PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-4

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2013 Fisheries Management Survey Report

Dunlap Reservoir

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July 31, 2014

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Lake Dunlap were surveyed in 2013 using electrofishing and trap netting and in 2014 using gill netting. Historical data are presented with the 2013-2014 data for comparison. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir Description:** Lake Dunlap is a 410-acre impoundment located on the Guadalupe River in Guadalupe County and is regulated by the Guadalupe-Blanco River Authority (GBRA). The reservoir, impounded in 1928, is used for water supply, hydroelectric generation, and recreation. Lake Dunlap is classified as a mainstream reservoir and has a fairly constant water level. Substrate in the upper section is composed primarily of rock and gravel, while the middle and lower sections of the reservoir are composed of clay, sand, and silt. Habitat features included boat docks, rocks, flooded timber, and both native and exotic vegetation species.

- **Management History:** Important sport fish include Blue and Channel catfish, Largemouth Bass, and White Crappie. The management plan from the 2010 survey report focused on spring trap net sampling for White Crappie, exotic species, especially exotic vegetation, and publicizing the Largemouth Bass and Blue Catfish populations. Fall trap net catch rates of White Crappie were historically less than 1.0/nn using both standard and non-standard surveys. Spring trap nets using both random and biologist-selected stations were conducted with mixed results. Exotic species were monitored via vegetation and routine fisheries surveys. Water hyacinth was found and mechanically removed from the reservoir since the last report. Several press releases were prepared and distributed regarding the excellent Largemouth Bass and Blue Catfish angling opportunities. An unsanctioned cutting of submerged timber occurred since the last report.

- **Fish Community**
  - **Prey species:** Electrofishing catch rates of shad and sunfish species decreased since the 2010 report but did not negatively impact predatory species. Prey species populations were comprised primarily of small size classes; benefitting most predatory fish species. Redear and Redbreast sunfish provided anglers with excellent angling opportunities.

  - **Catfishes:** Blue, Channel, and Flathead catfish were present in the reservoir, with Channel Catfish being the predominant species. The majority of catfish sampled were greater than Legal length limits and both Blue and Flathead catfish reached a large size.

  - **Black Basses:** Smallmouth, Spotted, Largemouth, and Guadalupe bass were present in the reservoir, with Largemouth Bass being the predominant species. Largemouth Bass relative abundance decreased since the 2010 report, however, they continued to exhibit good body condition and growth to legal size. Several Largemouth Bass over 20” were collected during the electrofishing survey and numerous fish >10 pounds, including a ShareLunker in 2012 were reported by anglers.

  - **Crappie:** White Crappie were present in the reservoir. Spring trap nets surveys at both random and biologist-selected stations did not result in consistent catch rates of White Crappie. Further refining of spring trap net surveys should be examined.

- **Management Strategies:** Continue to manage the fisheries under current regulations, continue to refine White Crappie sampling, to monitor the reservoir for nuisance aquatic vegetation, and to work with the local Friends of Reservoirs (FOR) group on enhancing habitat in the reservoir.

INTRODUCTION

This document is a summary of fisheries data collected from Lake Dunlap in 2013-2014. 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 are presented with the 2013-2014 data for comparison.

Reservoir Description

Lake Dunlap is a 410-acre impoundment located on the Guadalupe River in Guadalupe County and is regulated by the Guadalupe-Blanco River Authority (GBRA). The reservoir, impounded in 1928, is used for water supply, hydroelectric generation, and recreation. The reservoir is mainstream and maintains a fairly constant water level. Substrate in the upper section is composed primarily of rock and gravel, while the middle and lower sections of the reservoir are composed of clay, sand and silt. Land around the reservoir has been heavily developed for residential use. Shoreline habitat was comprised of bulkhead and cutbank. Littoral habitat consisted of native aquatic plant species, primarily spatterdock, and water willow. Hydrilla was not observed in the 2013-2014 survey period but *Hygrophila* sp., a nuisance exotic plant, and water hyacinth were present in the reservoir. *Hygrophila* sp. has been present in the Comal River (upstream) for many years but has yet to become problematic in Lake Dunlap. Water hyacinth was found in several places in lower half of the reservoir. Additional descriptive characteristics of Lake Dunlap can be found in Table 1.

Angler Access

Lake Dunlap has two public boat ramps and several private boat ramps. The upstream-most public ramp, located under the I35 underpass in New Braunfels, Texas, provided free access to the reservoir. The second public ramp, Schuman's Launch, was located down-lake off Schuman's Beach Road and was pay-to-use access to the reservoir. Both boat ramps are typically usable as the lake experiences stable water level. Additional boat ramp characteristics are in Table 2. Shoreline access is limited to the public boat ramp areas.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Findeisen and Binion 2010) included:

1. Trap net catch rates of White Crappie are low (generally less than 1.0/nn) using both standard and non-standard sets in the fall resulting in minimal population information for this species. Greater numbers of White Crappie have been collected in the spring by other gear types such as gill nets (6.6/nn in 2010).
    Action: Trap net surveys were conducted in spring 2012 and 2014 at both randomly selected and biologist-selected stations. Catch rates of White Crappie were inconsistent and did not provide adequate data regarding the status of the population. Additional refining of sampling Crappies is required.

2. Exotic vegetation has been problematic in this reservoir in the past. Currently, *Hygrophila* is the only exotic species in the reservoir but has yet to become problematic. Both rooted stands and floating fragments of hydrilla were found in Lake McQueeney (downstream of Lake Dunlap) and could possibly be transported to Lake Dunlap via boat trailers.
    Action: Exotic aquatic vegetation was monitored through routine fisheries and vegetation surveys. Hydrilla was not observed in the reservoir and *Hygrophila* still had not become problematic. A small water hyacinth stand was reported by

an angler and confirmed in fall 2012. TPWD and GBRA staff conducted monthly water hyacinth surveys, removing all plants encountered during the surveys. Several months into the removal effort it was determined a landowner was placing the water hyacinth in her boat slip. The individual was educated on exotic species introductions and impacts on native species. The constituent willingly ceased the introductions.

3. The Largemouth Bass and Blue Catfish populations increased in recent years and provide anglers with excellent fishing opportunities.
   Action: Several press releases were written and distributed to media outlets surrounding Lake Dunlap. A television news crew (KSAT12) did a short story on bass fishing at Lake Dunlap in the January 2013 shortly after a ShareLunker fish was caught from the reservoir.

4. Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels (*Dreissena polymorpha*) can multiply rapidly and attach themselves to any available hard structure, restricting water flow in pipes, fouling swimming beaches and plugging engine cooling systems. 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.
   Action: TPWD and GBRA worked collaboratively regarding the control of established invasive species, including the removal of water hyacinth and monitoring of *Hygrophila*, preventing the re-establishment of hydrilla and taking actions to minimize the spread of zebra mussels to the reservoir. Numerous meetings were held with Guadalupe Lake homeowner groups discussing how they could help prevent the spread or further establishment of invasive species.

Harvest regulation history: Sport fishes in Lake Dunlap have always been managed with statewide regulations (Table 3).

Stocking history: Lake Dunlap was stocked with 6,093 ShareLunker Largemouth Bass in May 2013. Prior to 2013, the reservoir has not been stocked since 2001 (Blue Catfish). Triploid grass carp were stocked in 1995 and 1996 for hydrilla control and have been collected during electrofishing surveys. Florida Largemouth Bass have not been stocked since 1984. A complete stocking history can be found in Table 4.

Vegetation/habitat management history: Prior to 1996, Lake Dunlap had a severe hydrilla problem. Through herbicide treatments and the introduction of triploid grass carp, hydrilla was no longer present in the reservoir as of 2005 but was found in the reservoir directly downstream of Lake Dunlap. Water hyacinth was also present in Lake Dunlap prior to 1996 and was discovered again in the reservoir in fall 2012. TPWD and GBRA conducted monthly water hyacinth surveys, mechanically removing all water hyacinth encountered. The 2012 water hyacinth infestation was the result of a lake-front homeowner introducing the plant in her boat slip. The homeowner was educated about the legality of her actions and the harmful effects water hyacinth could have on Lake Dunlap. *Hygrophila* sp., an exotic and potentially nuisance species, was documented actively growing in Lake Dunlap in 2004. This plant has been present in the Comal River (upstream of Lake Dunlap) for many years. *Hygrophila* sp. fragments began appearing in Lake Dunlap during the summer 2004 and were probably linked to recreational tubing activities in the Comal River during this same time period. Although this species has become established in Lake Dunlap, it is not expected to cause any access problems due to the limited areas for growth.

