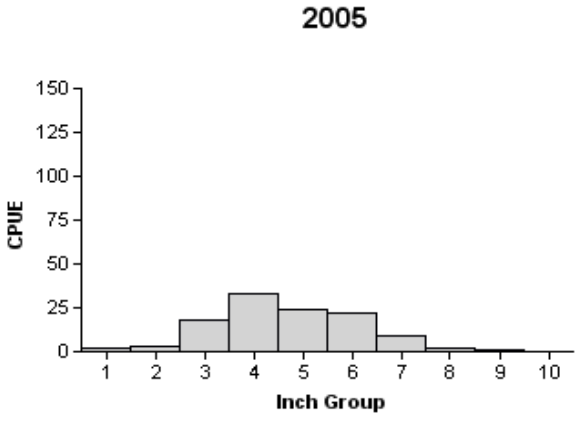
Bluegill



Effort =	1.0
Total CPUE =	131.0 (19; 131)
PSD =	41.0 (0.11)



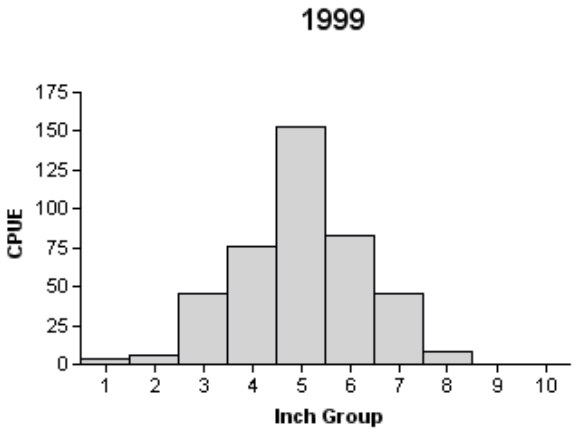
Effort =	1.0
Total CPUE =	312.0 (14; 312)
PSD =	14.0 (0.03)



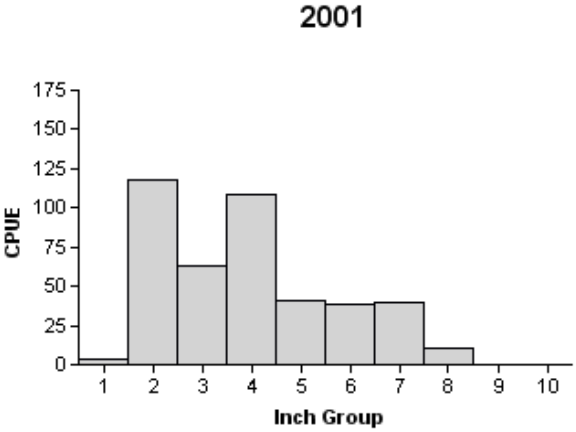
Effort =	1.0
Total CPUE =	114.0 (21; 114)
PSD =	31.0 (0.06)

Figure 3. Number of bluegill caught per hour (CPUE) population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Inks Reservoir, Texas, 1999, 2001 and 2005.

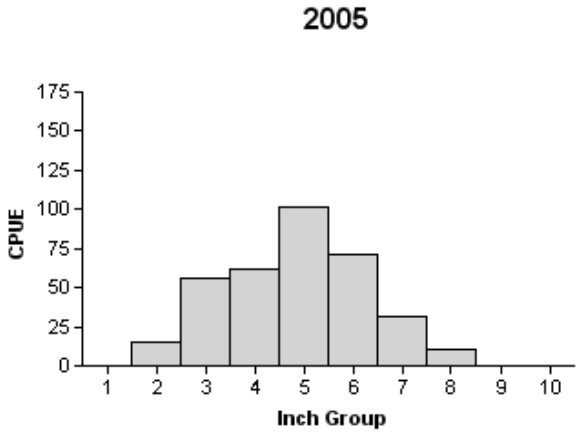
Redbreast Sunfish



Effort = 1.0
Total CPUE = 420.0 (36; 420)
PSD = 33.0 (0.06)
CPUE-7 = 53.0 (28; 53)



Effort = 1.0
Total CPUE = 423.0 (19; 423)
PSD = 29.0 (0.11)
CPUE-7 = 51.0 (56; 51)



Effort = 1.0
Total CPUE = 348.0 (20; 348)
PSD = 34.0 (0.05)
CPUE-7 = 42.0 (25; 42)

Figure 4. Number of redbreast sunfish caught per hour (CPUE) population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Inks Reservoir, Texas, 1999, 2001 and 2005.

