

PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

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FEDERAL AID PROJECT F-221-M-4

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2013 Fisheries Management Survey Report

Granbury Reservoir

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SURVEY AND MANAGEMENT SUMMARY

Fish Populations in Granbury Reservoir were surveyed in 2013 with electrofishing. Low water levels prevented trap netting surveys in winter 2013 and gill netting surveys in 2014. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir Description:** Granbury Reservoir is an 8,700-acre impoundment located within the Brazos River system in Hood County, Texas. Near constant water level is maintained by a spillway consisting of 16 tainter gates and 2 sluice gates; retention time has been estimated at 260 days. Primary water uses include storage of flood and storm waters, municipal water supply, power plant cooling, and recreation. Granbury Reservoir has only moderate productivity, yet the fishery has been hampered by golden algae since 2001. Habitat features were dominated by extensive bulk heading, natural shoreline and docks/piers.
- **Management history:** Sport fishes in Granbury Reservoir are currently managed with statewide regulations with the exception of a 16-inch minimum length limit on Largemouth Bass. Important sport fish include Largemouth Bass and Striped Bass. Both have been affected by nearly annual, toxic Golden Algal blooms since 2001. Efforts to mitigate these losses included collecting supplemental fisheries data, stocking Striped Bass annually, and stocking Florida Largemouth Bass. Trap netting became optional in 2009, and because of weak crappie catch rates in prior years, it is no longer a primary objective of scheduled sampling. Most recently, a public relations campaign began within the district to inform and educate constituents about zebra mussels in order to prevent their introduction into Granbury Reservoir. Recent low water levels have made monitoring difficult.
- **Fish Community**
 - **Prey species:** Catch rates of all prey species were well below historical averages.
 - **Catfishes:** Low water levels prevented gill netting in 2014. Blue and Channel Catfish were collected in 2012 at 0.1 and 5.8/nn respectively. Body condition of collected individuals remained high. Flathead Catfish remain present in the reservoir.
 - **Temperate basses:** Low water levels prevented gill netting in 2014. White and Striped Bass were collected in 2012 at 0.8 and 0.1/nn respectively. Body condition of collected individuals remained high.
 - **Largemouth Bass:** The Largemouth Bass catch rate was near the historical average, and body conditions were average.
 - **White Crappie:** Trap netting was last conducted in 2005 and White Crappie were present in the reservoir in low numbers. Low water levels prevented trap netting in 2013.
- **Management Strategies:** Continue managing Granbury Reservoir with existing regulations, and continue annual stocking requests for Striped Bass pending reservoir water levels. Work with the Brazos River Authority to improve ramp usability during low water periods. Conduct standard electrofishing and gill netting in 2017 and 2018 respectively and supplemental electrofishing and gill netting in 2015 and 2016. Collect age data from largemouth bass in 2017. Collect crappie data from the 2016 and 2018 gill netting surveys. Conduct aquatic vegetation and access surveys during summer 2017. Continue efforts to educate constituents about zebra mussel issues and protect the reservoir from zebra mussel introductions.

3
INTRODUCTION

This document is a summary of fisheries data collected from Granbury Reservoir 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. Historical data is presented with the 2013-2014 data for comparison.

Reservoir Description

Granbury Reservoir is an 8,700-acre impoundment of the Brazos River, located between Possum Kingdom and Whitney reservoirs in Hood County, Texas. It was constructed in 1969 and is operated and controlled by the Brazos River Authority (BRA). Primary water uses include storage of flood and storm waters, municipal water supply, power plant cooling, and recreation. Granbury Reservoir is moderately eutrophic with a mean and maximum depth of 18.0 and 75.0 feet respectively. Near constant water level is maintained by a spillway consisting of 16 tainter gates and 2 sluice gates; retention time has been estimated at 260 days. Habitat features were dominated by extensive bulk heading, natural shoreline and docks/piers. Native aquatic plants present include Cattail and Bulrush (See Table 1 for other descriptive characteristics of Granbury Reservoir).

Angler Access

Boat access on Granbury Reservoir is adequate and consists of five public boat ramps and several private boat ramps. In April and May of 2013, the public boat ramps at Rough Creek and DeCordova Bend were extended 30' and 25' respectively by the BRA to improve access during drought conditions. In addition, both courtesy docks were rebuilt and the ramp at DeCordova Bend was widened from 14' to 40'. Despite these improvements, boating access was not possible at 4 of the 5 public access sites as of June 2014. Hunter Park is slated for widening from 14' to 40' and the courtesy dock rebuilt in 2014. Unfortunately, the bottom topography is such that it cannot be lengthened (See Table 2 for additional boat ramp characteristics. Public bank access is limited to the five public parks with ramps. Bank anglers have a choice of three "T" fishing piers, with a pier located at Hunter Park, Rough Creek Park and DeCordova Bend.

Management History

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

1. Sample the reservoir biennially for the next four years using electrofishing and gill netting; perform supplemental monitoring as required by severe Golden Algal blooms. Make fishery data available to agencies researching Golden Alga, and cooperate with researchers as needed.
Action: Biennial sampling was maintained on Granbury with the exception of 2011 electrofishing and 2014 gill netting, which were cancelled due to low water levels. Inland Fisheries staff has maintained good working relationships with Golden Alga partners including the BRA, and have shared fishery data upon request. Staff is also active in Golden Alga monitoring on an annual basis.
2. Obtain either a tier III or IV age and growth sample on Largemouth Bass.
Action: Low water levels during fall 2013 electrofishing contributed significantly to low catch rates of Largemouth Bass, which made a tier III or IV age and growth sample impractical.
3. Sample White Crappie in winter 2013.
Action: White Crappie could not be sampled in winter 2013 due to low water levels.
4. Adjust the Striped Bass stocking rates if necessary due to Golden Alga fish kills.
Action: The stocking rates for Striped Bass were changed to 5-fish/acre during the winter

2009 request.

- 5 Cooperate with the BRA to post appropriate invasive species signage at access points throughout the reservoir. Educate marina owners about invasive species and provide them with posters and literature, etc. so that they can educate their customers. Educate the public about invasive species through the use of media and the internet. Make a speaking point about invasive species when presenting to constituent and user groups. Keep track of (i.e., map) all existing and future inter-basin water transfer routes to facilitate potential invasive species responses.

Action: Invasive species signage was posted at Granbury access points during summer 2013. District biologists have made a speaking point about invasive species, how to prevent their spread, and potential effects on Granbury Reservoir while speaking to constituent groups (i.e., Central Texas Flyrodders, Legacy Outfitters, and Brazos River Sportsman's Club). Inter-basin water transfers are a permanent fixture in this report now and will be updated appropriately.

Harvest regulation history: Sport fishes are currently managed with statewide regulations with the exception of a 16-inch minimum length limit on Largemouth Bass (Table 2).

Vegetation/habitat management history: No vegetation/habitat management actions have been performed on Granbury Reservoir, and no problematic species of aquatic vegetation exist in the reservoir.

Stocking history: Striped Bass have been stocked nearly annually since 1972 (Table 3). The Striped Bass stocking rate was changed from 15 to 5/acre in 2009 due to a perceived low usage by anglers in response to chronic golden alga fish kills. A large (208,273) number of Florida Largemouth Bass were stocked to mitigate cumulative losses from fish kills associated with golden alga (See Table 4 for the complete stocking history).

Water Transfer: Granbury Reservoir is primarily used for storage of flood and storm waters, municipal water supply, power plant cooling, and recreation. There are currently two major pumping stations on the reservoir which transfer water to other sites. The first is operated by Luminant, formally known as TXU Electric Company, which uses untreated water from Granbury for nuclear power plant operations on Squaw Creek. The other is operated by the Authority's Lake Granbury Surface Water and Treatment System (SWATS), which supplies treated water to several municipalities in Hood and Johnson Counties. No additional diversions are known at this time.

METHODS

Fishes were collected by electrofishing (1.5 hours at 18, 5-min stations) and gill netting (10 net nights at 10 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 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 2011).

Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD), terminology modified by Guy et al. (2007)], 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). Standard error (SE) was calculated for structural indices and IOV. Relative standard error (RSE = 100 X (SE of the estimate)/estimate) was calculated for all CPUE statistics. Fish aging became optional in 2004, and no age and growth data have been collected from sport fishes since then.

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 from 2005 through 2012 and electrophoresis for

previous years.

The source for water level data was the United States Geological Survey (USGS 2014).

RESULTS AND DISCUSSION

Habitat: Littoral zone habitat consisted primarily of extensive bulk heading, boat docks, standing timber, dead trees and stumps, and limited amounts of natural shoreline. The number of boat docks and piers was estimated at 2,896 by remote sensing and was later ground-truthed. Structural habitat was surveyed in 2010 and a side scan sonar survey was conducted during summer 2012 (Tables 5 and 6, Appendix D). Low water levels jeopardized woody habitat within the reservoir, so a letter recommending habitat protection was provided to the BRA. Those recommendations were adopted by the BRA, which prevented wide-scale woody habitat removal as water levels fell.

Creel: No creels were conducted during this survey period.

Prey species: Gizzard Shad were collected by electrofishing at 150.7/h in 2013 (Figure 2), which was similar to the historical average (168.0/h; Appendix B). Threadfin Shad were not collected during 2013. The IOV for Gizzard Shad was lower than the previous survey, and 69% of Gizzard Shad were available to existing predators as forage (Figure 2). Bluegill were collected in low numbers (Figure 3).

Catfishes: Low water levels prevented gill netting for catfishes in 2014. Blue Catfish were collected with gill nets at 0.1/nn in 2012, and this catch rate equates to a single collected individual which was legal size and in good condition (Figure 4).

Channel Catfish were collected with gill nets at 5.8/nn in 2012 (Figure 5). This catch rate equates to 58 collected individuals and was near the historical average of 7.6/nn (Appendix B). Proportional size distribution was good, indicating balanced recruitment, growth, and mortality rates. Most Channel Catfish sampled were legal size, although few approached the preferred size category of 24 inches. Body condition was excellent (Figure 5).

One Flathead Catfish was also observed during 2012 sampling.

Temperate basses: Low water levels prevented gill netting for temperate bass in 2014. White Bass were collected with gill nets at 0.8/nn in 2012 (Figure 6). This catch rate equates to 8 collected individuals and was below the historical average of 2.6/nn (Appendix B). Proportional size distribution was 100, indicating a skewed population of larger individuals with poor recruitment, likely due to lower water conditions over the past 2 years. Body condition was good (Figure 6).

Striped Bass were collected with gill nets at 0.1/nn in 2012. This catch rate is from a single collected fish in excellent condition and was much less than the catch rate observed in 2010 (2.9/nn; Figure 7).

Largemouth Bass: Largemouth Bass were collected by electrofishing at 35.0/h in 2013 (Figure 8). This catch rate equates to 52 collected individuals and was similar to the historical average of 39.0/h (Appendix B). Proportional size distribution (60) was good, indicating a balanced population. The proportion of individuals 16-inches and larger was 10, indicating the presence of harvestable bass for anglers. Body condition was excellent for smaller size classes, but declined with increasing lengths (Figure 8). Largemouth Bass genetics were analyzed in 2013 and showed good Florida influence (49%; Table 7).

White Crappie: Low water levels prevented trap netting for White Crappie in 2013. See Appendix B for historical catch rates.

Fisheries management plan for Granbury Reservoir, Texas

Prepared – July 2010

ISSUE 1: Despite BRA extending ramps at Rough Creek and Decordova Bend in 2013, boating access was not possible at 4 of 5 public access sites as of June 2014. Only City Park ramp was open.

MANAGEMENT STRATEGY

1. Discuss the possibility of extending ramps further with the BRA.

ISSUE 2: 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.

MANAGEMENT STRATEGIES

1. Cooperate with the City of Granbury and the BRA to maintain appropriate invasive species signage at access points around the reservoir.
2. Educate the public about invasive species through the use of media and the internet.
3. Make a speaking point about invasive species when presenting to constituent and user groups.
4. Keep track of (i.e., map) existing and future inter-basin water transfers to facilitate potential invasive species responses.

ISSUE 3: Largemouth bass are the most popular sport fish species in the reservoir, and age and growth information is eight years old. Chronic Golden Alga issues and fish kills have prevented age and growth samples from being conducted.

MANAGEMENT STRATEGY

1. Pending the number and severity of Golden Alga fish kills and water levels over the next three years, obtain either a category III or category IV age and growth sample in 2017.

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule includes general monitoring with electrofishing and gill netting in 2017 and 2018, supplemental monitoring with electrofishing and gill netting in 2015 and 2016, and aquatic vegetation and access surveys in summer 2017 (Table 8).

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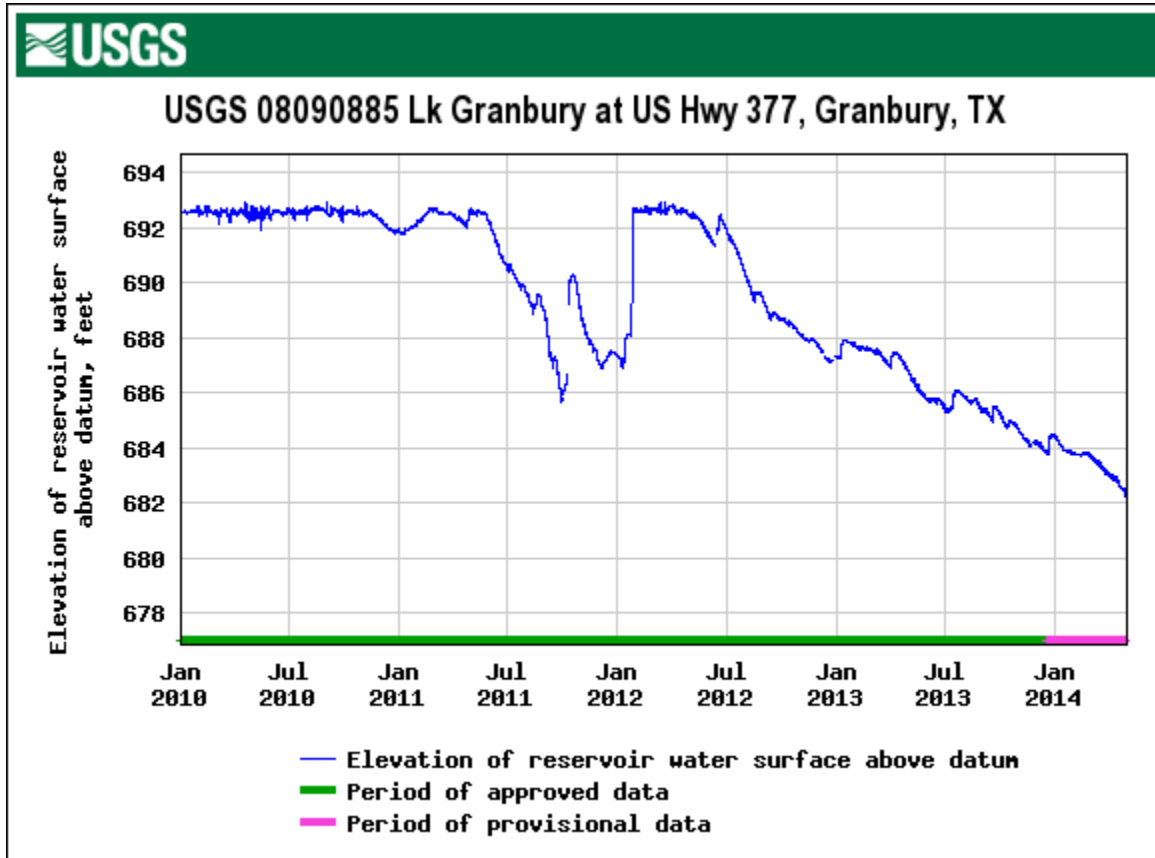


Figure 1. Daily mean water levels for Granbury Reservoir, from January 1, 2010 through May 1, 2014. Conservation pool level (693 feet above mean sea level).