Lake Dunlap has an 8.4 acre submerged timber field located near the dam. This submersed timber field has withstood numerous flood events and is an important habitat feature to the Lake Dunlap aquatic ecosystem. In December 2011 lake-front homeowners, without the permission of GBRA, removed the upper 4-6 feet of timber in 3.8 acres of the submersed timber field while the reservoir was drawn down for dam repairs. A proposal to enhance this area with native aquatic vegetation and artificial habitat has been submitted to GBRA.

Water transfer: Lake Dunlap is primarily used for hydropower generation, recreation, and to lesser extent flood control. There are currently no pumping stations on the reservoir and no inter-basin transfers are known to exist.

METHODS

Fishes were collected by electrofishing (1.0 hour at 12, 5-minute stations), Spring trap netting (5 net nights at 5 random stations and 5 net nights at 5 biologist-selected 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 trap and gill nets as the number of fish caught in one net set overnight (fish/nn). The habitat (shoreline) survey was conducted in 2005 and the vegetation survey was conducted in July 2009 using the digital shapefile methodology. All electrofishing and gill netting survey sites were randomly selected and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2011).

Genetic analysis of largemouth bass was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2011). Micro-satellite DNA analysis was used to determine genetic composition of individual fish since 2005 and by electrophoresis for previous years.

Sampling statistics (CPUE for various length categories) and structural indices [Proportional Size Distribution (PSD), as defined by Guy et al. (2007)] and relative weight (W_r) was calculated for target fishes and length classes defined 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. Mean age at length data for Largemouth Bass was determined using otoliths from 13 individuals between 13 and 14.9 inches total length.

RESULTS AND DISCUSSION

Habitat: Littoral zone structural habitat consisted of bulkhead, cutbank, and boat docks/piers (Findeisen and Binion 2010) Aquatic vegetation was similar in 2005 and 2009 and consisted of native floating vegetation (spatterdock), native emergent vegetation (water willow), and native submersed vegetation (strap-leaf sagittaria) (Table 5). A vegetation survey was conducted in 2013 but corrupt files prevented importation into GIS program. Rooted *Hygrophila* sp. was documented during the vegetation survey and floating fragments were seen during all fisheries and vegetation surveys. An angler reported finding water hyacinth in Lake Dunlap in fall 2012. TPWD and GBRA conduct monthly water hyacinth surveys, removing all water hyacinth encountered. The 2012 water hyacinth infestation was the result of a lake-front homeowner introducing the plant in her boat slip. The homeowner was educated about the legality of her actions and the harmful effects water hyacinth could have on Lake Dunlap.

Prey species: Gizzard Shad relative abundance decreased over the report period, with the lowest electrofishing CPUE occurring in 2013 at 91.0/h (Figure 1). Prey availability was excellent as IOV values ranged from 62-85 (Figure 1), indicating the majority of Gizzard Shad collected were of suitable sizes as forage for predatory fishes. Threadfin Shad CPUE was 19.0/h in 2013. Redbreast Sunfish, Bluegill, and Redear Sunfish CPUEs were 143.0/h, 169.0/h, and 62.0/h in 2013, respectively (Figures 2, 3, and 4).

Redbreast Sunfish and Bluegill CPUEs in 2013 were substantially lower compared to the 2009 CPUEs but were similar to the 2011 CPUEs (Figures 2 and 3). The 2013 CPUE of Redear Sunfish was greater than the CPUEs in 2009 and 2011 (Figure 4). Low PSD values for Bluegill indicate the majority of this population was comprised of small fish and available as forage to predatory fishes. Redbreast and Redear Sunfish PSD values were more indicative of balanced populations but these species still provided predatory fishes with additional forage species. Sunfish grew to large size-classes in this reservoir with Redear Sunfish attaining preferred (≥9 inches) and memorable (≥11 inches) size.

Blue Catfish: The gill net CPUE for Blue Catfish in 2014 was 0.8/nn, substantially lower than 3.6/nn in 2010 and similar to 0.4 in 2006 (Figure 5). All Blue Catfish collected in gill net surveys were larger than the 12-inch minimum length limit. Historically, the majority of these fish exceed 20-inches in length, with a few exceeding the 30-inch, preferred size group (Figure 5). The lack of sub-legal fish and highly variable CPUEs from gill net surveys suggest Blue Catfish immigrate to and emigrate from this reservoir quite readily. Body condition of Blue Catfish was excellent as W_r values generally exceeded 100. Anglers targeted trophy-sized Blue Catfish at Lake Dunlap as evidenced by pictures of large, landed fish on several internet fishing forums. Further, the Blue Catfish lake record was broken in 2013 with a 51.5 pound 48.5 inch catch.

Channel Catfish: The gill net CPUE for Channel Catfish in 2014 was 15.0/nn, greater than 7.0/nn in 2006 and 4.2/nn in 2010 (Figure 6). The majority of Channel Catfish sampled were greater than the 12-inch minimum length limit. Thirty-four percent of these legal-sized fish were greater than the 16-inch, quality size class and a few just below the 24-inch, preferred size class (Figure 6). Mean relative weights of stock size and greater Channel Catfish reflected excellent body condition, with most W_r values over 120 (Figure 6). Channel Catfish provided anglers with quality catfishing opportunities.

Flathead Catfish: The gill net CPUE for Flathead Catfish in 2014 was 1.4/nn, similar to 1.0/nn in 2006 and 1.2/nn in 2010 (Figure 7). All but one Flathead Catfish collected in gill net surveys exceeded the 18-inch minimum length limit. A few of these legal-sized fish exceeded the 28-inch, preferred size class and exhibited the ability to grow to the 34-inch, memorable size class. Flathead Catfish also provided anglers with trophy fish angling opportunities as evidenced by pictures of large Flathead Catfish from Lake Dunlap posted on several internet fishing forums.

Largemouth Bass: The electrofishing CPUE for Largemouth Bass steadily decreased since 2009, to 109.0/h in 2013 (Figure 8). PSD values remained similar for all three years and were indicative of a balanced population. CPUE of legal-sized Largemouth Bass (14-inches) was excellent, ranging from 20/h to 37/h. Several fish exceeded the 20-inch, memorable size class (Figure 8). Mean relative weights indicated condition of Largemouth Bass was good as W_r values were near 100 for most inch classes (Figure 8). Largemouth Bass growth was excellent as mean age at 14 inches (range 13.0 to 14.9 inches) was 1.9 years in 2013 (N=13; range 1-2), falling within the normal range of variation in this reservoir (Table 6). Florida Largemouth Bass alleles ranged from 60-71% since 2003 (Table 7), indicating the genetic potential for growing trophy Largemouth Bass. Anecdotal data and internet fishing forum posts suggest 10+ lb Largemouth Bass are caught frequently from Lake Dunlap. In 2012, a 13+ lb fish was donated to the TPWD ShareLunker Program. Additionally, 5-fish bag limits from tournaments held on Lake Dunlap exceeded 25 lbs frequently, with one stringer eclipsing 35 lbs.

White Crappie: Historically fall trap net CPUEs of White Crappie have been low (<1.0/nn) using both random and biologist-selected stations. In 2010, 33 White Crappie were collected in the spring gill net survey (Findeisen and Binion 2010). Spring trap net CPUEs at randomly selected stations for White Crappie were 2.2/nn in 2012 and 0.2/nn in 2014 (Figure 9) and spring trap net CPUEs at biologist selected stations for White Crappie were 5.2/nn in 2012 and 0.2/nn in 2014 Figure 10). The majority of White Crappie collected in the spring 2012 trap net surveys were caught in nets set in or directly adjacent to the submersed timber field. However, trap nets set in or near the submersed timber field in 2014 captured one White Crappie. Trap net sampling for Crappies on this reservoir needs further refinement.

Fisheries management plan for Lake Dunlap, Texas

Prepared – July 2014.

ISSUE 1: Trap net catch rates of White Crappie have been highly variable and generally yielded little data despite using random and non-random sites as well as conducting surveys in both spring and fall. Typically, spring surveys provided more data relative to fall surveys in Lake Dunlap. White Crappie are abundant in the reservoir, especially near the submersed timber field, but additional refining of survey techniques are needed to collect adequate trend data on this species.

MANAGEMENT STRATEGIES

1. Conduct biologist-selected trap net surveys in spring 2016 and 2018, using both shoreline (single cod) and offshore (dual cod) sets.

ISSUE 2: In December 2011, homeowners removed the upper 4-6 feet of timber in 3.8 acres of an 8.4 acre submerged timber field located near the dam. These unauthorized, rogue cuttings created hazardous boating conditions, requiring GBRA to delineate the entire submersed timber field as a No Wake Zone. The economic and biological losses of the destroyed habitat are unknown. Enhancement of the remaining habitat in this area has been discussed with GBRA and approved.