Channel Catfish

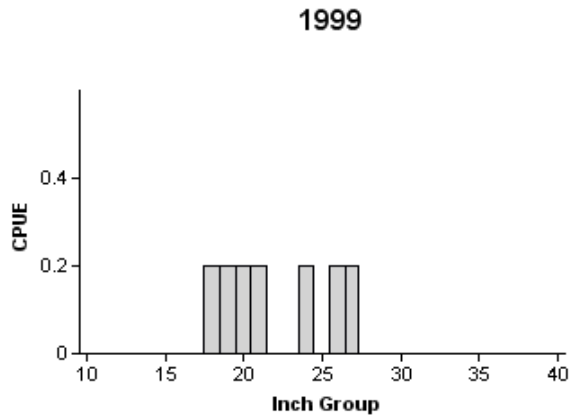
Effort = 5.0
Total CPUE = 9.8 (56; 49)
PSD = 21.0 (0.09)

Effort = 5.0
Total CPUE = 1.4 (27; 7)
PSD = 71.0 (0.20)

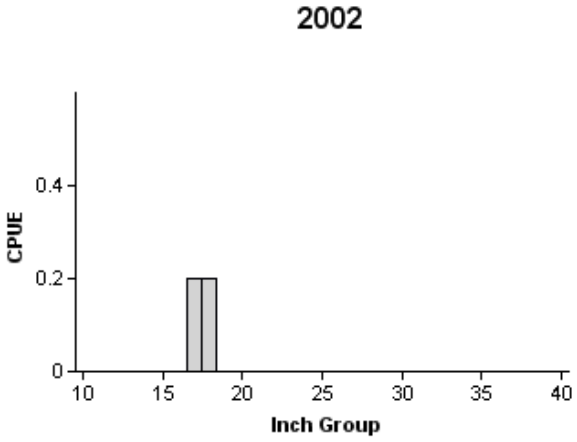
Effort = 5.0
Total CPUE = 3.2 (45; 16)
PSD = 19.0 (0.12)

Figure 5. Number of channel catfish caught per hour (CPUE) population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Inks Reservoir, Texas, 1999, 2002 and 2006.

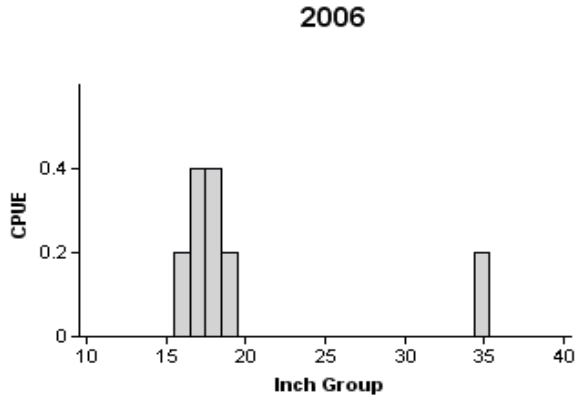
Blue Catfish



Effort = 5.0
Total CPUE = 1.4 (43; 7)
PSD = 71.0 (0.14)



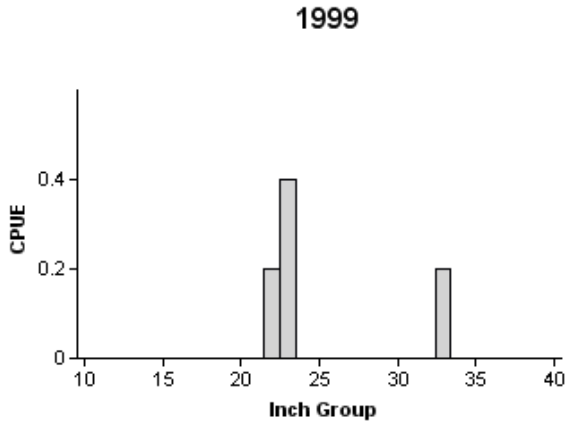
Effort = 5.0
Total CPUE = 0.4 (0; 2)
PSD = 0.0 (1.00)