Table 1. Characteristics of Granbury Reservoir, Texas.

| Characteristic | Description |
|-----------------------------------|------------------------------|
| Year Constructed | 1969 |
| Controlling authority | Brazos River Authority (BRA) |
| Counties | Hood |
| Reservoir type | Mainstem |
| Shoreline Development Index (SDI) | 8.4 |
| Conductivity | 2400 umhos/cm |

Table 2. Boat ramp characteristics for Granbury Reservoir, Texas, 2013. Latitude and longitude are in decimal degrees. Low water levels can impact ramp usability.

| Boat ramp | Latitude; Longitude | Public? | Parking capacity | Condition |
|----------------|-------------------------------|---------|------------------|-------------------|
| Thorp Spring | 32.473392°N -97.814767°W | Y | 24 | 1 lane ramp; good |
| Hunter Park | 32.477817 °N -97.795361 °W | Y | 18 | 1 lane ramp; good |
| City Park | 32.443856 °N -97.770953 °W | Y | 44 | 3 lane ramp; good |
| Rough Creek | 32.418144 °N -97.786306 °W | Y | 27 | 4 lane ramp; good |
| DeCordova Bend | 32.377314 °N -97.691633 °W | Y | 24 | 3 lane ramp; good |

Table 3. Harvest regulations for Granbury Reservoir, Texas, 2013.

| Species | Bag Limit | Length limit (inches) |
|---|----------------------|-----------------------|
| Catfish: Channel and Blue Catfish, their hybrids and subspecies | 25 (any combination) | 12" minimum |
| Catfish, Flathead | 5 | 18" minimum |
| Bass, White | 25 | 10" minimum |
| Bass, Striped | 5 | 18" minimum |
| Bass, Largemouth | 5 ^a | 16" minimum |
| Bass, Spotted | 5 ^a | No minimum |
| Crappie: White and Black Crappie, their hybrids and subspecies | 25 (any combination) | 10" minimum |

^a Daily bag limit for Largemouth Bass and Spotted Bass = 5 fish in any combination.

Table 4. Stocking history of Granbury, Texas. Life stages are fry (FRY), fingerlings (FGL), advanced fingerlings (AFGL), adults (ADL) and unknown (UNK). Life stages for each species are defined as having a mean length that falls within the given length range. For each year and life stage the species mean total length (Mean TL; in) is given. For years where there were multiple stocking events for a particular species and life stage the mean TL is an average for all stocking events combined.

| Species | Year | Number | Life Stage | Mean TL (in) |
|-------------------------|-------------|---------------|-------------------|---------------------|
| Blue Catfish | 1991 | 86,343 | FGL | 2.5 |
| | Total | 86,343 | | |
| Channel Catfish | 1969 | 374,675 | AFGL | 7.9 |
| | 1993 | 300 | AFGL | 4.9 |
| | Total | 374,975 | | |
| Florida Largemouth Bass | 1986 | 8,178 | FRY | 0.9 |
| | 1989 | 212,290 | FGL | 1.3 |
| | 1989 | 212,234 | FRY | 0.9 |
| | 1994 | 435,331 | FGL | 1.1 |
| | 1995 | 435,924 | FGL | 1.4 |
| | 2003 | 425,723 | FGL | 1.3 |
| | 2004 | 214,164 | FGL | 1.6 |
| | 2008 | 208,273 | FGL | 1.5 |
| Total | 2,152,117 | | | |
| Largemouth Bass | 1969 | 126,640 | UNK | UNK |
| | 1970 | 1,700,000 | FRY | 0.7 |
| | 1972 | 30,160 | UNK | UNK |
| | 1993 | 200 | AFGL | 4.9 |
| | Total | 1,857,000 | | |
| Striped Bass | 1972 | 27,250 | FGL | 1.7 |
| | 1973 | 172,970 | FGL | 1.7 |
| | 1974 | 85,000 | FGL | 1.7 |
| | 1975 | 39,998 | UNK | UNK |
| | 1976 | 86,154 | UNK | UNK |
| | 1979 | 85,791 | UNK | UNK |
| | 1981 | 100,502 | UNK | UNK |
| | 1983 | 176,332 | UNK | UNK |
| | 1989 | 87,000 | FGL | 1.5 |
| | 1990 | 93,315 | FGL | 1.5 |
| | 1994 | 143,656 | FGL | 1.2 |
| | 1995 | 43,807 | FGL | 1.3 |
| | 1997 | 87,068 | FGL | 1.3 |
| | 1998 | 88,206 | FGL | 1.3 |
| | 1999 | 88,121 | FGL | 1.4 |
| | 2000 | 44,000 | FGL | 1.4 |
| 2001 | 2,100,000 | FRY | 0.8 | |
| 2002 | 174,657 | FGL | 1.6 | |

| Species | Year | Number | Life Stage | Mean TL (in) |
|----------------|-------------|------------------|-------------------|---------------------|
| | 2003 | 85,444 | FGL | 1.5 |
| | 2004 | 43,271 | FGL | 1.5 |
| | 2005 | 125,155 | FGL | 1.7 |
| | 2006 | 127,280 | FGL | 1.6 |
| | 2007 | 125,278 | FGL | 1.4 |
| | 2008 | 126,079 | FGL | 1.8 |
| | 2009 | 44,864 | FGL | 1.8 |
| | 2010 | 46,165 | FGL | 1.9 |
| | 2010 | 415,763 | FRY | 0.2 |
| | 2013 | 66,462 | FGL | 2.1 |
| | 2013 | 400,000 | FRY | 0.2 |
| | Total | <u>5,329,588</u> | | |

Table 5. Survey of structural habitat types, Granbury Reservoir, Texas, 2010. Shoreline habitat type units are in miles.

| Habitat type | Estimate | % of total |
|-------------------------------|------------|------------|
| Bulkhead | 81.5 miles | 42.3 |
| Boat docks/piers | 7.0 miles | 3.7 |
| Natural | 61.9 miles | 32.6 |
| Rocky shoreline (rocks > 4") | 25.0 miles | 13.2 |
| Gravel shoreline (rocks < 4") | 0.10 miles | 0.10 |

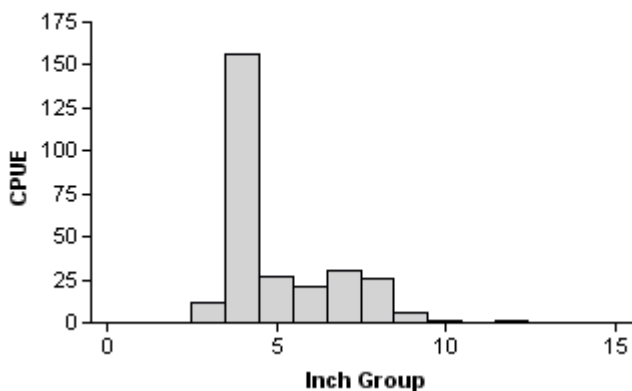
Table 6. Survey of aquatic vegetation, Granbury Reservoir, Texas, 2010 and 2013. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

| Vegetation | 2010 | 2013 |
|------------------------|-------------|-------|
| Native submersed | -- | 0.0 |
| Native floating-leaved | -- | 0.0 |
| Native emergent | 20.3 (0.23) | trace |

