PERFORMANCE REPORT

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FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-6

STATEWIDE FRESHWATER FISHERIES MONITORING AND MANAGEMENT PROGRAM

2015 Fisheries Management Survey Report

Mexia Reservoir

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Mexia Reservoir were surveyed during summer and fall 2015 using tandem hoop nets and boat electrofishing respectively, and during winter and spring 2016 using trap nets and gill nets. Historical data are presented with the 2015-2016 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:** Mexia Reservoir is a 1,009-acre impoundment located on the Navasota River within the Brazos River Basin, Limestone County. Water level has been within 6 feet of conservation pool (448.3) since 2011. The water level was 1 to 1.5' below conservation pool during the 2015 surveys, and at or near conservation pool during the 2016 surveys. Habitat features consisted of natural shoreline, rocky shoreline, bulkhead and boat docks and piers.

- **Management History:** Important sport fish include Largemouth Bass, Channel Catfish and White Crappie. Sport fish have always been managed with statewide regulations. Blue Catfish were originally stocked in 1975; then again in 1995 and 1996, but failed to produce a viable sport fishery. Since Blue Catfish were an appropriate choice for a supplemental top predator in this shallow reservoir, fingerlings were again stocked in 2008 to try and establish a population. A follow-up gill net survey in 2012 showed recruitment to the gear and record numbers of Blue Catfish in the collection. Full aquatic vegetation and shoreline habitat surveys were conducted in 2011. Recent management efforts have included sharing information about the reservoir's loss of volume (through erosion and sedimentation within its watershed) with Texas Parks and Wildlife Department's (TPWD's) habitat branch and others who could take-on the issue on a watershed scale, and cooperating with the controlling authority to post appropriate signage at access points to try and prevent the spread of the invasive zebra mussel into the reservoir.

- **Fish Community**
  - **Prey species:** Threadfin and Gizzard Shad were present in the reservoir in good numbers, and most Gizzard Shad were available as prey to sport fish. Other forage species included Bluegill, Longear Sunfish and Green Sunfish. Larger-sized sunfishes were not observed.
  - **Catfishes:** Channel Catfish remained an important sport fish in the reservoir, and their catch rate was above the historical average. Channel Catfish body condition was lower than previous years. Blue Catfish were collected in low numbers and Flathead Catfish were not observed during 2016 gill netting.
  - **White Bass:** White Bass were collected below their historical average again in 2016.
  - **Largemouth Bass:** Largemouth Bass were present in the reservoir but not abundant; catch rate was well below the historical average. Largemouth Bass body condition was lower than previous years and few legal-sized fish were observed.
  - **White Crappie:** White Crappie were abundant in the reservoir, and their catch rate was higher than it has been since 1991. White Crappie body condition remained high.

Management Strategies: Continue managing sport fishes at Mexia Reservoir with statewide regulations. Maintain invasive species signage and inform the public about the negative impacts of aquatic invasive species. Conduct access and vegetation surveys in summer 2019, and general monitoring surveys with trap nets and gill nets in 2019 and 2020.

INTRODUCTION

This document is a summary of fisheries data collected from Mexia Reservoir in 2015-2016. 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 fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented with the 2015-2016 data for comparison.

Reservoir Description

Mexia Reservoir is a 1,009-acre impoundment of the Navasota River within the Brazos River Basin, Limestone County, and is located approximately 7 miles west of Mexia. It is owned and operated by the Bistone Municipal Water Supply District (BMWSD) and primary water uses include municipal water supply and recreation. The reservoir has a drainage area of 200 square miles, a storage capacity of 10,000 acre-feet, and a shoreline length of 23.4 miles. Mean and maximum depths are 10 and 20 feet respectively. Mexia Reservoir is eutrophic with a TSI *chl-a* of 65.5 (Texas Commission on Environmental Quality, unpublished data). Habitat at time of sampling was dominated by natural and rock shoreline, bulkhead and boat docks and piers. Littoral vegetation is dominated by giant cutgrass, American water willow and common buttonbush. Water level has been within six feet of conservation pool (448.3 feet above mean sea level [MSL]) since 2011, one to two feet below conservation pool during summer and fall 2015 surveys, and near conservation pool during winter and spring 2016 surveys (Figure 1). Other descriptive characteristics for Mexia Reservoir are in Table 1.

Angler Access

Mexia Reservoir has a single public boat ramp (BMWSD) and several private boat ramps. The BMWSD ramp is a short, two-lane ramp near mid-reservoir, and is seldom used for launching anything other than small water craft (Table 2). Most of Mexia Reservoir's shoreline is private and convenient shoreline access is limited to the public boat ramp area.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Tibbs and Baird 2012) included:

1. Release one or more news articles showcasing the excellent Channel Catfish angling opportunities on Mexia Reservoir.
   Action: A news article was released to local newspapers in November 2013, showcasing Mexia Reservoir's Channel Catfish fishery.
2. Update the Texas Parks and Wildlife Department's website to reflect the most recent fish species data for Mexia Reservoir.
   Action: The web page for Mexia Reservoir was updated in August 2012.
3. Share information on Mexia Reservoir with the TPWD watershed coordinator, Southeast Aquatic Resource Partnership (SARP) and Reservoir Fish Habitat Partnership (RFHP); propose funding from SARP and RFHP to perform best management practice (BMP) work within the watershed.
   Action: A short document was drafted to: 1) describe the status of Mexia Reservoir and its fishery, 2) present the information to the Habitat Branch of the Inland Fisheries Division for their review and consideration and 3) request their expertise in retaining grant funding to accomplish the needed work. Funding from organizations such as the SARP and RFHP could then be used to promote best management practices or other work to reverse the effects of erosion and sedimentation within this watershed. The document is included in this report as Appendix D.

4. Cooperate with the controlling authority to post appropriate invasive species signage at access points throughout the reservoir. 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 interbasin water transfer routes to facilitate potential invasive species responses.

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

Harvest Regulation History: Sport fishes in Mexia Reservoir have always been managed with statewide regulations. The current harvest regulations are listed in Table 3.

Stocking History: Mexia Reservoir has not been stocked since 2008, when Blue Catfish fingerlings were stocked at a rate of 60 fish/acre. Over half a million Florida Largemouth Bass were stocked into the reservoir between 1974 and 1998. The complete stocking history is in Table 4.

Water Transfer: Mexia Reservoir is primarily used for municipal water supply and recreation. The BMWSD has the only raw water intake structure on the reservoir which transfers water offsite during peak water demand events. There are currently no additional water transfers being considered.

Reservoir capacity: Mexia Reservoir was impounded in 1961. Original plans calculated the reservoir's capacity at conservation pool (448.3 feet above mean sea level) to be 10,000 acre-feet with a surface area of 1,200 acres. Two volumetric surveys have been conducted by the Texas Water Development Board (TWDB) on Mexia Reservoir since impoundment; one in 1996 and one in 2008. The 2008 survey found a volume of 4,687 acre-feet and a surface area of 1,009 acres at conservation pool elevation. According to the TWDB, Mexia Reservoir has accumulated 1,021 acre-feet of sediment volume, which equates to a loss of roughly 22 acre-feet of volume each year since impoundment. See Appendix D for additional information.

METHODS

Surveys were conducted to achieve survey and sampling objectives in accordance with the objective-based sampling (OBS) plan for Mexia Reservoir (TPWD unpublished). Primary components of the OBS plan are listed in Table 5. All survey sites, with the exception of two electrofishing stations, were randomly selected, and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015).