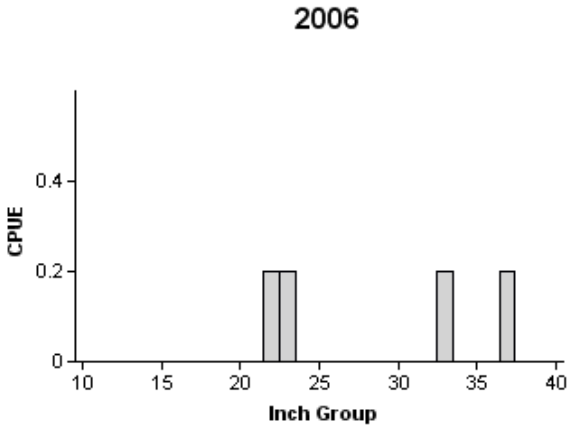
Effort = 5.0
Total CPUE = 1.4 (29; 7)
PSD = 14.0 (0.13)

Figure 6. Number of blue catfish caught per hour (CPUE) population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Inks Reservoir, Texas, 1999, 2002 and 2006.

Flathead Catfish



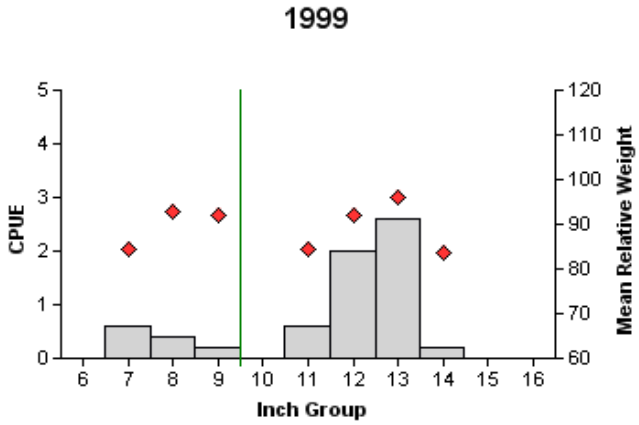
Effort = 5.0
Total CPUE = 0.8 (0; 4)
PSD = 100.0 (0.00)



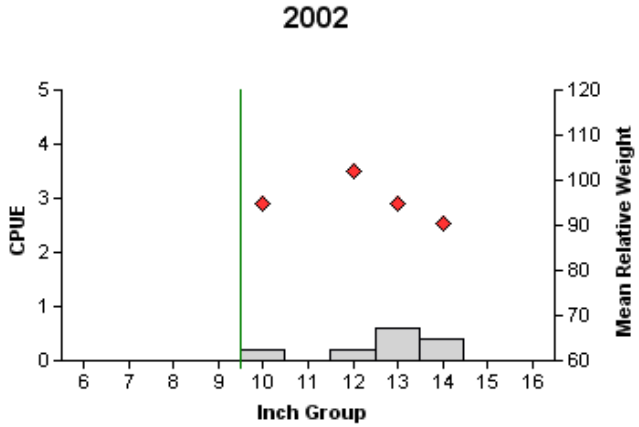
Effort = 5.0
Total CPUE = 0.8 (25; 4)
PSD = 100.0 (0.00)

Figure 7. Number of flathead catfish caught per hour (CPUE) population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Inks Reservoir, Texas, 1999 and 2006. Flathead catfish were targeted with gill nets in 2002, but none were collected.