MANAGEMENT STRATEGIES

1. Work with anglers, homeowners, GBRA staff, and the local Friends of Reservoirs (FOR) Chapter on planting native vegetation and installing artificial habitat in the submersed timber field.

ISSUE 3: The Largemouth Bass and Blue Catfish populations continued to provide anglers with excellent fishing opportunities and the chance of catch a trophy.

MANAGEMENT STRATEGIES

1. Write and distribute press releases through media outlets local to the reservoir as well as on the district acebook page.

ISSUE 4: Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels (*Dreissena polymorpha*) can multiply rapidly and attach themselves to any available hard structure, restricting water flow in pipes, fouling swimming beaches and plugging engine cooling systems. 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. Exotic vegetation has been problematic in this reservoir in the past. Currently, *Hygrophila* is the only exotic species in the reservoir but has yet to become problematic. Both rooted stands and floating fragments of hydrilla were found in Lake McQueeney (downstream of Lake Dunlap) and could possibly be transported to Lake Dunlap via boat trailers.

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.

SAMPLING SCHEDULE JUSTIFICATION:
The proposed sampling schedule includes routine electrofishing in the 2015, non-random trap netting in the spring 2016, and mandatory monitoring in 2017-2018 to monitor sport fish populations. A Federal Aid report will be prepared in 2018 (Table 8).

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Guy, C. S., R. M. Neumann, D. W. Willis, and R. O. Anderson. 2007. Proportional size distribution (PSD): A further refinement of population size structure index terminology. Fisheries 32(7):348.

Table 1. Characteristics of Lake Dunlap, Texas.

Characteristic	Description
Year constructed	1928
Controlling authority	Guadalupe-Blanco River Authority
County	Guadalupe
Reservoir type	Mainstream
Shoreline Development Index	2.25
Conductivity	450-550 umhos/cm
Access: Boat	Good, 1 Public ramp
Bank	Poor, limited due to private property
Handicapped	Poor, none

Table 2. Boat ramp characteristics for Lake Dunlap, Texas, August, 2013. Reservoir elevation at time of survey was 575.2 feet above mean sea level.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
I-35 Bridge (free)	29.692597 -98.107563	Y	25+	570.0	Excellent, no access issues
Schuman's Ramp (pay-to-use)	29.671436 -98.069557	Y	8	574.0	Excellent, no access issues

Table 3. Harvest regulations for Lake Dunlap, Texas.

Species	Bag Limit	Length Limit
Catfish: Channel and Blue Catfish, their hybrids and subspecies	25 (in any combination)	12-inch minimum
Catfish, Flathead	5	18-inch minimum
Bass, White	25	10-inch minimum
Bass, Striped	5	18-inch minimum
Bass, Palmetto	5	18-inch minimum
Bass, Largemouth	5[a]	14-inch minimum
Bass, Spotted and Guadalupe	5[a] (in any combination)	None
Crappie: White and Black Crappie, their hybrids and subspecies	25 (in any combination)	10-inch minimum

[a] Daily bag for largemouth bass, spotted bass, and Guadalupe bass = 5 fish in any combination.

Table 4. Stocking history of Lake Dunlap, Texas. Size categories are: FGL = fingerling, ADL = adults, and UNK for unknown size.

Year	Number	Size
	Blue Catfish	
1988	16	ADL
1995	41,000	FGL
1996	34,400	FGL
1997	41,553	FGL
2001	34,308	FGL
Species Total	151,277	
	Channel Catfish	
1968	2,000	UNK
1973	6,000	UNK
Species Total	8,000	
	Striped Bass	
1978	4,000	UNK
1983	5,340	UNK
Species Total	9,340	
	Coppernose Bluegill	
1983	15,000	UNK
	Largemouth Bass	
1966	8,400	UNK
1967	10,000	UNK
Species Total	18,400	
	Florida Largemouth Bass	
1978	16,400	FGL
1984	20,200	FGL
1988	41,194	FGL
Species Total	77,794	
	ShareLunker Largemouth Bass	
2013	6,093	FGL
	Triploid Grass Carp*	
1995	25	ADL
1996**	3	ADL
Species Total	28	

* Radio-tagged fish

** Replace dead radio-tagged fish

Table 5. Survey of aquatic vegetation, Lake Dunlap, Texas, 2005 and 2009. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

Vegetation	2005	2009	2013[a]
Native submersed		0.15 (<0.1)	
Native floating-leaved	29.09 (7.1)	15.90 (3.9)	
Native emergent	0.02 (<0.1)	0.05 (<0.1)	
Non-native			
Water hyacinth (Tier I)*			<0.1 (<1.0)[b]
Hygrophila (Tier III)*	Floating fragments	Floating fragments	

[a]A vegetation survey was conducted in Summer 2013 but corrupt files would not allow for importation into GIS program.
*Tier I is immediate Response, Tier III is Watch Status
[b]Estimated coverage based on amount of water hyacinth removed by hand.

Gizzard Shad

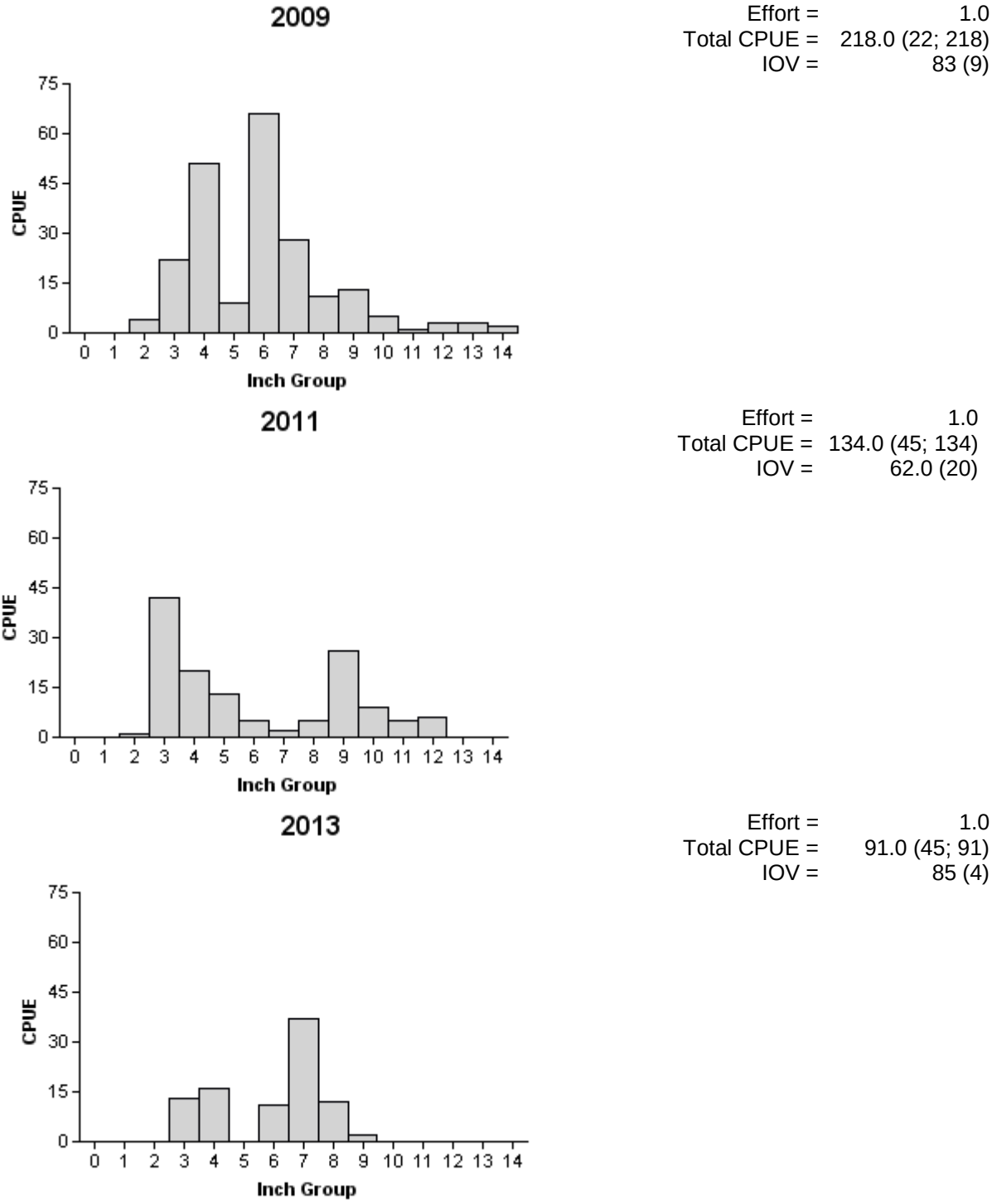
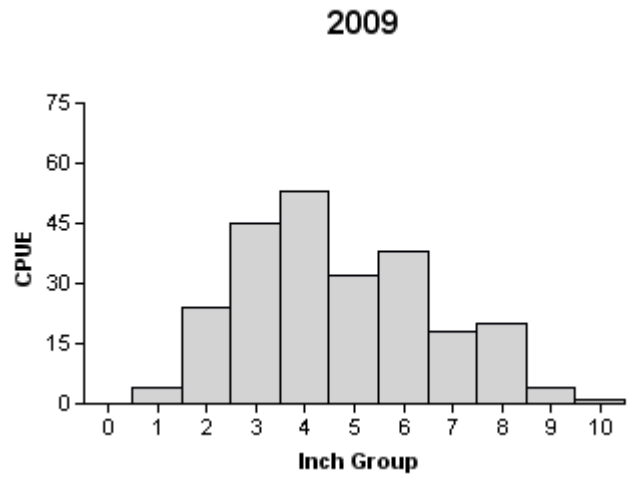
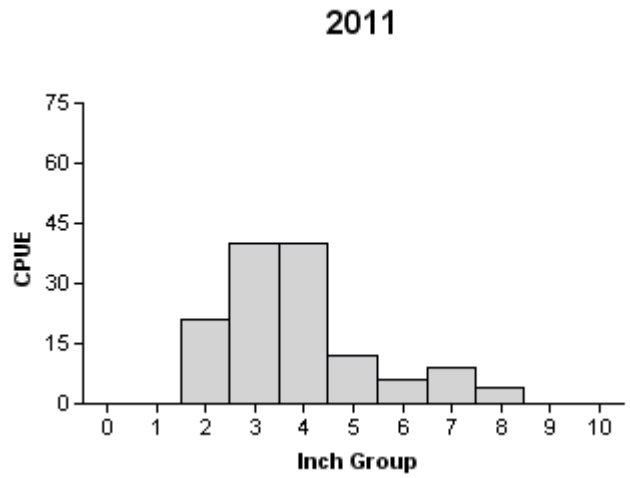