Electrofishing – Largemouth Bass, sunfishes, Gizzard Shad and Threadfin Shad were collected by electrofishing (5, random 5-minute stations and 2, biologist-selected 15-minute stations). The five-minute stations were abandoned during the fall 2015 electrofishing survey due to poor catch rates and the shallow shoreline habitat encountered; 15-minute, biologist-selected stations were instead electrofished near preferred habitats in order to attain the sampling objective of 30 Largemouth Bass for genetic purposes. Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing.

Trap netting – White Crappie were collected using trap nets (5 net nights at 5 stations). CPUE for trap netting was recorded as the number of fish caught per net night (fish/nn).

Gill netting – Channel Catfish were collected by gill netting (5 net nights at 5 stations). CPUE for gill

netting was recorded as the number of fish caught per net night (fish/nn).

Tandem hoop nets – Channel Catfish were sampled using 6 tandem hoop net series at 6 stations. Nets were baited with cheese logs (N = 3) and soap (N = 3) and deployed for 2-night soak durations. CPUE for tandem hoop netting was recorded as the number of fish caught per tandem hoop net series (fish/tandem hoop net series).

Genetics – Genetic analysis of Largemouth Bass was conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2015). Micro-satellite DNA analysis was used to determine genetic composition of individual fish from 2005 to present, and by electrophoresis for previous years.

Statistics – 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.

Habitat – The 2011 structural habitat and vegetation surveys were conducted according to Tibbs and Baird (2012). Vegetation surveys were conducted using an adaptation of the point method during 2015 (TPWD, Inland Fisheries Division, unpublished manual revised 2015). Points were randomly generated on the shoreline and averaged a minimum of one point per shoreline mile. Aquatic vegetation has always been found close to the shore in Mexia Reservoir, so stratifying the random points to exclude deep-water areas increased precision and resulted in better data.

Water level – Source for water level data was the United States Geological Survey (USGS 2016).

RESULTS AND DISCUSSION

Habitat: Mexia Reservoir is a shallow, turbid reservoir with a secchi range less than two feet. The most recent structural habitat survey results can be found in Table 6. A full vegetation survey conducted during summer 2015 found dominant shoreline vegetation to be giant cutgrass (Zizaniopsis m*iliacea*), American water willow (*Justicia americana*), common buttonbush (*Cephalanthus occidentalis*), bulrushes (*Scirpus spp.*), cattail (Typha spp.) and one noxious species of vegetation, giant reed (*Arundo donax*), which comprised 12% of the littoral shoreline (Table 7).

Prey species: Threadfin and Gizzard Shad were collected by electrofishing at catch rates of 674.4/h and 2,152.8/h respectively in 2015, both well above the historical average (Figure 2 and Appendices A and B). The IOV for Gizzard Shad was excellent, and 95% of individuals were available as prey to sport fish (Figure 2). Other forage species collected were Bluegill (21.6/h), Longear Sunfish (12.0/h) and Green Sunfish (2.4/h) (Figures 3 and 4; Appendices A and B). Sunfish seldom reach preferred size classes in Mexia Reservoir, and few anglers actively seek them.

Catfishes: Objective based sampling plans for Channel Catfish consisted of a minimum of 5 randomly selected tandem hoop net stations during summer 2015. Although tandem hoop nets were added to the TPWD Procedures manual as an approved gear in 2014 and had shown promising results in many situations, our tandem hoop netting results were poor and the goal of collecting 50 stock size fish was not reached. We baited 3 tandem hoop net stations fully with cheese blocks and an additional 3 stations with soap, but only collected 9 Channel Catfish overall (Figure 5). Given the low catch rate, and no indication that collecting the proposed number of fish would be reasonable, summer tandem hoop netting was suspended, and spring gill netting was conducted similarly to previous surveys on Mexia Reservoir.

Channel Catfish were collected with gill nets at 9.6/nn in 2016; this catch rate equates to 48 collected individuals, and was higher than the historical average (Figure 6; Appendices A and B). Only forty-one of the individuals collected were stock size or larger, so the OBS goal was not reached. The PSD value (34) was moderate in 2016 indicating a relatively balanced population of small and large fish (Figure 6). Body condition, expressed as mean *Wr*, generally improved across size classes, but was lower than *Wrs* reported in previous surveys for most inch groups (Figure 6).

Blue and Flathead Catfish are species with low-density populations in Mexia Reservoir, and are generally caught incidentally to other targeted species. These catfish species were not targeted during the 2015-2016 OBS surveys, but are still included in Appendices A and B.

White Bass: White Bass are a low-density population in Mexia Reservoir, and are generally caught incidentally to other targeted species. White Bass were not targeted during the 2015-2016 OBS surveys, but are still included in Appendices A and B.

Largemouth Bass: Largemouth Bass were collected by electrofishing at 12.0/h in 2015; this catch rate equated to 5 collected individuals and was well below the historical average for the reservoir (Figure 7 and Appendices A and B). The OBS goal for this species was reached. Proportional size distribution was poor (14) and much lower than in the previous two surveys; only one legal-sized bass was present in the sample (Figure 7). Body condition was fair for all but one size class (12-inch fish; *Wr* = 74) (Figure 7). Largemouth Bass genetics were analyzed in 2015 and showed poor Florida influence (23%) (Table 8).

White Crappie: White Crappie were collected from trap nets at 88.8/nn in 2015; this catch rate was the highest on record for White Crappie since the 1991 survey (Figure 8; Appendices A and B). The OBS goal for this species was easily reached. The PSD value (55) was good in 2015 indicating a relatively balanced population of small and large fish (Figure 8). Nearly 30% of fish were ≥ legal-size (10 inches), and many fish approached or exceeded memorable size (≥12 inches). Body condition ranged from fair to excellent and improved with increasing length beyond the 7-inch class (Figure 8).

Fisheries management plan for Mexia Reservoir, Texas

Prepared – July 2016

ISSUE 1: Reservoir loss of volume (and the resulting deteriorating habitat) (Appendix D) are the major contributing factors affecting the Largemouth Bass population on Mexia Reservoir. The 2015 OBS Plan included fall electrofishing to evaluate Largemouth Bass despite historically low catch rates and anecdotal evidence suggesting Largemouth Bass were rarely sought by anglers on Mexia Reservoir. Instead, the plan mentioned the statewide popularity of the species as justification for sampling. Total Largemouth Bass CPUE was 12.0/h during fall 2015 electrofishing, which was one of the lowest reported rates in the history of monitoring Mexia Reservoir. Standard electrofishing stations had to be abandoned during fall 2015, and biologist-selected stations were required in order to collect 30 Largemouth Bass for genetic purposes.

MANAGEMENT STRATEGIES

1. Discontinue electrofishing as a standard tool for future Mexia Reservoir OBS plans.
2. Discontinue genetic sampling of Largemouth Bass every eight years since no stockings of this species will be conducted.
3. Collect data on all important prey species from other sampling methods when used.
4. Utilize White Crappie and Channel Catfish condition to provide information on forage abundance and vulnerability.

ISSUE 2: Mexia Reservoir is plagued with sedimentation issues (Appendix D) and as a result, only the lower two-thirds of the reservoir is typically navigable and fishable. The habitat that is available is limited.