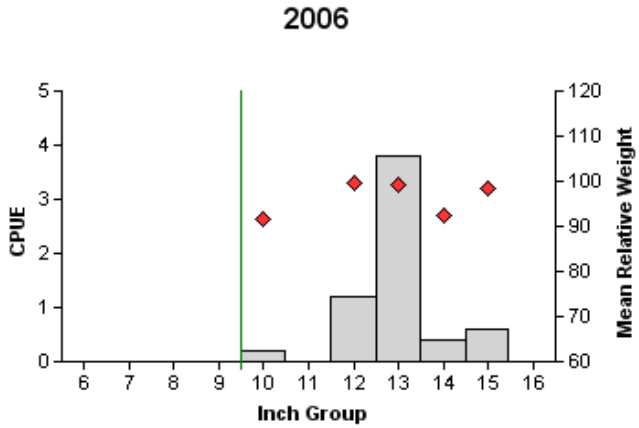
White Bass



Effort =	5.0
Total CPUE =	6.6 (18; 33)
RSD-P =	73.0 (0.13)
RSD-M =	0.0 (0)
PSD =	85.0 (0.1)



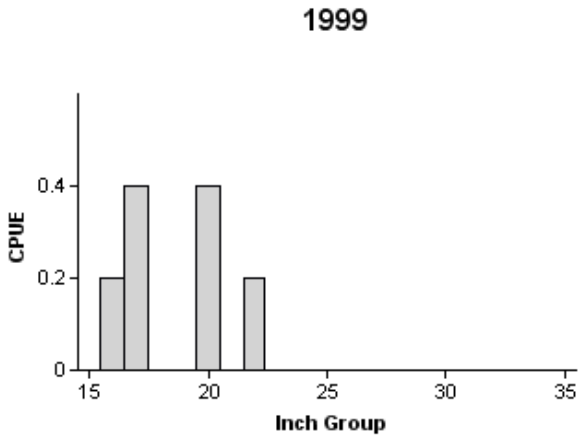
Effort =	5.0
Total CPUE =	1.4 (27; 7)
RSD-P =	86.0 (0.17)
RSD-M =	0.0 (0)
PSD =	100.0 (0.00)

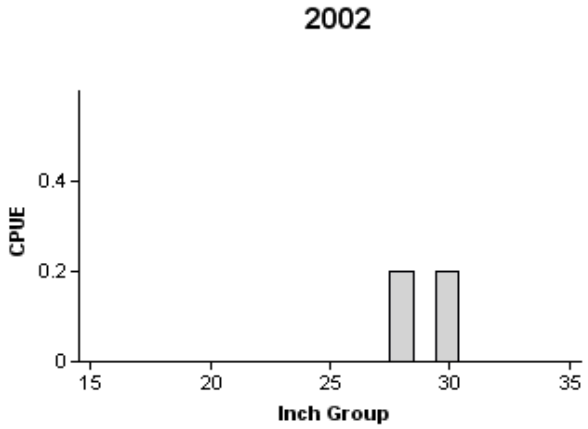


Effort =	5.0
Total CPUE =	6.2 (50; 31)
RSD-P =	97.0 (0.04)
RSD-M =	10.0 (0.04)
PSD =	100.0 (0.00)

Figure 8. Number of white bass caught per hour (CPUE) population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Inks Reservoir, Texas, 1999, 2002 and 2006.