Figure 1. Number of Gizzard Shad caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Lake Dunlap, Texas, 2009, 2011, and 2013.

Redbreast Sunfish





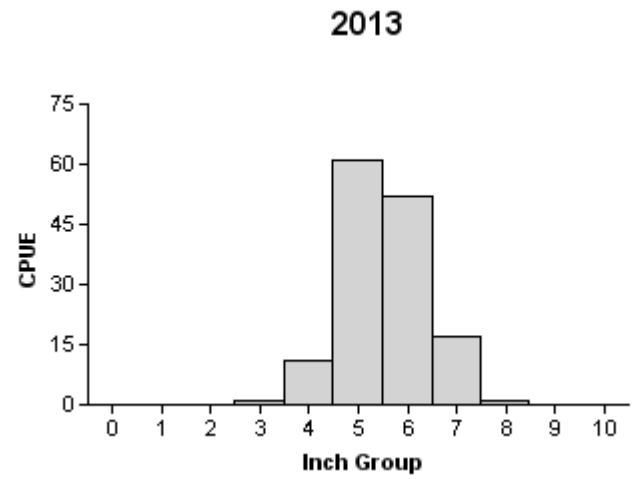


Figure 2. Number of Redbreast Sunfish caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for PSD are in parentheses) for fall electrofishing surveys, Lake Dunlap, Texas, 2009, 2011, and 2013.

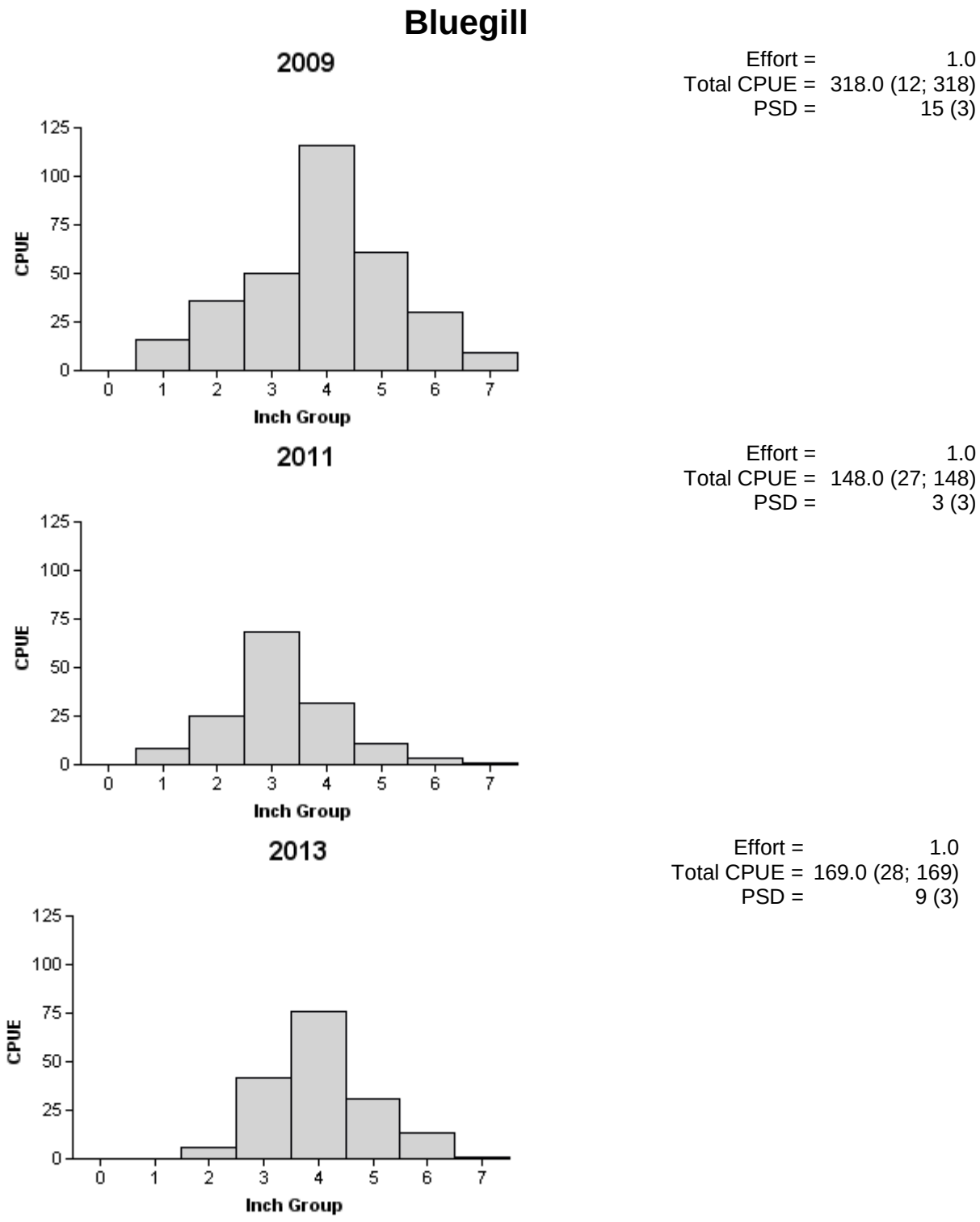
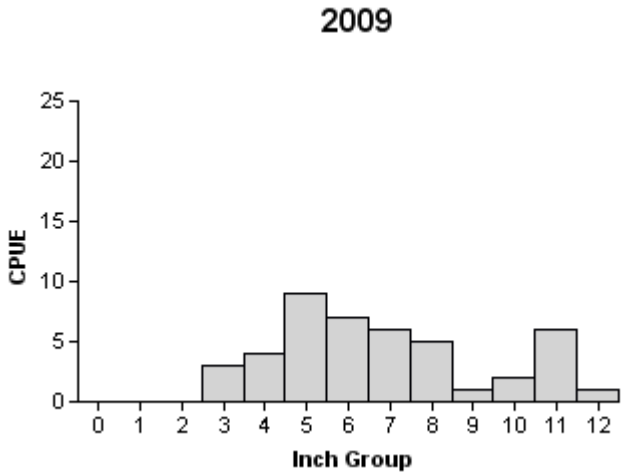
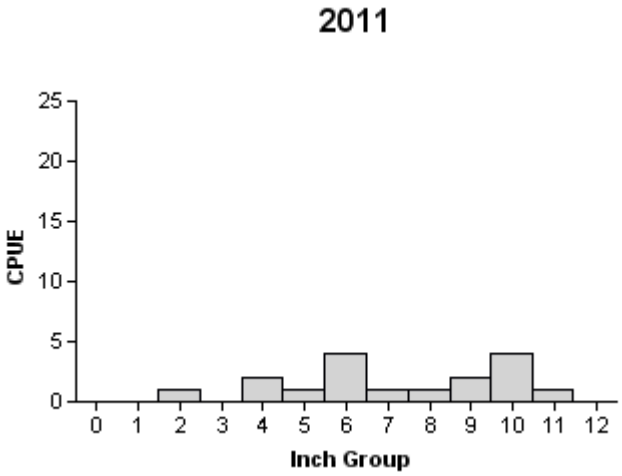


Figure 3. Number of Bluegill caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for PSD are in parentheses) for fall electrofishing surveys, Lake Dunlap, Texas, 2009, 2011, and 2013.