MANAGEMENT STRATEGIES

1. Construct and deploy fish attractors in the best habitats within the reservoir.
2. Add fish attractor map and coordinates for Mexia Reservoir to TPWD website.
3. Release a news article describing the location(s) and benefits of the fish attractors to the fishery.

ISSUE 3: 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 Bistone Municipal Water Supply District to maintain appropriate 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.

Objective - Based Sampling Plan and Schedule, 2016 - 2020

Sport fish, forage fish and other important fishes

Survey data suggest important sport fishes in Mexia Reservoir include White Crappie and Channel Catfish. Important forage fishes include Gizzard Shad, Threadfin Shad, Bluegill and Longear Sunfish. The proposed sampling schedule (Table 9) lists trap netting and gill netting surveys planned for the next four years.

Low-density fisheries

Largemouth Bass, Spotted Bass, White Bass, Blue Catfish, Flathead Catfish and Black Crappie occur in low abundance in Mexia Reservoir. We will continue collecting and reporting data for these species, and upgrade their status if appropriate.

Survey objectives, fisheries metrics, and sampling objectives

Winter trap netting: Anecdotal evidence suggests White Crappie are highly sought after in Mexia Reservoir. The goal of the 2019 trap net survey would be general monitoring of trend data to characterize the White Crappie population and make comparisons with historical and future data. Collecting ≥50 stock-length fish during winter 2019 will allow us to calculate proportions (i.e., size structure indices) with an 80% confidence interval. A minimum of 5 randomly selected trap net stations will be sampled. If the goal is not attained, and catch rates indicate that collecting the proposed number of fish is reasonable, sampling will continue at pre-determined random stations until the target is reached.

Spring gill netting: This survey would be used to evaluate Channel Catfish, as anecdotal evidence suggests this species is highly sought after in Mexia Reservoir. The goal of the survey would be general monitoring of trend data to characterize the Channel Catfish population and make comparisons with historical and future data. Collecting ≥50 stock-length fish during spring 2020 will allow us to calculate proportions (i.e., size structure indices) with an 80% confidence interval. A minimum of 5 randomly selected gill net stations will be sampled. If the goal is not attained, and catch rates indicate that collecting the proposed number of fish is reasonable, sampling will continue at pre-determined random stations until the target is reached.

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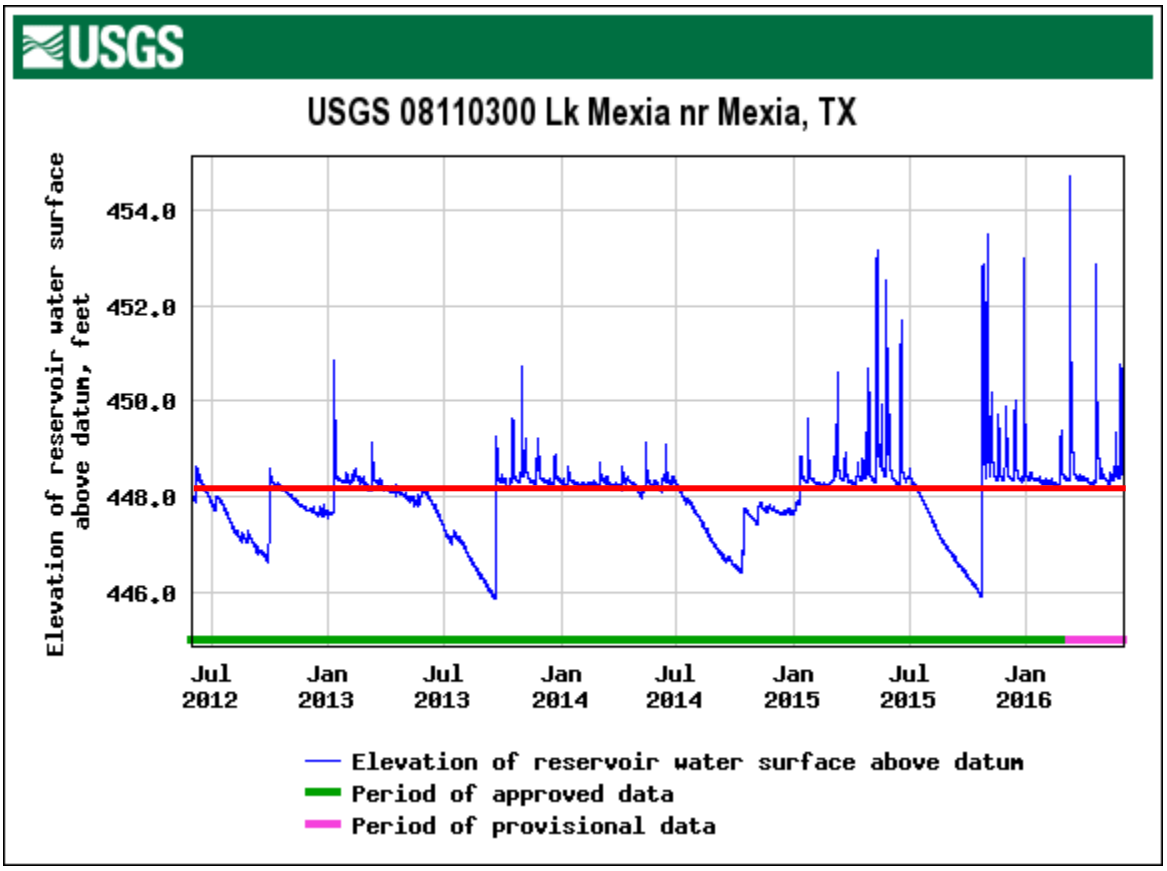


Figure 1. Daily mean water levels for Mexia Reservoir from July 1, 2012 through July 1, 2016. Conservation pool level (red line) is 448.3 feet above mean sea level. Figure from the USGS website.

Table 1. Characteristics of Mexia Reservoir, Texas 2015 - 2016.

Characteristic	Description
Year Constructed	1961
Controlling authority	Bistone Municipal Water Supply District
County	Limestone
Reservoir type	Tributary, Brazos River Basin
Shoreline Development Index	8.0
Conductivity	220 umhos

Table 2. Boat ramp characteristics for Mexia Reservoir, Texas, July, 2015. Reservoir elevation at time of survey was 447.9 feet above MSL (0.4 feet below conservation pool).

Boat ramp	Latitude Longitude (dd)	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Bistone M.W.S.D.	31.65416/-96.59361	15	444	Good

Table 3. Harvest regulations for Mexia Reservoir, 2015 - 2016.

Species	Bag Limit	Minimum-Maximum Length (inches)
Catfish: Channel Catfish, Blue Catfish, their hybrids and subspecies	25 (in any combination)	12 - No Limit
Catfish, Flathead	5	18 - No Limit
Bass, White	25	10 - No Limit
Bass: Largemouth	5	14 - No Limit
Crappie: White Crappie, Black Crappie, their hybrids and subspecies	25 (in any combination)	10 - No Limit

Table 4. Stocking history of Mexia Reservoir, Texas. Life stages are fry (FRY), fingerling (FGL), adult (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	1975	30,000	UNK	UNK
	1995	140,000	FGL	1.9
	1996	140,000	FGL	1.9
	2008	60,061	FGL	2.0
	Total	370,061		
Flathead Catfish	1969	3,806	UNK	UNK
	Total	3,806		
Florida Largemouth Bass	1974	63,745	FGL	2.2
	1974	11,375	FRY	1.0
	1976	70,000	FRY	1.0
	1977	140,340	FRY	1.0
	1995	142,384	FGL	1.3
	1998	140,668	FGL	1.3
	Total	568,512		
Green Sunfish x Redear Sunfish	1980	1,000	UNK	UNK
	Total	1,000		
Largemouth Bass	1996	43	ADL	12.0
	Total	43		

Table 5. Objective-based sampling plan components for Mexia Reservoir, Texas 2015 – 2016. Gill netting was added to the plan after tandem hoop netting proved to be unsuccessful.