Striped Bass





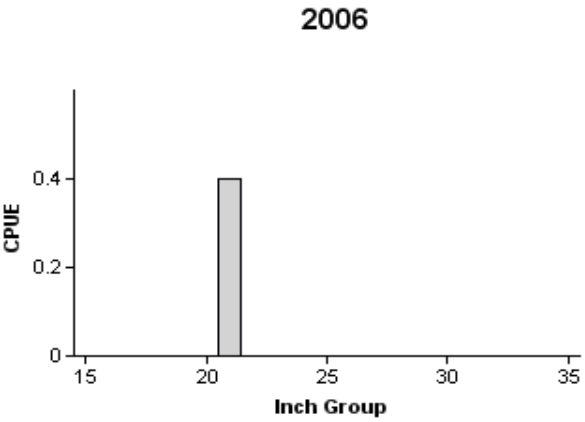
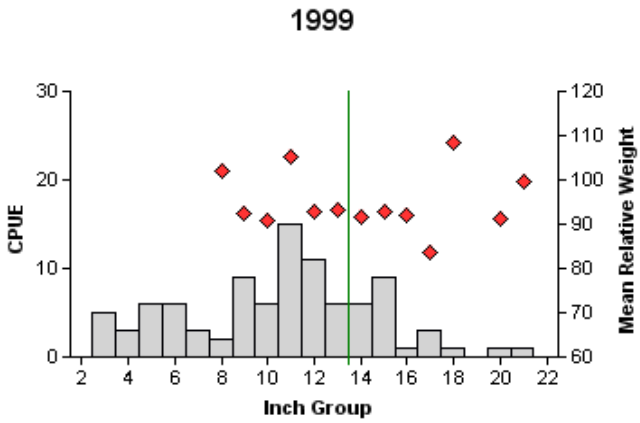
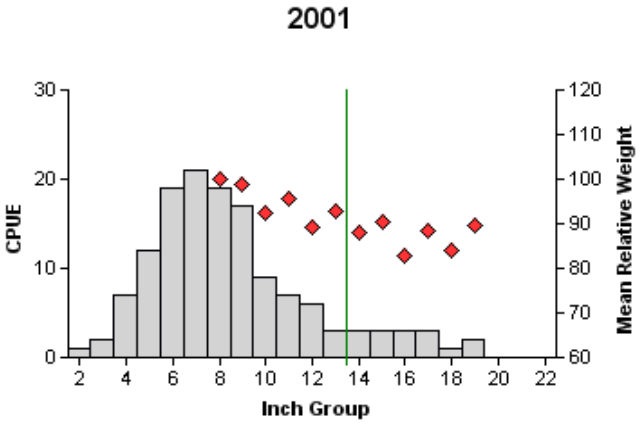


Figure 9. Number of striped bass caught per hour (CPUE) population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Inks Reservoir, Texas, 1999, 2002 and 2006.

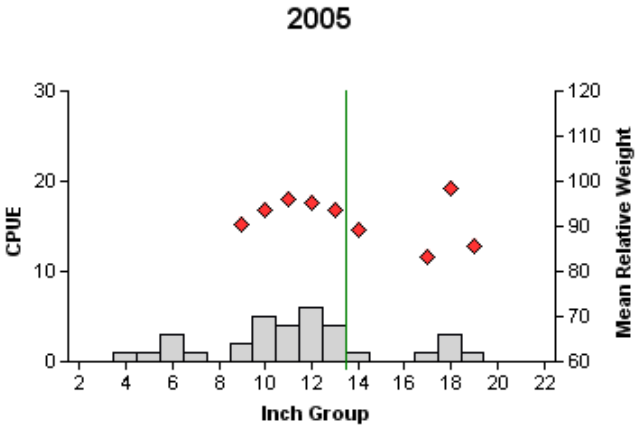
Largemouth Bass



Effort =	1.0
Total CPUE =	94.0 (14; 94)
Stock CPUE=	71.0 (17; 71)
PSD =	55.0 (0.06)
RSD-14 =	31.0 (0.06)
CPUE-14 =	22.0 (24; 22)



Effort =	1.0
Total CPUE =	138.0 (13; 138)
Stock CPUE=	76.0 (20; 76)
PSD =	32.0 (0.06)
RSD-14 =	20.0 (0.03)
CPUE-14 =	15.0 (24; 15)



Effort =	1.0
Total CPUE =	33.0 (20; 33)
Stock CPUE=	27.0 (26; 27)
PSD =	59.0 (0.08)
RSD-14 =	22.0 (0.07)
CPUE-14 =	6.0 (37; 6)

Figure 10. 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, Inks Reservoir, Texas, 1999, 2001 and 2005.