Redear Sunfish





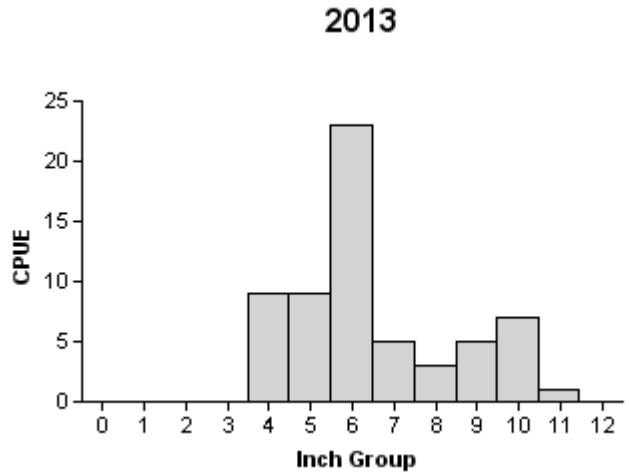
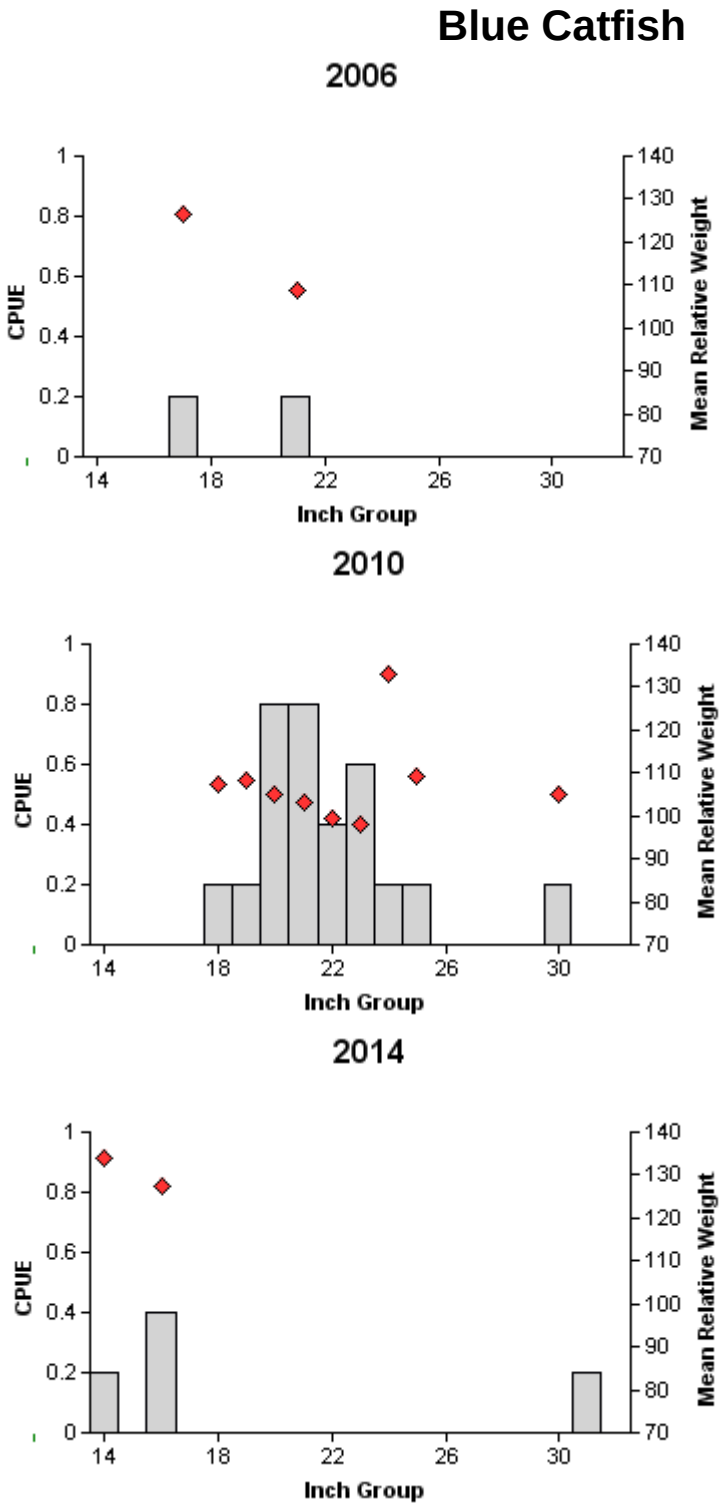


Figure 4. Number of Redear Sunfish caught per hour (CPUE, bars) and population indices (RSE and N for CPUE and SE for PSD are in parentheses) for fall electrofishing surveys, Lake Dunlap, Texas, 2009, 2011, and 2013.



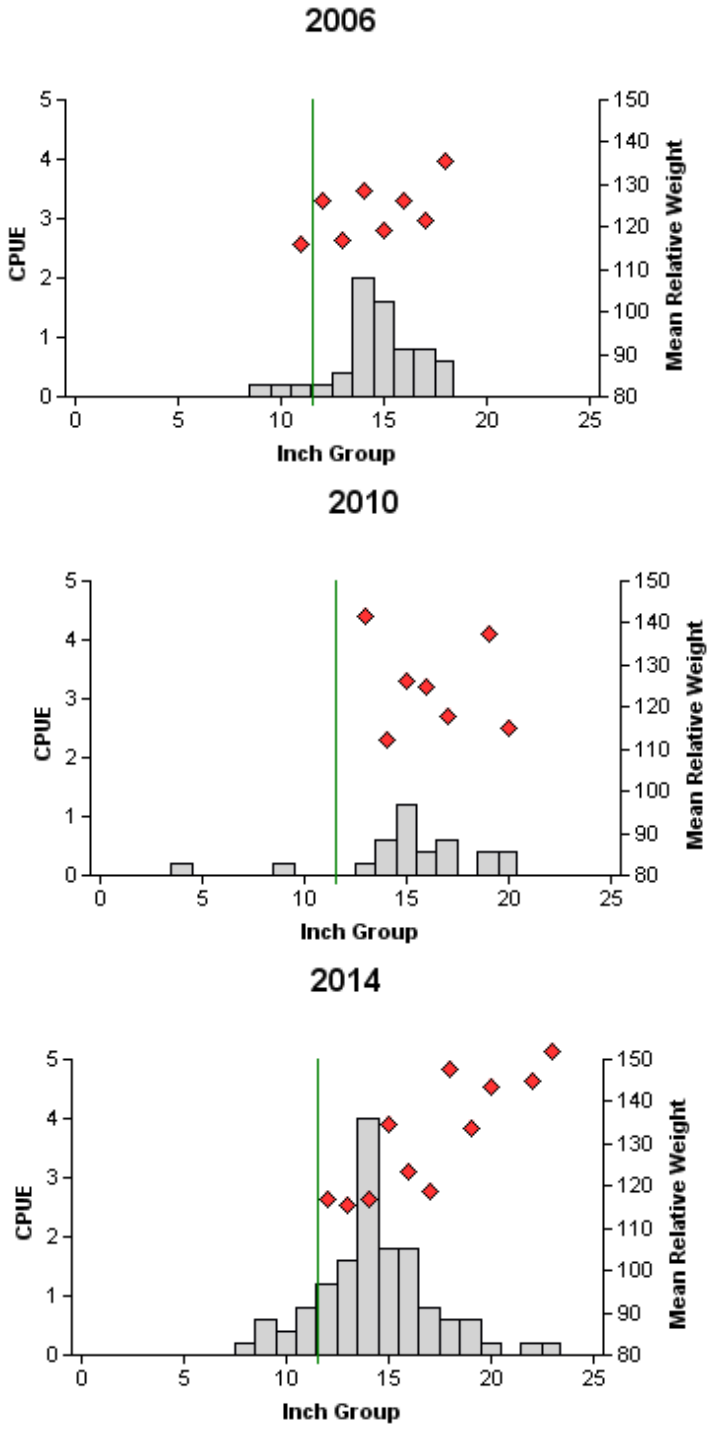
Effort =	5.0
Total CPUE =	0.4 (100; 2)
Stock CPUE =	0.4 (100; 2)
CPUE-12 =	0.4 (100; 2)
CPUE-20 =	0.2 (100; 1)
PSD =	50 (0)