Gizzard Shad

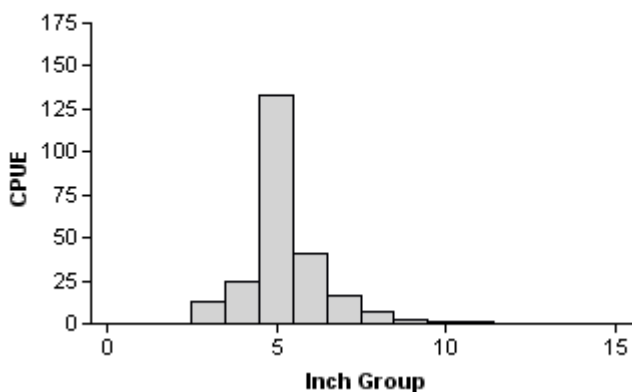
2007

Effort = 1.5
 Total CPUE = 279.3 (36; 419)
 Stock CPUE = 62.0 (36; 93)
 IOV = 89 (7.6)



2009

Effort = 1.5
 Total CPUE = 240.7 (18; 361)
 Stock CPUE = 28.7 (28; 43)
 IOV = 95 (1.8)



2013

Effort = 1.5
 Total CPUE = 150.7 (25; 226)
 Stock CPUE = 114.7 (30; 172)
 IOV = 69 (5.9)

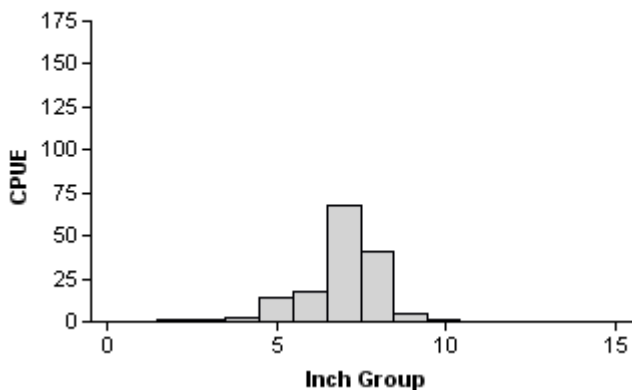
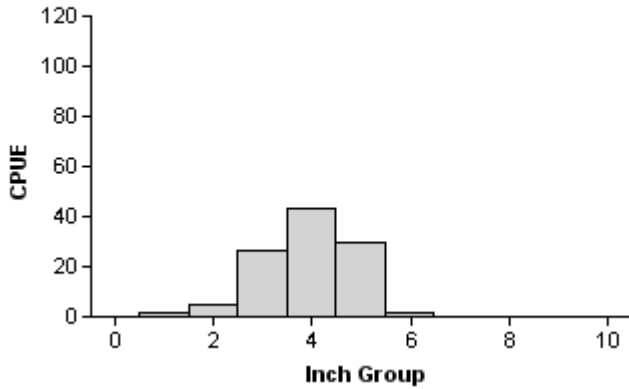


Figure 2. Number of Gizzard Shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for IOV are in parentheses) for fall electrofishing surveys, Granbury Reservoir, Texas, 2007, 2009, and 2013.

Bluegill

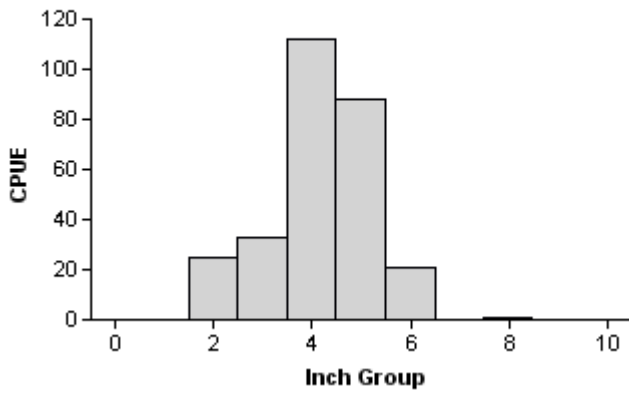
2007

Effort = 1.5
 Total CPUE = 108.7 (23; 163)
 Stock CPUE = 102.0 (25; 153)
 PSD = 2 (1.2)



2009

Effort = 1.5
 Total CPUE = 278.7 (21; 418)
 Stock CPUE = 254.0 (22; 381)
 PSD = 8 (2.2)



2013

Effort = 1.5
 Total CPUE = 8.7 (37; 13)
 Stock CPUE = 8.7 (37; 13)
 PSD = 31 (12.9)

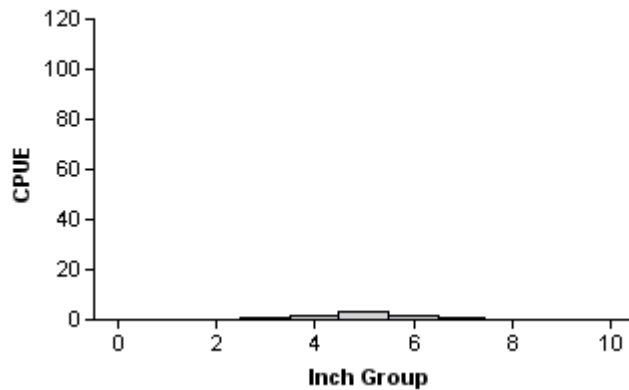
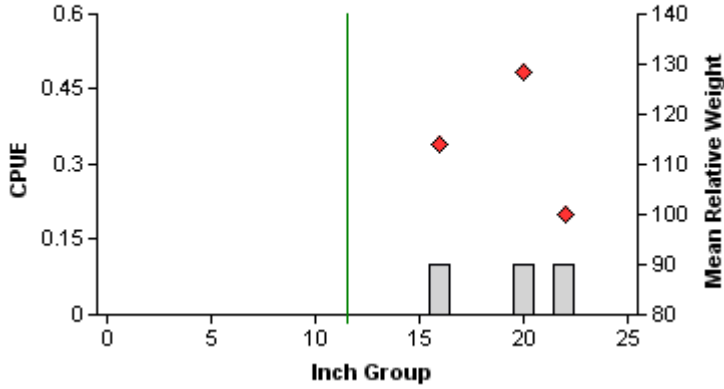


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Granbury Reservoir, Texas, 2007, 2009, and 2013.

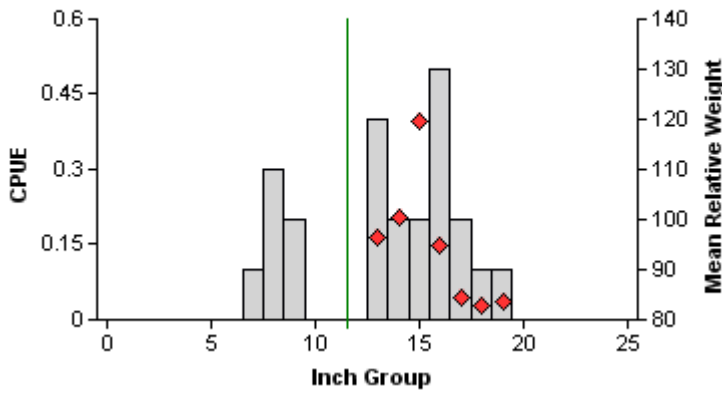
Blue Catfish

2004



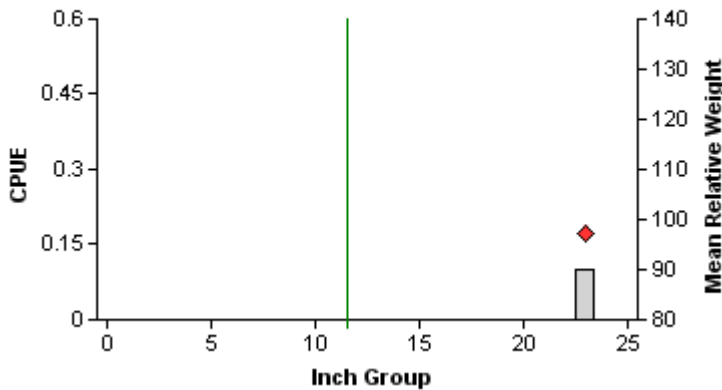
Effort = 10.0
 Total CPUE = 0.3 (71; 3)
 Stock CPUE = 0.3 (71; 3)
 PSD = 67 (16.7)
 PSD-12 = 100 (0)