Gear/target species	Survey objective	Metrics	Sampling objective
Electrofishing			
Largemouth Bass	Exploratory	Presence/Abundance	Practical effort
	Genetics	% FLMB	N = 30, any age
Bluegill [a]	Exploratory	Presence/Absence	Practical effort
Longear Sunfish [a]	Exploratory	Presence/Absence	Practical effort
Gizzard Shad [a]	Exploratory	Presence/Absence	Practical effort
Threadfin Shad [a]	Exploratory	Presence/Absence	Practical effort
Gill netting			
Channel Catfish	General monitoring and trend data	Size structure	N ≥ 50 stock
Trap netting			
White Crappie	Evaluation of specific management strategy or environmental factor	CPUE – stock Size structure	RSE- Stock ≤ 25 10 fish/inch group
Tandem hoop netting			
Channel Catfish	General monitoring and trend data	Size structure	N ≥ 50 stock

[a] No additional effort will be expended to achieve an RSE ≤ 25 for CPUE of prey species if not reached from designated Largemouth Bass sampling effort. Instead, Largemouth Bass body condition can provide information on forage abundance, vulnerability, or both relative to predator density.

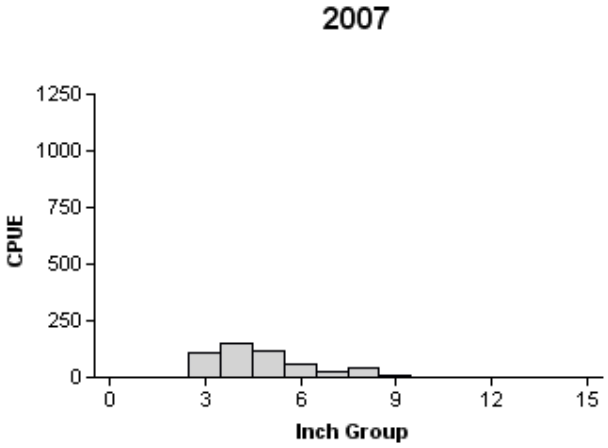
Table 6. Survey of structural habitat types, Mexia Reservoir, Texas, 2012. Survey was conducted using 2010 NAIP, 1-meter resolution satellite imagery. Shoreline habitat type units are in miles. One hundred and forty-two (142) boat docks and piers were observed during the survey.

Habitat type	Estimate	% of total
Bulkhead	1.9 miles	8.3
Rock shoreline (rocks>4”)	1.6 miles	6.6
Natural shoreline	19.9 miles	85.1

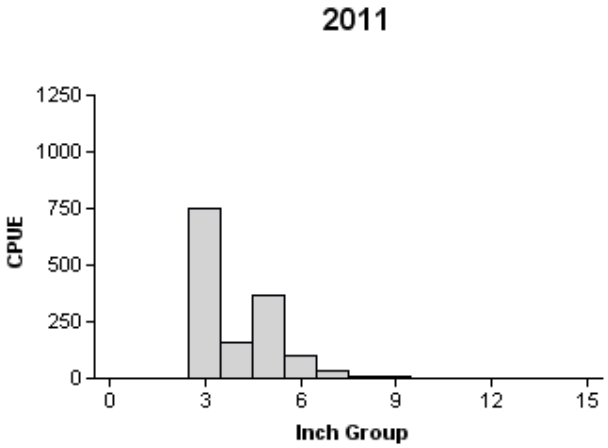
Table 7. Survey of aquatic vegetation, Mexia Reservoir, Texas, 2011 and 2015. Percent of total reservoir surface area is listed for 2011, while percent of randomly-selected points where species occurred~~, is~~, is listed for 2015. Water level was 448.3 and 447.9 feet above MSL, respectively, at the time of the surveys.

Vegetation	2011	2015
American water-willow (*Justicia americana*)	6.2%	56% (14 of 25)
Bulrush (*Scirpus* spp.)	56.5%	16% (4 of 25)
Common buttonbush (*Cephalanthus occidentalis*)		36% (9 of 25)
Cattail (*Typha* spp.)		8% (2 of 25)
Giant cutgrass (*Zizaniopsis miliacea*)	61.8%	68% (17 of 25)
Giant reed (*Arundo donax)*		12% (3 of 25)

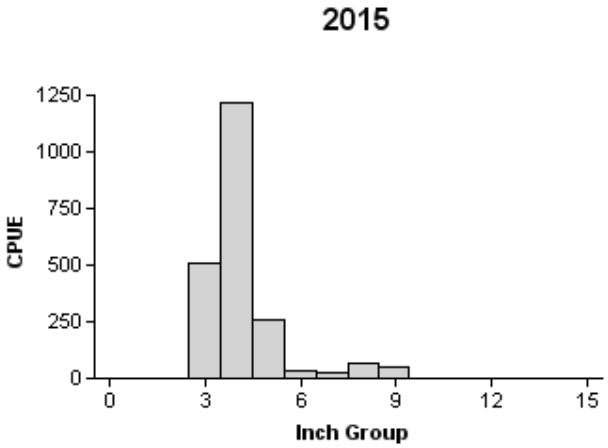
Gizzard Shad



Effort = 1.0
Total CPUE = 519.0 (18; 519)
Stock CPUE = 84.0 (28; 84)
IOV = 89 (2)



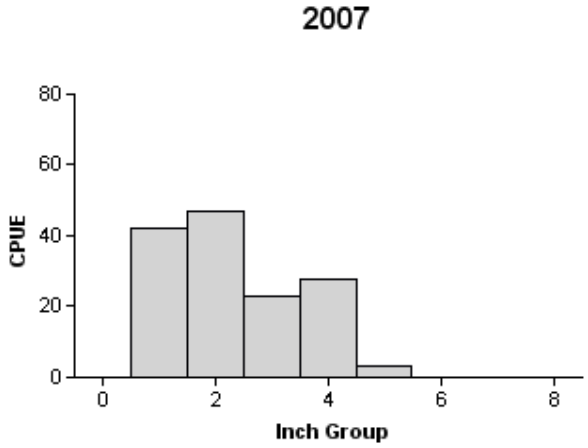
Effort = 1.0
Total CPUE = 1432.0 (40;1432)
Stock CPUE = 61.0 (19; 61)
IOV = 98 (1)



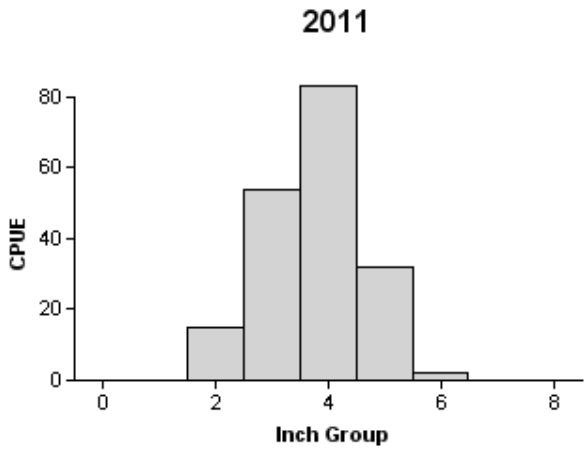
Effort = 0.4
Total CPUE = 2152.8 (21; 897)
Stock CPUE = 139.2 (3; 58)
IOV = 95 (2)

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, Mexia Reservoir, Texas, 2007, 2011 and 2015.