Effort =	5.0
Total CPUE =	3.6 (14; 18)
Stock CPUE =	3.6 (14; 18)
CPUE-12 =	3.6 (14; 18)
CPUE-20 =	3.2 (18; 16)
PSD =	89 (11)

Effort =	5.0
Total CPUE =	0.8 (47; 4)
Stock CPUE =	0.8 (47; 4)
CPUE-12 =	0.8 (47; 4)
CPUE-20 =	0.2 (100; 1)
PSD =	25 (26)

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 population indices are in parentheses) for spring gill net surveys, Lake Dunlap, Texas, 2006, 2010, and 2014.

Channel Catfish



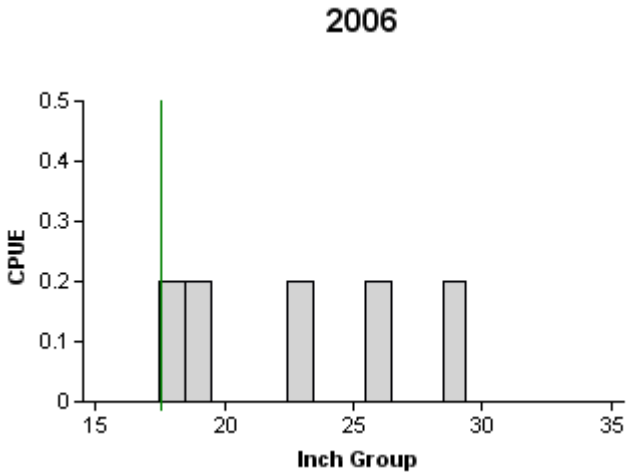
Effort =	5.0
Total CPUE =	7.0 (34; 35)
Stock CPUE =	6.6 (37; 33)
CPUE-12 =	6.4 (35; 32)
CPUE-16 =	2.2 (56; 11)
PSD =	33 (9)

Effort =	5.0
Total CPUE =	4.2 (20; 21)
Stock CPUE =	3.8 (26; 19)
CPUE-12 =	3.8 (26; 19)
CPUE-16 =	1.8 (41; 9)
PSD =	47 (12)

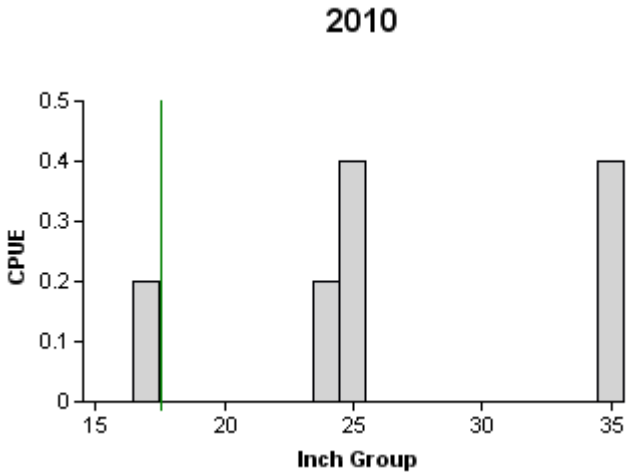
Effort =	5.0
Total CPUE =	15.0 (7; 75)
Stock CPUE =	13.8 (9; 69)
CPUE-12 =	13.0 (11; 65)
CPUE-16 =	4.4 (38; 22)
PSD =	32 (13)

Figure 6. 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 population indices are in parentheses) for spring gill net surveys, Lake Dunlap, Texas, 2006, 2010, and 2014. The vertical line denotes 12-inch minimum length limit.

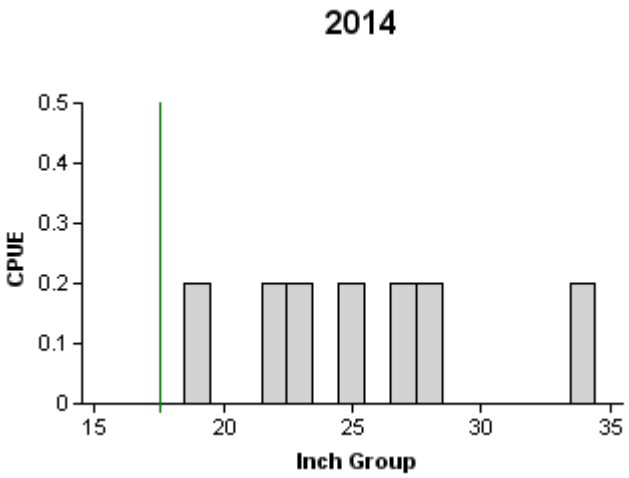
Flathead Catfish



Effort =	5.0
Total CPUE =	1.0 (55; 5)
CPUE-18 =	1.0 (55; 5)
CPUE-24 =	0.4 (100; 2)
PSD =	60 (32.9)



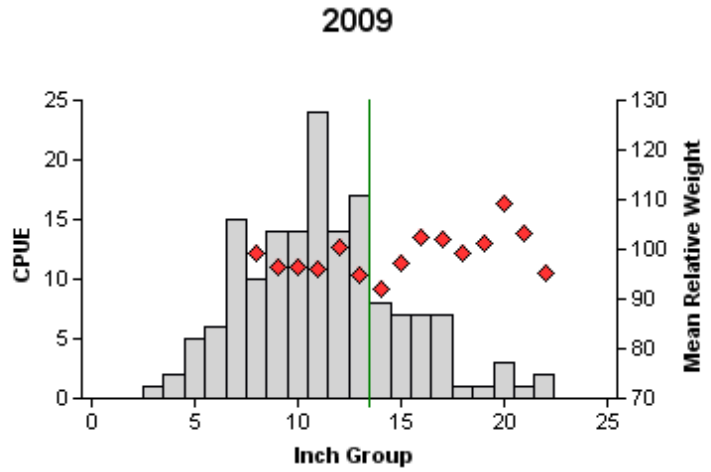
Effort =	5.0
Total CPUE =	1.2 (31; 6)
CPUE-18 =	1.0 (32; 5)
CPUE-24 =	1.0 (32; 5)
PSD =	83 (14.5)



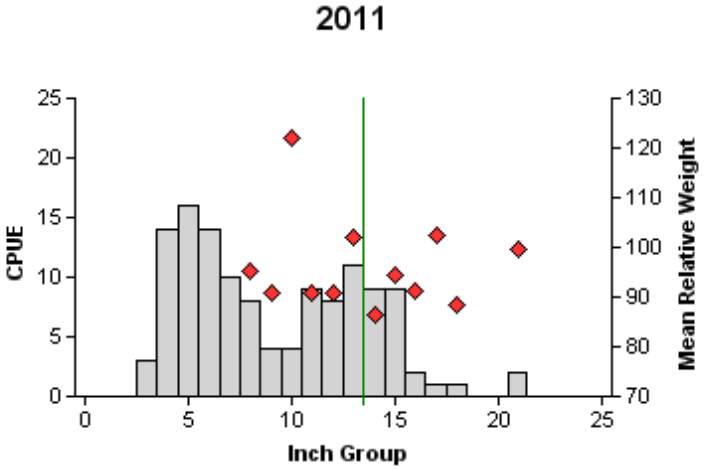
Effort =	5.0
Total CPUE =	1.4 (29; 7)
CPUE-18 =	1.4 (29; 7)
CPUE-24 =	0.8 (47; 4)
PSD =	86 (15.8)

Figure 7. Number of Flathead Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE are in parentheses) for spring gill net surveys, Lake Dunlap, Texas, 2006, 2010, and 2014. The vertical line denotes 18-inch minimum length limit.