2010



Effort = 10.0
 Total CPUE = 2.3 (25; 23)
 Stock CPUE = 1.7 (35; 17)
 PSD = 0 (56.5)
 PSD-12 = 100 (0)

2012

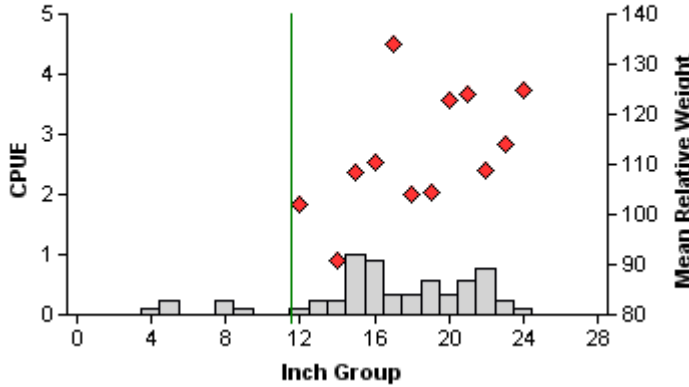


Effort = 10.0
 Total CPUE = 0.1 (100; 1)
 Stock CPUE = 0.1 (100; 1)
 PSD = 100 (0)
 PSD-12 = 100 (0)

Figure 4. Number of Blue Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Granbury Reservoir, Texas, 2004, 2010 and 2012. Minimum length limit represented by vertical line.

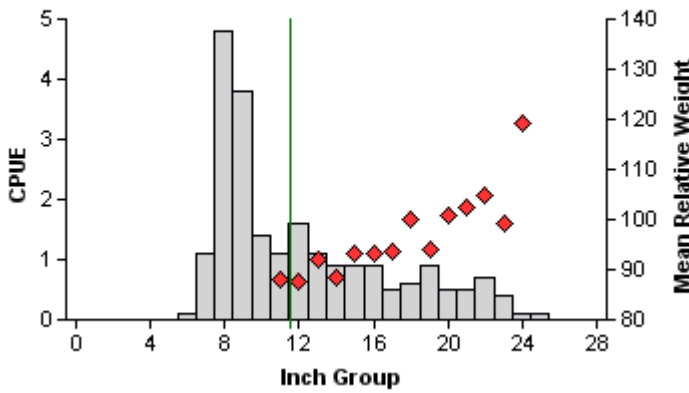
Channel Catfish

2008



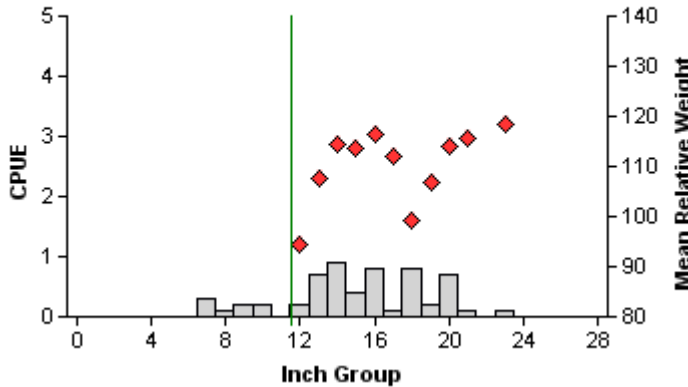
Effort = 9.0
 Total CPUE = 6.3 (22; 57)
 Stock CPUE = 5.7 (24; 51)
 PSD = 73 (4.9)
 PSD-12 = 100 (0)

2010



Effort = 10.0
 Total CPUE = 22.0(12;220)
 Stock CPUE = 10.8(23;108)
 PSD = 48 (3.8)
 PSD-12 = 90 (1.9)

2012



Effort = 10.0
 Total CPUE = 5.8 (19; 58)
 Stock CPUE = 5.0 (17; 50)
 PSD = 56 (10.9)
 PSD-12 = 100 (0)

Figure 5. Number of Channel Catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Granbury Reservoir, Texas, 2008, 2010 and 2012. Minimum length limit represented by vertical line.

White Bass

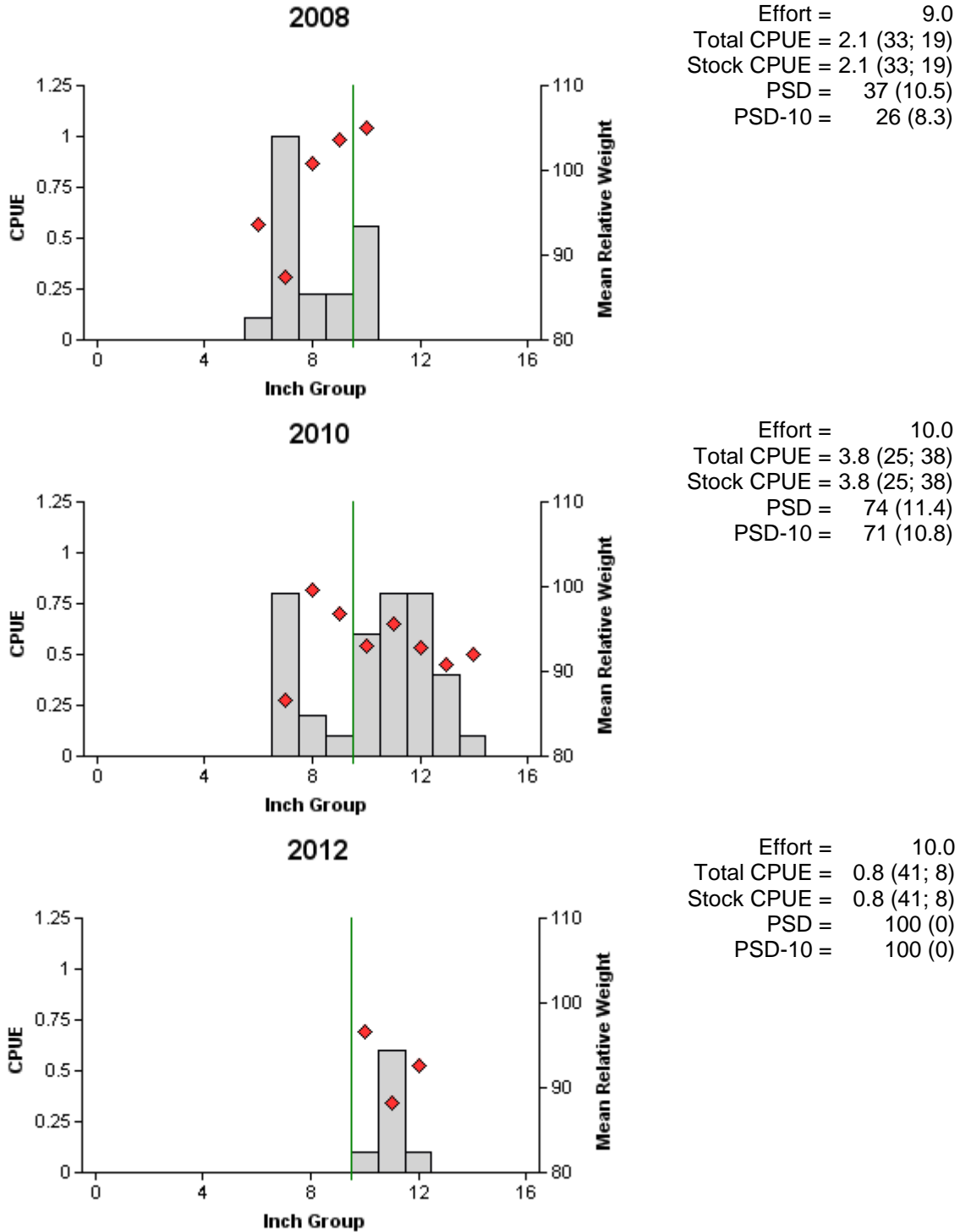
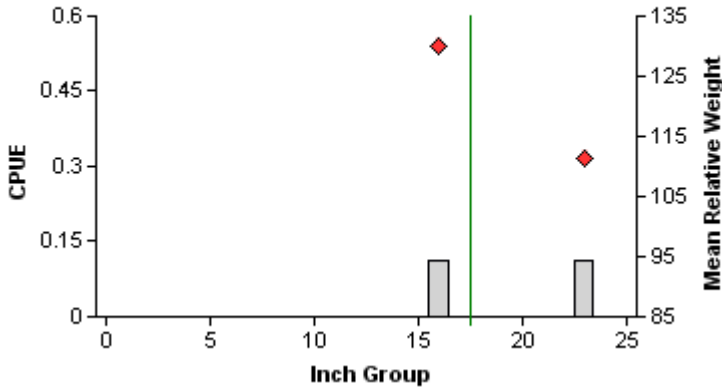


Figure 6. Number of White Bass caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Granbury Reservoir, Texas, 2008, 2010, and 2012. Minimum length limit represented by vertical line.