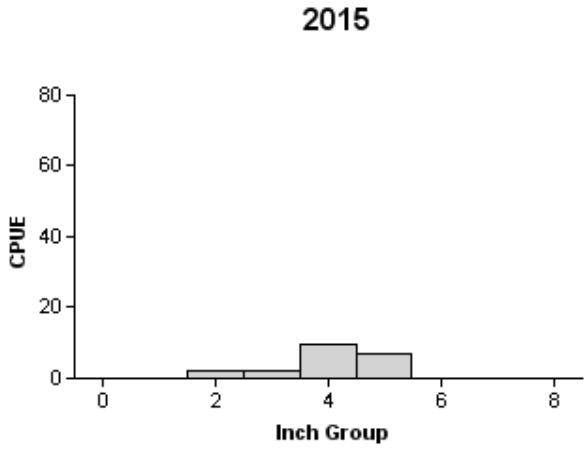
Bluegill



Effort = 1.0
Total CPUE = 143.0 (58; 143)
Stock CPUE = 54.0 (45; 54)
PSD = 0 (0)



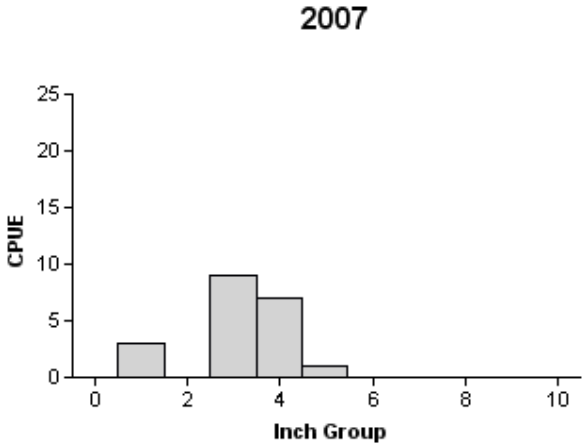
Effort = 1.0
Total CPUE = 186.0 (42; 186)
Stock CPUE = 171.0 (41; 171)
PSD = 1 (1)



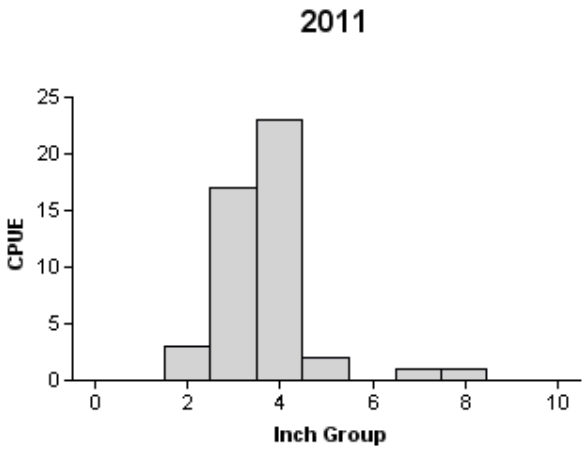
Effort = 0.4
Total CPUE = 21.6 (62; 9)
Stock CPUE = 19.2 (70; 8)
PSD = 0 (0)

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, Mexia Reservoir, Texas, 2007, 2011 and 2015.

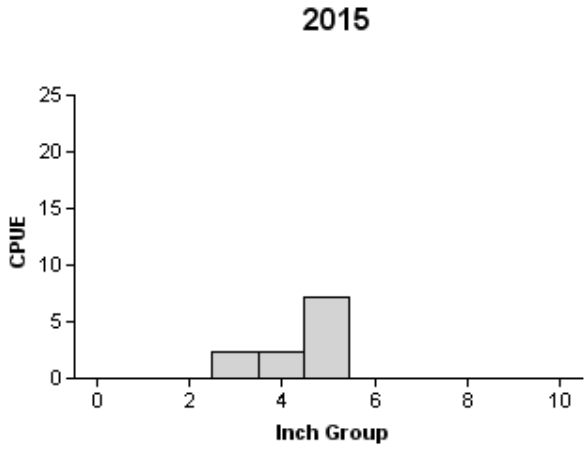
Longear Sunfish



Effort = 1.0
Total CPUE = 20.0 (45; 20)
Stock CPUE = 20.0 (45; 20)
PSD = 100 (0)



Effort = 1.0
Total CPUE = 47.0 (51; 47)
Stock CPUE = 47.0 (51; 47)
PSD = 100 (0)



Effort = 0.4
Total CPUE = 12.0 (32; 5)
Stock CPUE = 12.0 (32; 5)
PSD = 100 (0)

Figure 4. Number of Longear Sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Mexia Reservoir, Texas, 2007, 2011 and 2015.

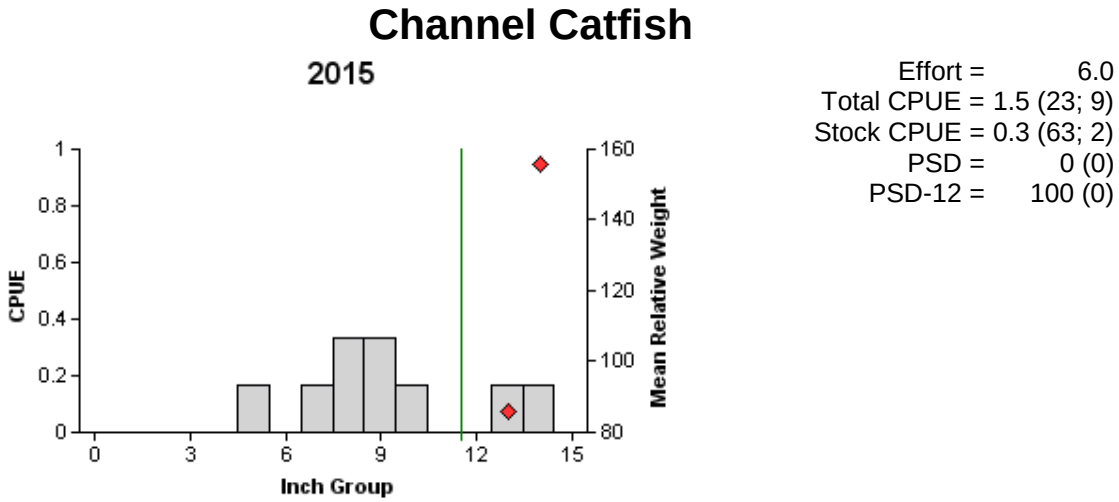
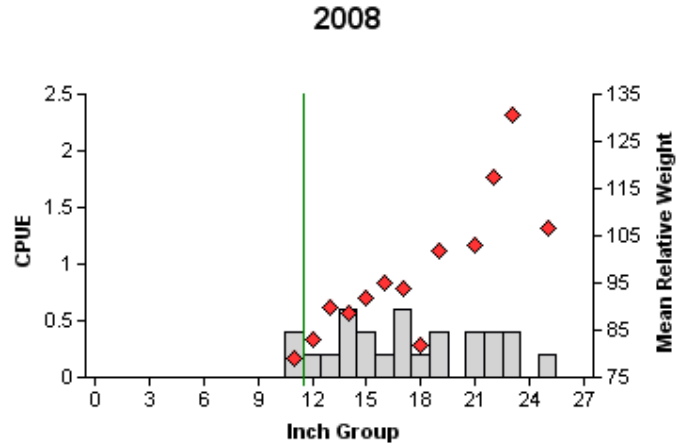
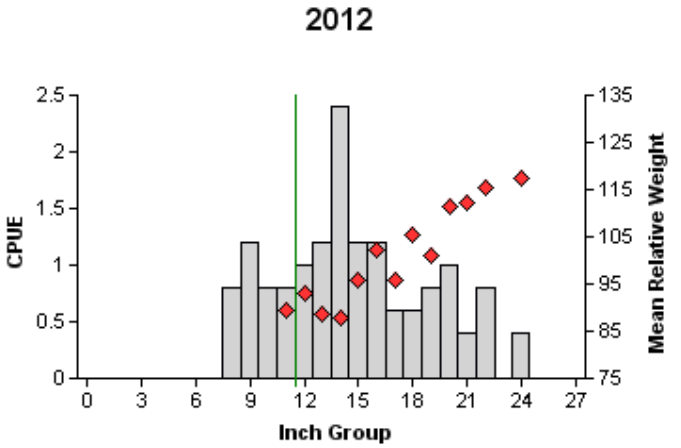