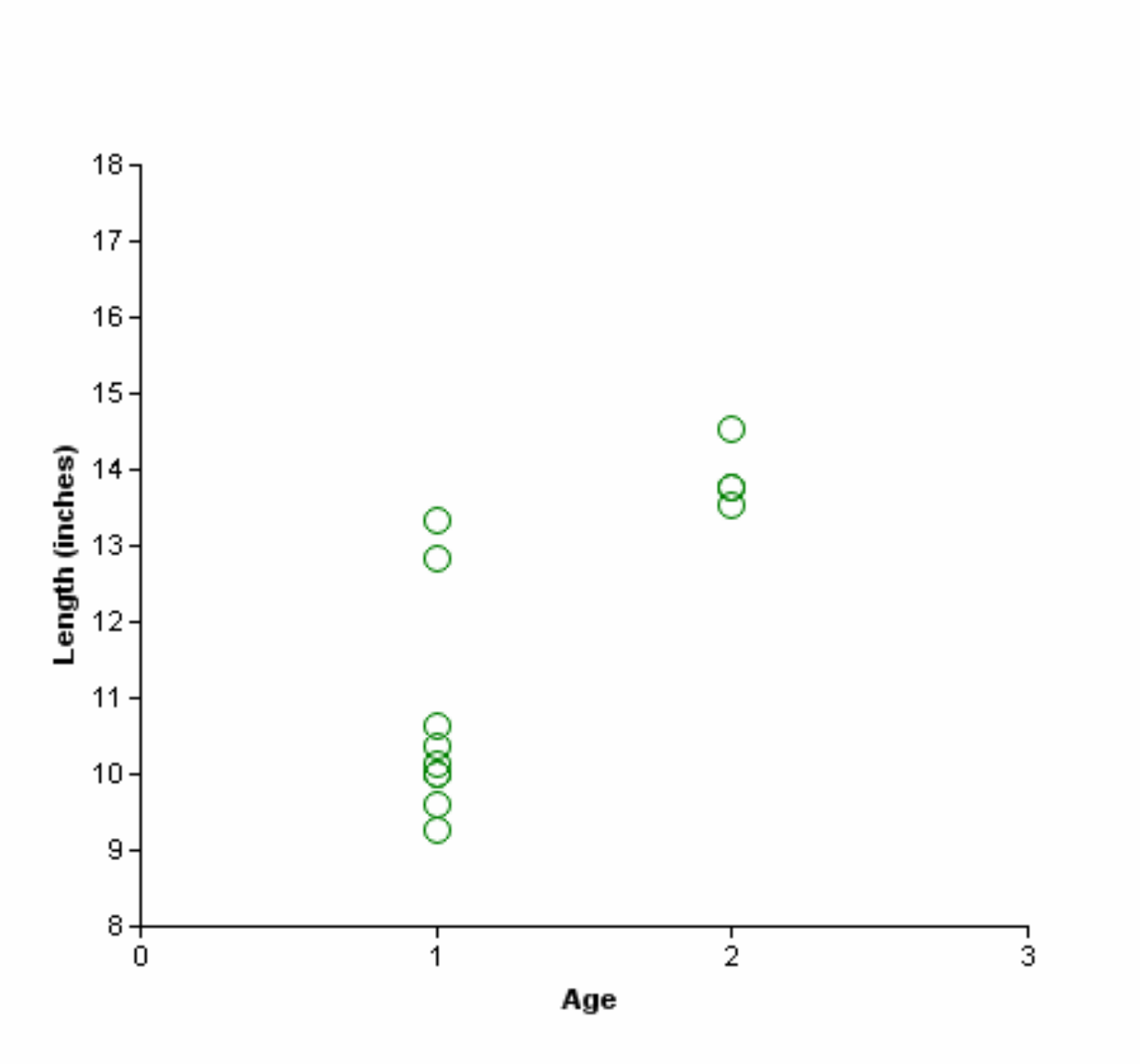


Figure 11. Length at age for largemouth bass collected by electrofishing at Inks Reservoir, Texas, November 2005.

Table 5. Results of genetic analysis of largemouth bass collected by electrofishing, Inks Reservoir, Texas, 1999, 2001 and 2005. FLMB = Florida largemouth bass, NLMB = northern largemouth bass, F1 = first generation hybrid between a FLMB and NLMB, Fx = second or higher generation hybrid between FLMB and NLMB.