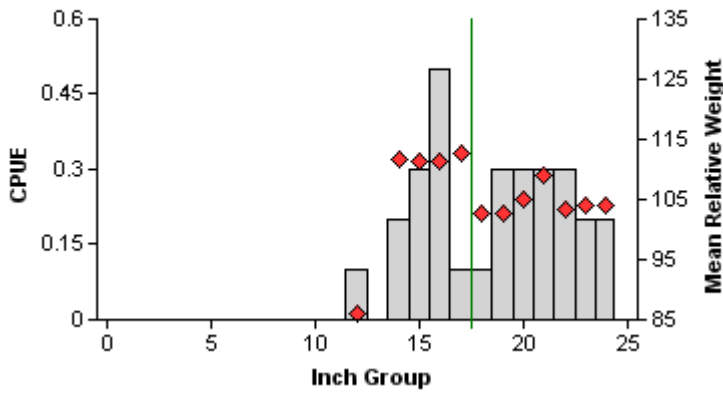
Striped Bass

2008



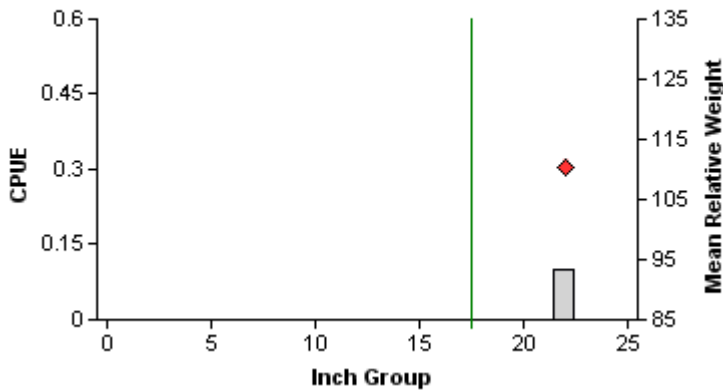
Effort = 9.0
 Total CPUE = 0.2 (66;2)
 Stock CPUE = 0.2 (66;2)
 PSD = 50 (37.5)
 PSD-18 = 50 (37.5)

2010



Effort = 10.0
 Total CPUE = 2.9(29;29)
 Stock CPUE = 2.9(29;29)
 PSD = 45 (12)
 PSD-18 = 59 (17.1)

2012

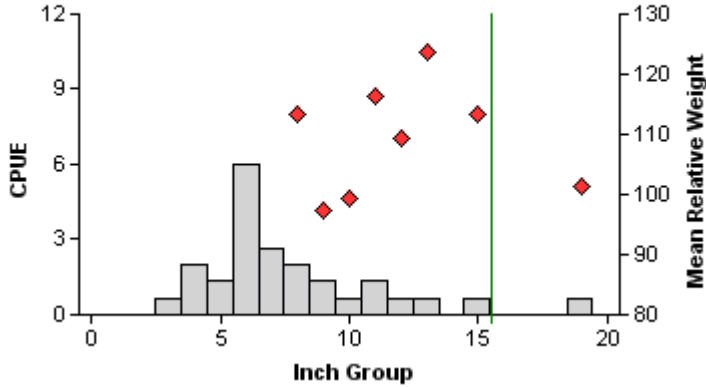


Effort = 10.0
 Total CPUE = 0.1 (100; 1)
 Stock CPUE = 0.1 (100; 1)
 PSD = 100 (0)
 PSD-18 = 100 (0)

Figure 7. Number of Striped Bass caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Granbury Reservoir, Texas, 2008, 2010, and 2012. Minimum length limit represented by vertical line.

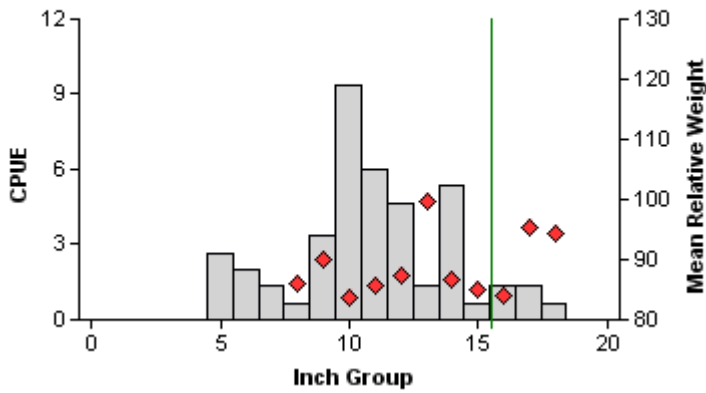
Largemouth Bass

2007



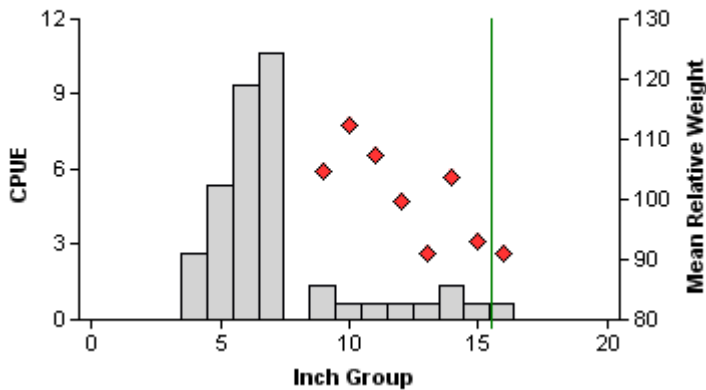
Effort = 1.5
 Total CPUE = 20.7 (26; 31)
 Stock CPUE = 8.0 (42; 12)
 PSD = 33 (10.7)
 PSD-16 = 8 (6.4)

2009



Effort = 1.5
 Total CPUE = 40.7 (16; 61)
 Stock CPUE = 34.7 (17; 52)
 PSD = 44 (5.5)
 PSD-16 = 10 (3.7)

2013



Effort = 1.5
 Total CPUE = 34.7 (21; 52)
 Stock CPUE = 6.7 (36; 10)
 PSD = 60 (13.3)
 PSD-16 = 10 (9.1)

Figure 8. Number of Largemouth Bass caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Granbury Reservoir, Texas, 2007, 2009 and 2013. Minimum length limit represented by vertical line.

Table 7. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Granbury Reservoir, Texas, 2003, 2005, 2007, and 2013. FLMB = Florida Largemouth Bass, NLMB = Northern Largemouth Bass, Intergrade = hybrid between a FLMB and a NLMB. Genetic composition was determined by electrophoresis prior to 2005 and with micro-satellite DNA analysis since 2005.

| Year | Sample size | Number of fish | | | % FLMB alleles | % FLMB |
|------|-------------|----------------|------------|------|----------------|--------|
| | | FLMB | Intergrade | NLMB | | |
| 2003 | 30 | 0 | 26 | 4 | 39 | 0 |
| 2005 | 28 | 1 | 26 | 1 | 51 | 4 |
| 2007 | 23 | 0 | 20 | 3 | 26 | 0 |
| 2013 | 29 | 0 | 30 | 0 | 49 | 0 |

Table 8. Proposed sampling schedule for Granbury Reservoir, Texas. Survey period is June through May. 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.