Figure 5. Number of Channel Catfish caught per tandem hoop net series (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for summer tandem hoop net surveys, Mexia Reservoir, Texas, summer 2015. The vertical line represents the minimum length limit.

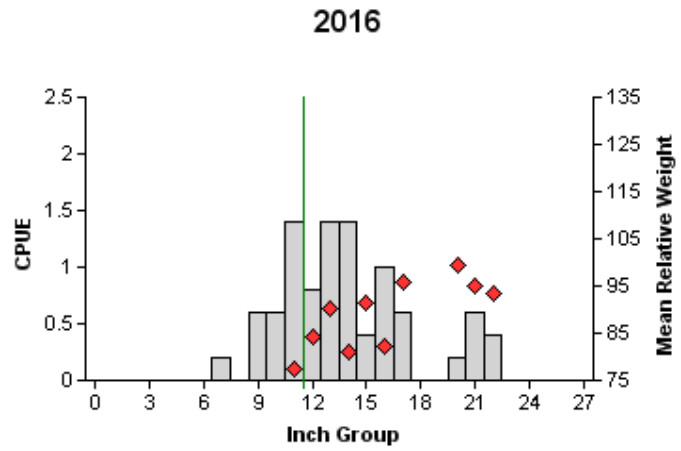
Channel Catfish



Effort = 5.0
Total CPUE = 4.6 (39; 23)
Stock CPUE = 4.6 (39; 23)
PSD = 61 (3)
PSD-12 = 91 (5)



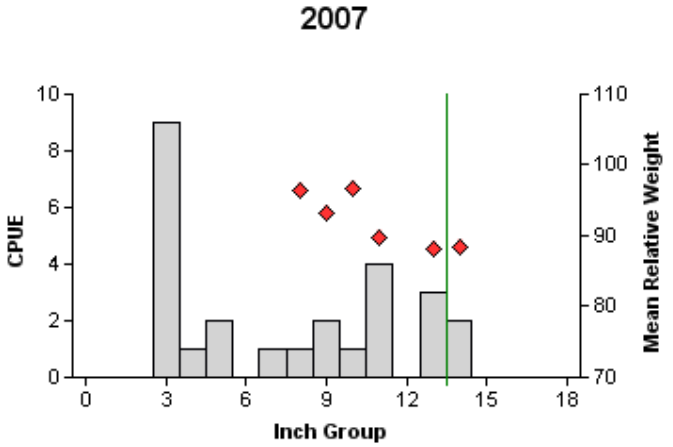
Effort = 5.0
Total CPUE = 15.2 (15; 76)
Stock CPUE = 12.4 (22; 62)
PSD = 47 (4)
PSD-12 = 94 (4)



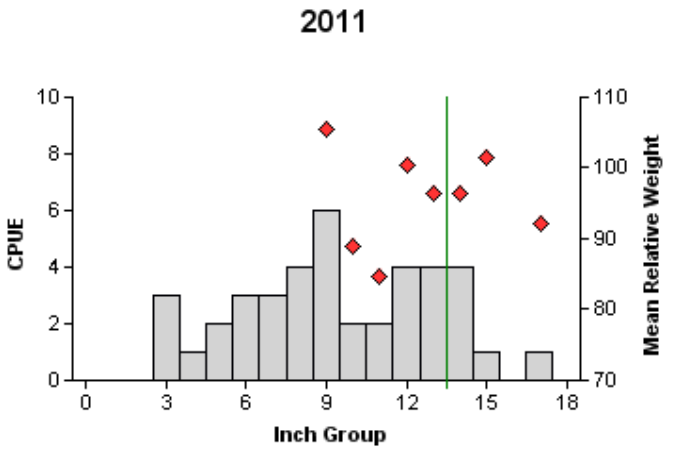
Effort = 5.0
Total CPUE = 9.6 (16; 48)
Stock CPUE = 8.2 (19; 41)
PSD = 34 (3)
PSD-12 = 83 (6)

Figure 6. 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, Mexia Reservoir, Texas, 2008, 2012 and 2016. The vertical line represents the minimum length limit.

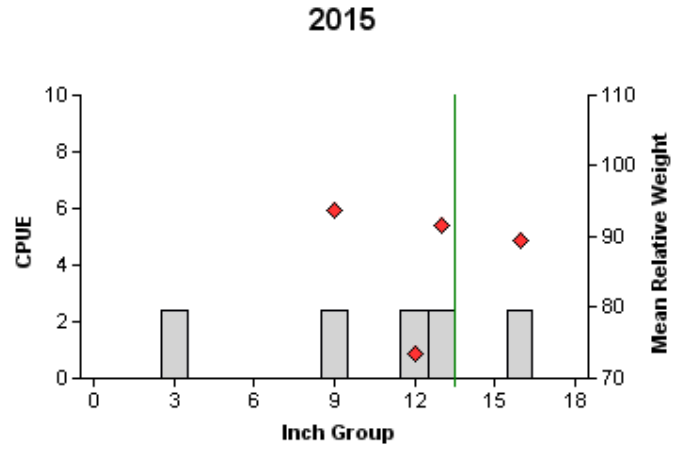
Largemouth Bass



Effort = 1.0
Total CPUE = 26.0 (50; 26)
Stock CPUE = 13.0 (61; 13)
PSD = 38 (15)
PSD-14 = 15 (6)



Effort = 1.0
Total CPUE = 40.0 (32; 40)
Stock CPUE = 28.0 (29; 28)
PSD = 50 (7)
PSD-14 = 21 (5)



Effort = 0.4
Total CPUE = 12.0 (45; 5)
Stock CPUE = 9.6 (47; 4)
PSD = 14 (10)
PSD-14 = 25 (26)