Year	Sample size	Genotype				% FLMB alleles	% pure FLMB
		FLMB	F1	Fx	NLMB		
1999	30	7	6	16	1	60.8	23.3
2001	29	4	12	13	0	75.0	13.8
2005	13	2	0	11	0	66.6	16.0

Table 6. Proposed sampling schedule for Inks Reservoir, Texas. Gill netting surveys are conducted in the spring, while electrofishing and trap netting surveys are conducted in the fall. Standard survey denoted by S.

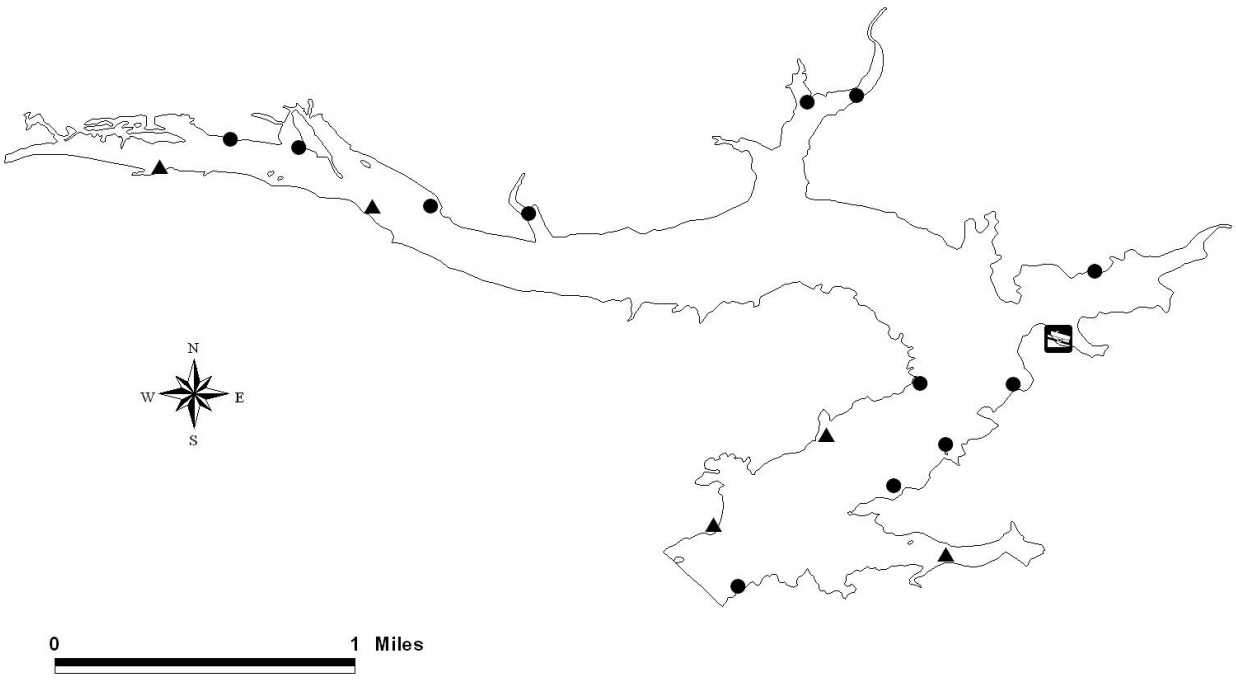
Survey Year	Electrofisher	Trap Net	Gill Net	Creel Survey	Report
Fall 2006-Spring 2007					
Fall 2007-Spring 2008					
Fall 2008-Spring 2009					
Fall 2009-Spring 2010	S		S		S

Appendix A

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

	Gill Net		Electrofishing	
Species	N	CPUE	N	CPUE
Gizzard shad			226	226
Threadfin shad			127	127
Redbreast sunfish			348	348
Green Sunfish			1	1
Warmouth			2	2
Bluegill			114	114
Longear sunfish			1	1
Redear sunfish			5	5
Largemouth bass			33	33
Guadalupe bass			2	2
Blue catfish	7	1.4		
Channel catfish	16	3.2		
Flathead catfish	4	0.8		
White bass	31	6.2		
Striped bass	2	0.4		

Appendix B



Location of sampling sites, Inks Reservoir, Texas, 2005-2006. Gill net and electrofishing stations indicated by ▲ and ●, respectively.