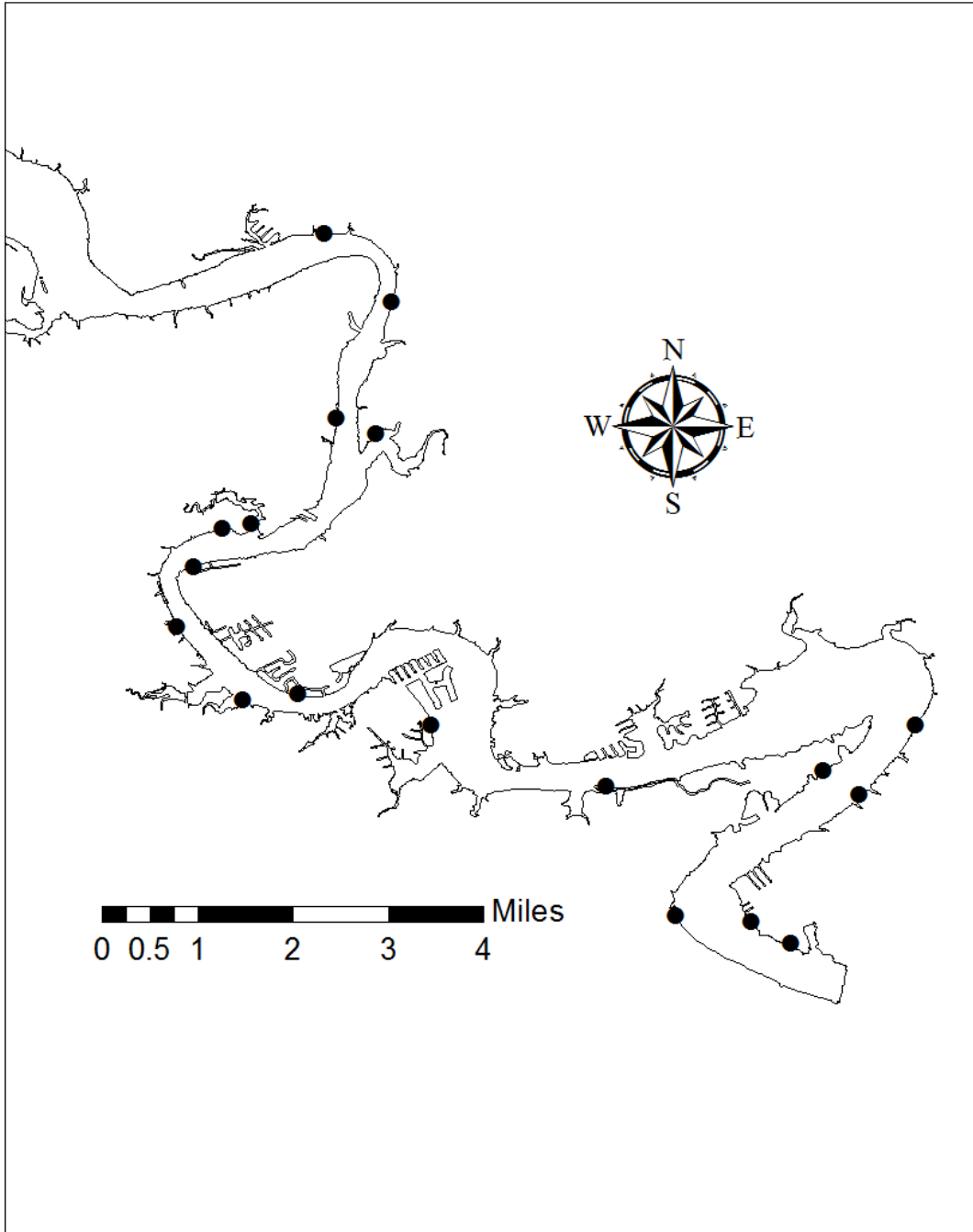
| Survey year | Electrofishing Fall(Spring) | Trap net | Gill net | Habitat | | | Creel survey | Report |
|-------------|--------------------------------|----------|----------|------------|------------|--------|--------------|--------|
| | | | | Structural | Vegetation | Access | | |
| 2014-2015 | | | | | | | | |
| 2015-2016 | A | | A | | | | | |
| 2016-2017 | | | | | | | | |
| 2017-2018 | S | | S | | S | S | | S |

APPENDIX A

Number (N) and catch rate (CPUE) of all target species collected from electrofishing from Granbury Reservoir, Texas, 2013. Sampling effort was 1 hour for electrofishing.

| Species | Electrofishing | |
|-----------------|----------------|-------|
| | N | CPUE |
| Gizzard Shad | 226 | 150.7 |
| Bluegill | 13 | 8.7 |
| Longear Sunfish | 1 | 0.7 |
| Redear Sunfish | 8 | 8.0 |
| Largemouth Bass | 52 | 34.7 |

APPENDIX C



Location of sampling sites, Granbury Reservoir, Texas, 2013. Electrofishing stations are indicated by circles. Water level was approximately 8 feet low at time of sampling.

APPENDIX D

Figures 1 through 4 represent summaries of data collected during June, 2012 as part of a habitat and access assessment for all BRA reservoirs. Data was collected using Hummingbird Side scan imaging and processed using ArcView and Dr. Depth. These figures were part of Appendix G-5 in the BRA operating plan titled "Operating guidelines to manage impacts on fisheries from reservoir level fluctuations" (2012).

Figure 1. Elevation specific littoral zone (< 6 ft. water depth) coverage in Lake Granbury, Texas, for upper, middle, and lower reservoir reaches and all reaches combined.

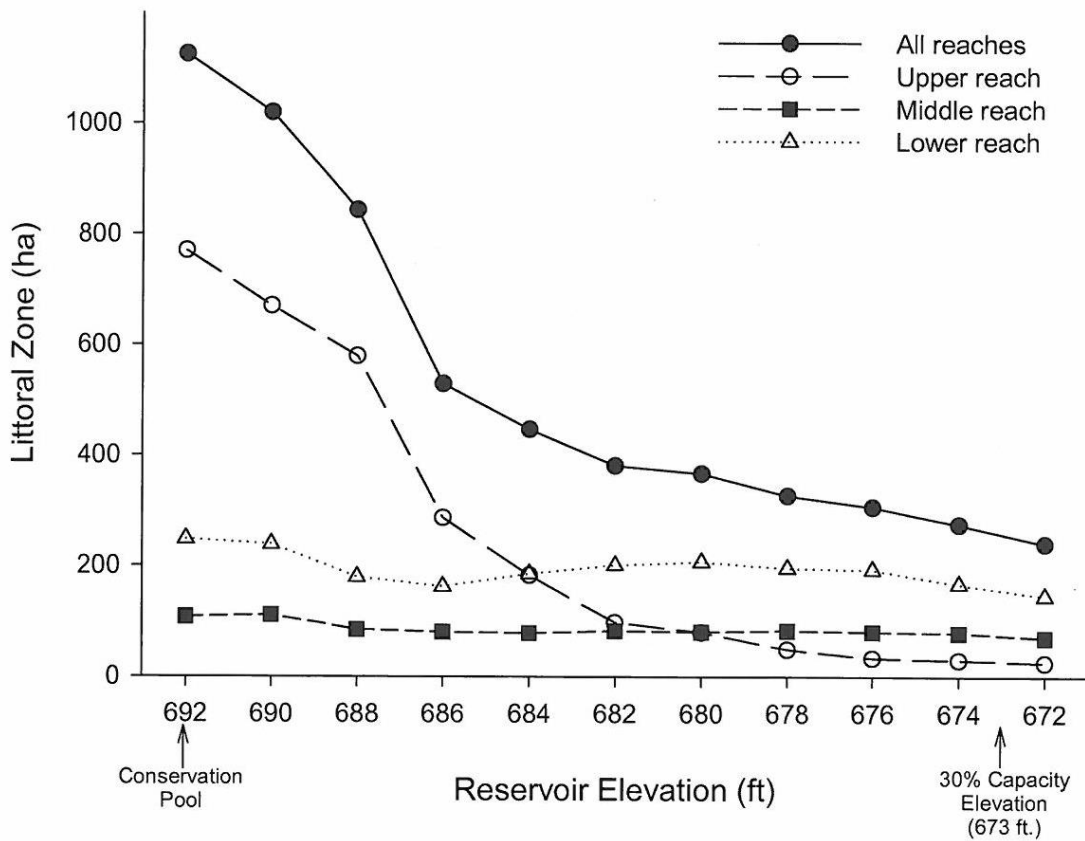


Figure 2. Elevation specific littoral zone (< 6 ft. water depth) coarse substrate availability in Lake Granbury, Texas.