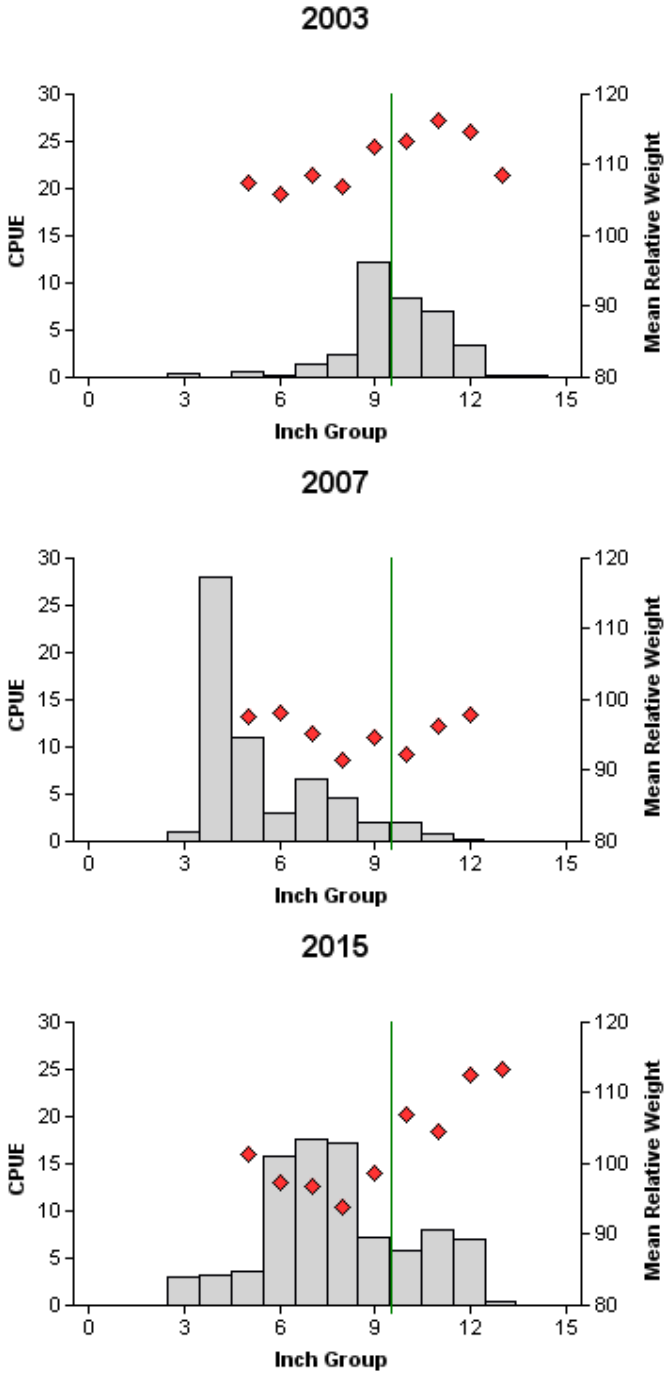
Figure 7. Number of Largemouth Bass caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Mexia Reservoir, Texas, 2007, 2011 and 2015. The vertical line represents the minimum length limit.

Largemouth Bass

Table 8. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Mexia Reservoir, Texas, 1999, 2003 and 2015. 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	Hybrid	NLMB		
1999	28	0	18	10	28	0
2003	30	1	16	13	25	4
2015	30	0	28	2	23	0

White Crappie



Effort = 5.0
Total CPUE = 36.4 (41; 182)
Stock CPUE = 36.0 (41; 180)
PSD = 94 (3)
PSD-10 = 53 (8)

Effort = 5.0
Total CPUE = 59.2 (38; 296)
Stock CPUE = 30.2 (28; 151)
PSD = 32 (7)
PSD-10 = 10 (2)

Effort = 5.0
Total CPUE = 88.8 (11; 444)
Stock CPUE = 82.6 (12; 413)
PSD = 55 (6)
PSD-10 = 26 (6)

Figure 8. Number of White Crappie caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap net surveys, Mexia Reservoir, Texas, 2003, 2007 and 2015. The vertical line represents the minimum length limit.

Table 9. Proposed sampling schedule for Mexia 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 and winter. Standard survey denoted by S and additional survey denoted by A.

Survey year	Electrofish Fall(Spring)	Trap net	Gill net	Habitat		Access	Creel survey	Report
				Structural	Vegetation			
2016-2017								
2017-2018								
2018-2019								
2019-2020		S	S		S	S		S

APPENDIX A

Number (N), relative standard error (RSE) and catch rate (CPUE) of all target species collected from all gear types from Mexia Reservoir, Texas, 2015-2016. Asterisks denote tandem hoop net data from summer 2015.

Species	Gill Netting		Trap Netting		Electrofishing	
	N/RSE	CPUE	N/RSE	CPUE	N/RSE	CPUE
Gizzard Shad					897/21	2,152.8
Threadfin Shad					281/27	674.4
Blue Catfish	2/100	0.4				
Channel Catfish	48/16	9.6				
	9/23*	1.5*				
White Bass	5/77	1.0				
	2/100*	0.33*				
Green Sunfish					1/100	2.4
Bluegill					9/62	21.6
Longear Sunfish					5/32	12.0
Largemouth Bass					5/45	12.0
White Crappie			444/11	88.8		

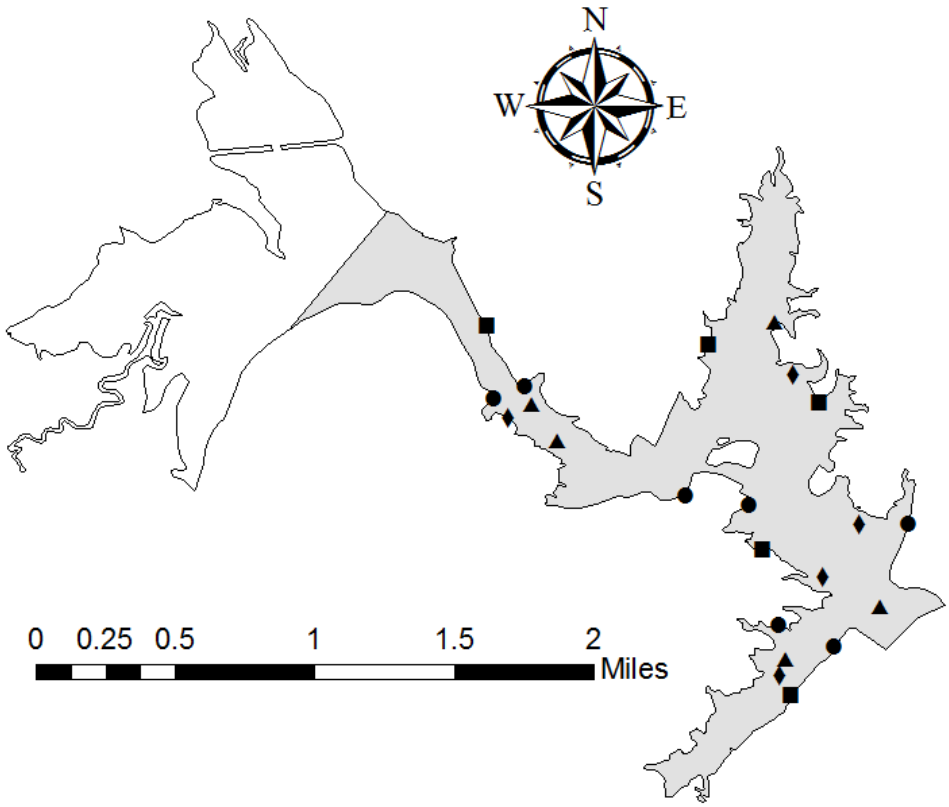
APPENDIX B

Catch rates (CPUE) of targeted species by gear type for standard surveys on Mexia Reservoir, Texas, 1990 to present. Surveys prior to 1996 utilized biologist-selected stations while those after 1996 utilized randomly-selected stations. Electrofishing stations were shocked with a 5.0 Smith-Root GPP (Gas Powered Pulsator) until 2010, then a 7.5 Smith-Root GPP was used. Objective based sampling began in 2015. Species averages are in bold. Dashes represent no data collection; asterisks represent a survey conducted outside the normal time range for that gear.