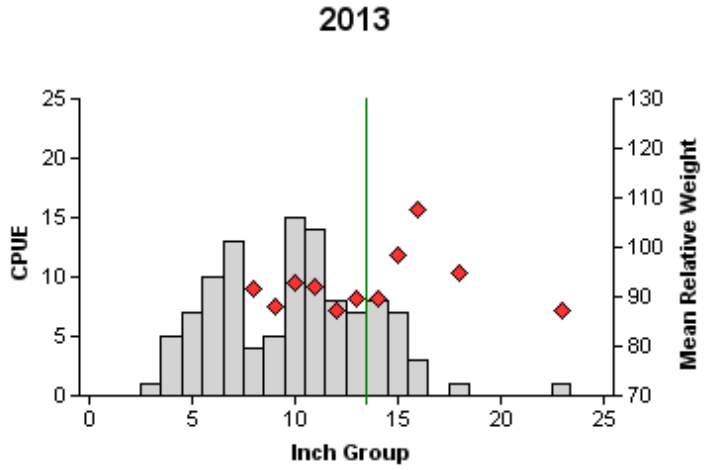
Largemouth Bass



Effort =	1.0
Total CPUE =	159.0 (15; 159)
Stock CPUE =	130.0 (15; 130)
CPUE-14 =	37.0 (23; 37)
CPUE-20 =	6.0 (46; 6)
PSD =	52 (5)



Effort =	1.0
Total CPUE =	125.0 (17; 125)
Stock CPUE =	68.0 (22; 68)
CPUE-14 =	24.0 (27; 24)
CPUE-20 =	2.0 (67; 2)
PSD =	63 (7)



Effort =	1.0
Total CPUE =	109.0 (15; 109)
Stock CPUE =	73.0 (15; 73)
CPUE-14 =	20.0 (29; 20)
CPUE-20 =	1.0 (100; 1)
PSD =	48 (6)

Figure 8. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for population indices are in parentheses) for fall electrofishing surveys, Lake Dunlap, Texas, 2009, 2011, and 2013. The vertical line denotes 14-inch minimum length limit.

Largemouth Bass

Table 6. Mean age at legal length (14-inches) for largemouth bass collected by fall electrofishing, Lake Dunlap. Standard deviations are in parenthesis.

Year	N	Age Range	Age-at-Length
2005	13	2 – 4	2.7 (0.75)
2007	9	2 – 2	2.0 (0.00)
2009	15	1 – 3	1.5 (0.64)
2011	15	2 – 3	2.3 (0.49)
2013	13	1 – 2	1.9 (0.28)

Table 7. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Lake Dunlap, Texas 2003, 2005, 2009, and 2013. FLMB = Florida largemouth bass, NLMB = Northern largemouth bass, Intergrade = hybrid between a FLMB and a NLMB. Electrophoresis analysis was used to determine genetic composition prior to 2005 and micro-satellite DNA analysis since 2005.

		Number of Fish				
Year	Sample size	FLMB	Integrade	NLMB	% FLMB alleles	% Pure FLMB
2003	30	8	20	2	70.8	Unknown
2005	30	5	25	0	66.4	17
2009	16	0	15	1	60.0	0
2013	30	0	30	0	60.0	0

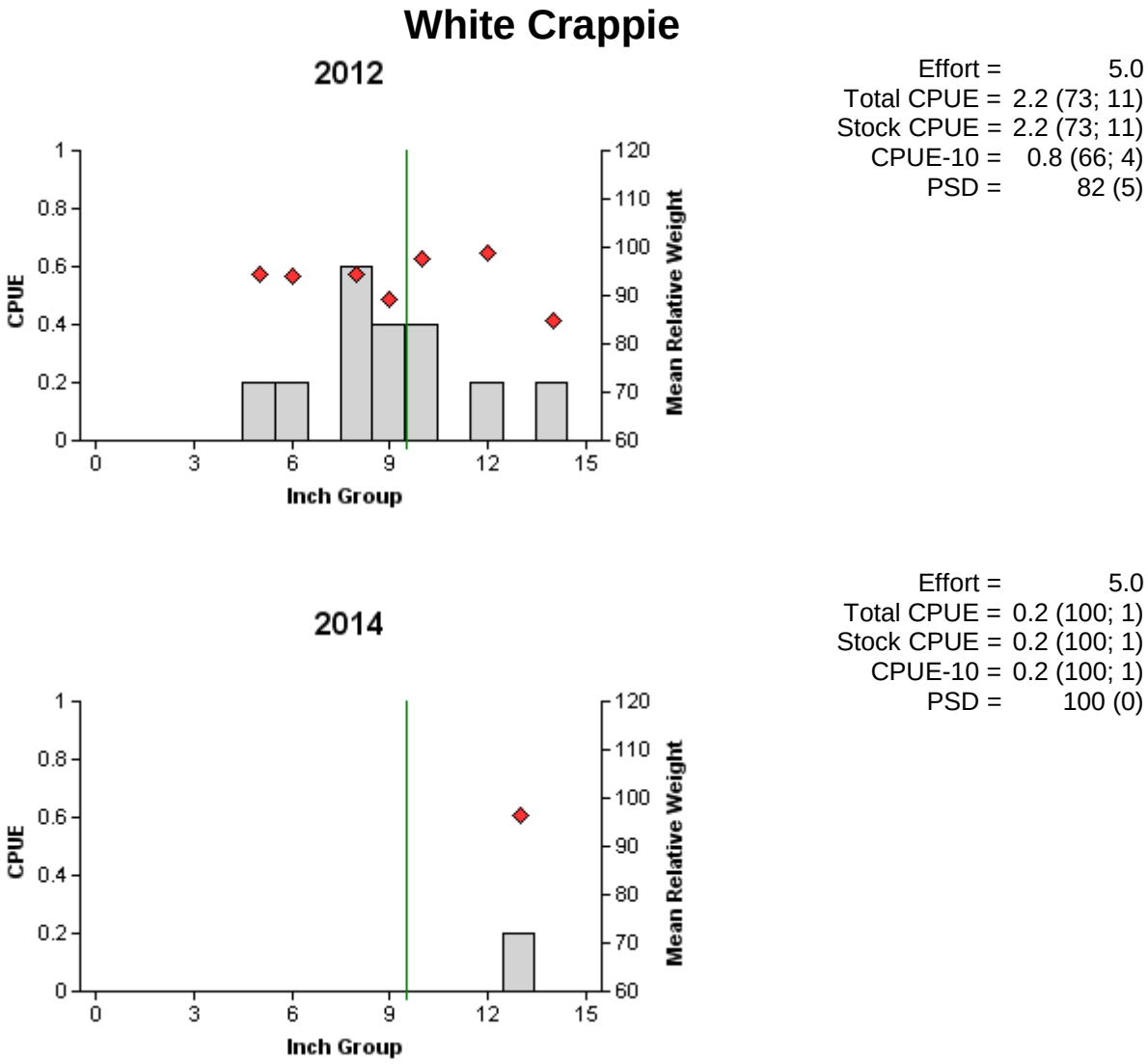


Figure 9. Number of White Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for population indices are in parentheses) for spring trap net surveys using randomly selected stations, Lake Dunlap, Texas, 2012 and 2014. The vertical line denotes 10-inch minimum length limit.