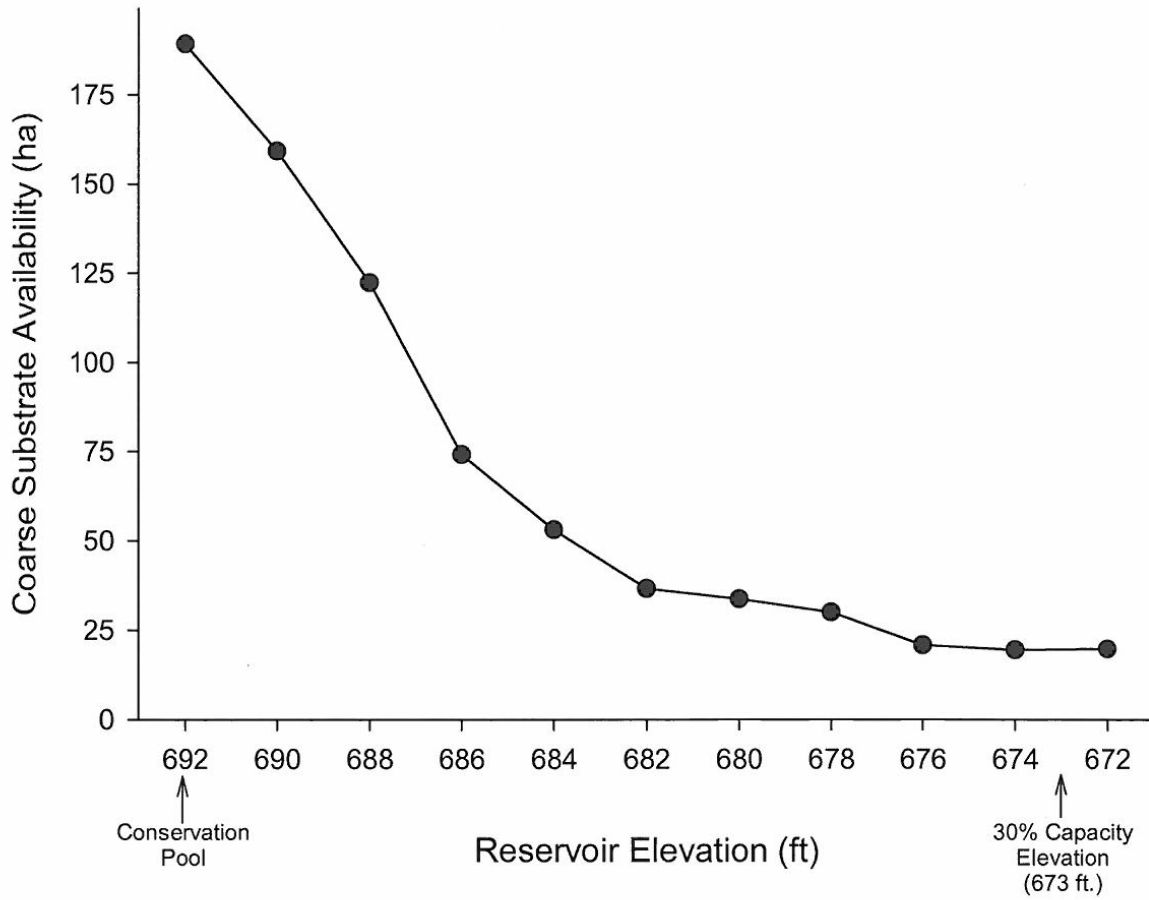


Figure 3. Elevation specific littoral zone (< 6 ft. water depth) woody and vegetative habitat availability in Lake Granbury, Texas. Woody habitat was defined as one inundated standing tree, downed tree, or brush pile attractor.

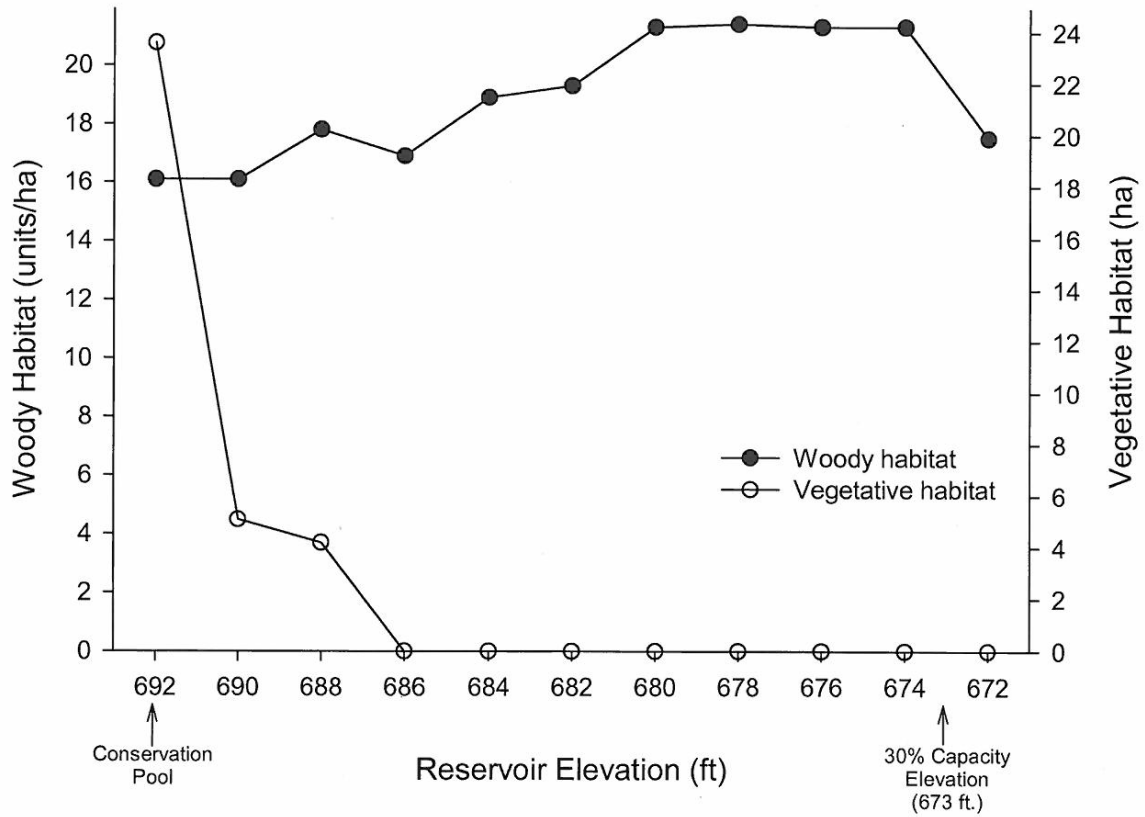


Figure 4. Elevation specific boat accessibility in Lake Granbury, Texas. The number of usable boat launches provided above each bar.