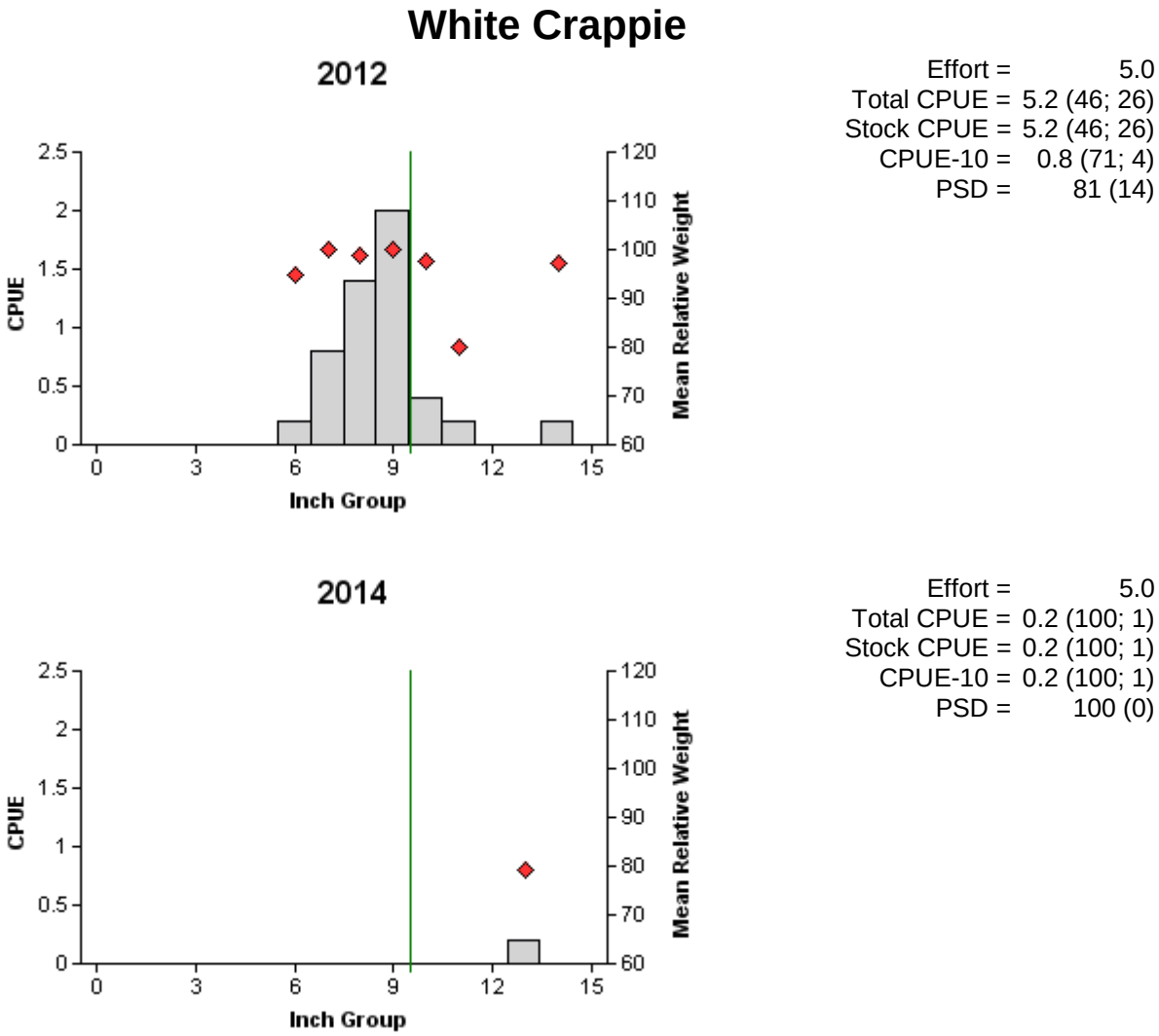


Figure 10. Number of White Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for population indices are in parentheses) for spring trap net surveys using biologist selected stations, Lake Dunlap, Texas, 2012 and 2014. The vertical line denotes 10-inch minimum length limit.

Table 8. Proposed sampling schedule for Lake Dunlap, Texas. Electrofishing and trap net surveys are conducted in the fall and the gill net survey in the spring. Standard survey denoted by S and additional survey denoted by A.

Survey year	Electrofish Fall	Trap net	Gill net	Habitat		Access	Creel survey	Report
				Structural	Vegetation			
2014-2015								
2015-2016	A	A*						
2016-2017								
2017-2018	S	S*	S		S	S		S

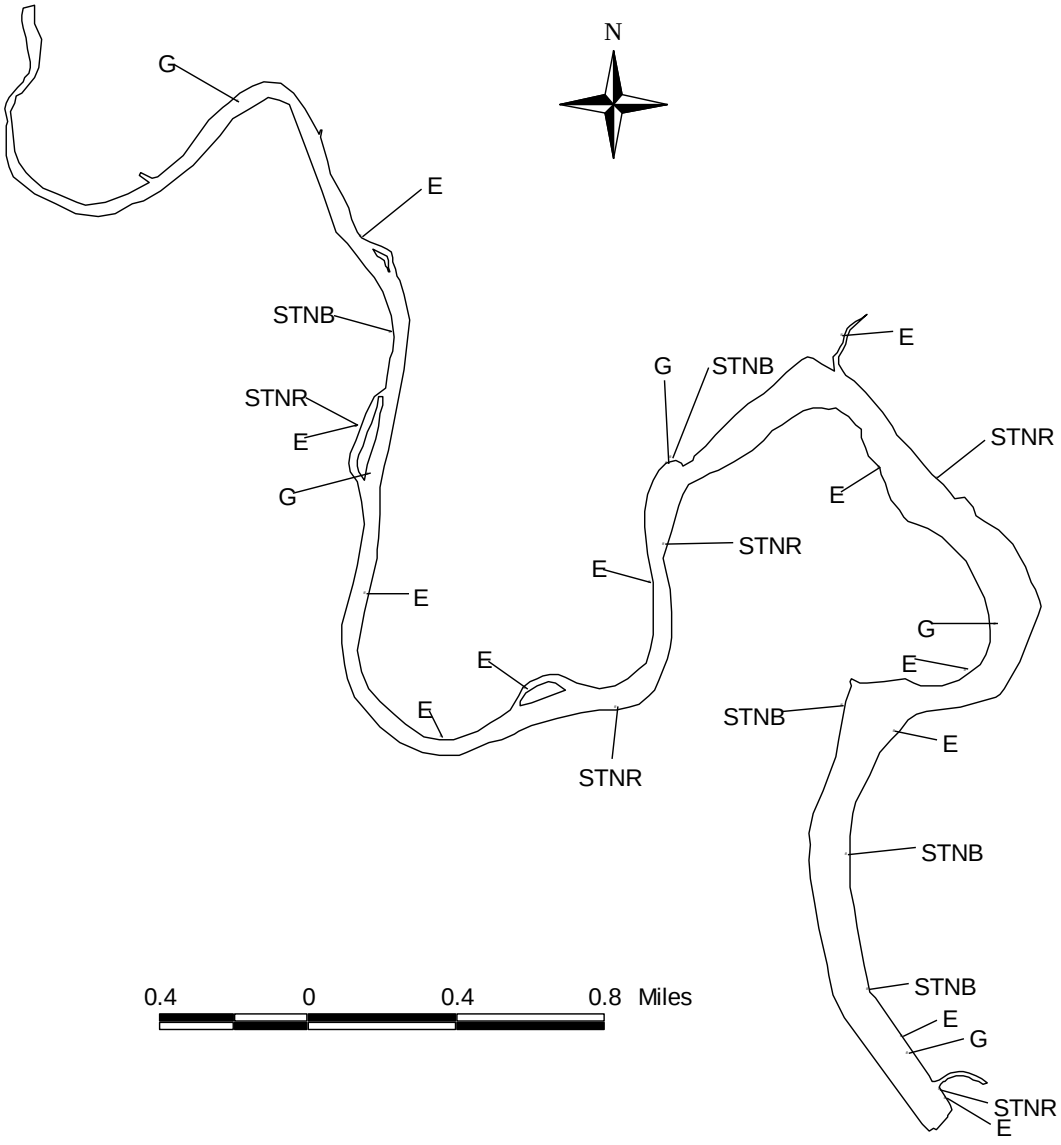
*Trap net surveys will be conducted in the spring at biologist-selected stations.

APPENDIX A

Number (N) and catch rate (CPUE) of all species collected from all gear types from Lake Dunlap, Texas, 2013-2014. Sampling effort was 5 net nights for gill netting, 5 net nights for trap netting at both random and biologist selected stations, and 1 hour for electrofishing.

	Electrofishing		Trap Netting (Random)		Trap Netting (Biologist-selected)		Gill Netting	
Species	N	CPUE	N	CPUE	N	CPUE	N	CPUE
Longnose Gar							17	3.4
Gizzard Shad	91	91.0	1	0.2			113	22.6
Threadfin Shad	19	19.0			4	0.8		
Common Carp							6	1.2
Grass Carp							1	0.2
Inland Silverside	11	11.0						
Blue Catfish							4	0.8
Channel Catfish	3	3.0					75	15.0
Flathead Catfish							7	1.4
Mexican Tetra	12	12.0	4	0.8				
Redbreast Sunfish	143	143.0	3	0.6			1	0.2
Warmouth	7	7.0	4	0.8	2	0.4	1	0.2
Bluegill	169	169.0	95	19.0	40	8.0	2	0.4
Longear Sunfish	69	69.0	6	1.2			1	0.2
Redear Sunfish	62	62.0	11	2.2	5	1.0	18	3.6
Spotted Bass	2	2.0						
Largemouth Bass	109	109.0					13	2.6
Guadalupe Bass	1	1.0						
White Crappie			1	0.2	1	0.2	2	0.4
Rio Grande Cichlid	5	5.0	1	0.2				
Blue Tilapia	4	4.0					25	5.0

APPENDIX B



Location of sampling sites, Lake Dunlap, Texas, 2013-2014. Electrofishing, Spring trap net (random and biologist-selected), and gill net stations are indicated by E, STNR, STNB, and G, respectively. Water level was near full pool at time of sampling.