	Electrofisher						
	Bass	Shad		Sunfish			
Year	Largemouth	Gizzard	Threadfin	Bluegill	Longear	Green	Warmouth
1990	32.0	544.7	0.0	147.3	34.7	0.7	40.7
1991	10.7	524.7	0.0	51.3	18.0	0.0	0.7
1993	34.7	434.7	216.7	94.0	11.3	1.3	2.0
1996	28.0	1877.3	256.0	23.3	8.7	0.0	4.7
1999	108.7	107.3	0.0	89.3	91.3	68.0	2.7
2003	62.0	505.0	2007.0	86.0	10.0	0.0	1.0
2004	-	-	-	-	-	-	-
2007	26.0	519.0	18.0	143.0	20.0	1.0	4.0
2008	-	-	-	-	-	-	-
2011	40.0	1432.0	1379.0	186.0	47.0	5.0	5.0
2012	-	-	-	-		-	-
2015	12.0	2,152.8	674.4	21.6	12.0	2.4	0.0
Avg.	**39.3**	**899.7**	**505.7**	**93.5**	**28.1**	**8.7**	**6.8**

	Gill nets				Trap nets
	Catfish			Bass	Crappie
Year	Blue	Channel	Flathead	White	White
1990	0.6	4.6	0.0	1.0	256.2
1991	2.8	5.6	0.0	2.8	123.4
1993	0.2	11.6	0.2	0.7	63.8
1996	0.0	4.0	0.0	5.0	38.8
1999	1.8	1.6	0.0	1.0	49.6*
2003	-	-	-	-	36.4
2004	0.0	6.6	0.0	2.6	-
2007	-	-	-	-	59.2
2008	0.2*	4.8*	0.0*	0.0	-
2011	-	-	-	-	-
2012	2.8	15.2	0.0	1.4	6.6
2015	0.4	9.6	0.0	1.0	89.0*
Avg.	**1.0**	**7.1**	**0.0**	**1.7**	**80.3**

APPENDIX C



Location of sampling sites, Mexia Reservoir, Texas, 2015-2016. Tandem hoop netting, electrofishing, trap netting and gill netting stations are indicated by diamonds, circles, squares and triangles respectively. Water level was within two feet of conservation pool at time of sampling. The upper one-third of the reservoir (no shading) is not navigable and was not sampled.

APPENDIX D

Introduction

The Waco Inland Fisheries Management District encompasses a 12 county area of north central Texas. The district is responsible for fourteen major reservoirs, thirty small impoundments, and at least eight important, navigable rivers – all flowing into the Brazos River, whose drainage bisects the district from north-west to south-east. The district also contains two major ecoregions: Cross Timbers and Blackland Prarie. The Cross Timbers ecoregion dominates the western two-thirds of the district, while Blackland Prarie covers an eastern-most sliver of district including the eastern portions of Hill, McLennan, and Bell Counties, the western portion of Limestone County and most of Falls County. Due to changes in native ground cover from agricultural and farming practices, these Blackland Prarie areas are highly susceptible to erosion by wind and especially water. As such, Mexia, Aquilla, Fort Parker, and Limestone reservoirs have lost substantial amounts of volume since impoundment from erosion and sedimentation within their watersheds. The objective of this appendix is to describe the status of Mexia Reservoir and its fisheries, and to provide the information to the Habitat Branch of the Inland Fisheries Division for their review and consideration of this regional problem – and for their expertise in securing grant funding opportunities with any future statewide watershed proposals.

Geographical Area

The Texas Blackland Prarie ecoregion is a 50,501 km^2 area which runs in a southwest to northeast direction, from San Antonio to the Oklahoma border. Historically, land cover within this ecoregion was dominated by rolling topography and tallgrass prairie species such as big bluestem, indiangrass, and switchgrass, with occasional forest and wetland areas near riparian bottomlands. Early settlers were drawn to the region by its black, fertile soils, and the majority of the land was soon converted to farmland. A recent estimate suggests as few as 5,000 acres remain in their natural condition in terms of land cover, plant species, etc. Today, land use is dominated by pastureland, supporting livestock such as beef cattle, and cropland, including hay, corn, wheat, sorghum, cotton, milo, soybeans and pecans. Clear cutting of the native trees and grasses, along with repeated plowing from heavy farming and agricultural practices, has led to severe soil loss by wind erosion and surface runoff. The development of agricultural best management practices (BMPs) have helped farmers and other landowners reduce soil loss in recent decades, however BMPs have not been implemented in many important areas of watershed, some existing BMPs are outdated, and much of the damage to streams and reservoirs has already occurred.

Reservoir Specifics

Mexia Reservoir is a 1,009-acre reservoir in Limestone County, approximately 7 miles southwest of Mexia, Texas. Land use throughout its 198 square mile watershed is primarily agriculture. The USACE constructed the reservoir for flood control, municipal water, and recreation by impounding the Navasota River in 1961. The Bistone Municipal Water Supply District (BMWSD) has the only raw water intake structure on the reservoir which transfers water offsite to the City of Mexia and the Mexia State School. The BMWSD also currently transfers water from Mexia Reservoir during peak water demand events. The reservoir has mean and maximum depths of 10 and 20 feet, respectively. Mexia Reservoir is moderately productive, with water clarity less than 2 feet. Structural habitat consists primarily of natural, rip-rap and bulk headed shoreline, and boat docks. Aquatic vegetation is dominated by native shoreline species like cutgrass, bulrush, water willow and button bush. *Arundo donax,* a noxious species, is present and common throughout the reservoir.

Loss of Volume and Impacts to the Fishery

Original plans calculated Mexia Reservoir's volume to be 10,000 acre-feet at conservation pool (448.3 feet above mean sea level) upon impoundment in 1961. The TWDB conducted volumetric surveys during 1996 and 2008. The 2008 survey found Mexia Reservoir's capacity to be 4,687 acre-feet, and that 22 acre-feet of reservoir volume is lost each year due to silt-loading or sedimentation. By way of comparison, Fort Parker Reservoir was constructed in 1935 by the Civilian Conservation Corps to cover an area of approximately 750 acres and hold 3,100 acre-feet of water. This makes it the oldest of the three reservoirs on the Navasota mainstem, predating its upstream neighbor, Mexia Reservoir, as well as Limestone reservoir downstream (constructed in 1978). It is also older than Aquilla Reservoir, which was completed in 1982 within the Blackland Prairie Ecosystem area. All four reservoirs lose volume annually to sedimentation by erosion within their watersheds. Although the loss of Fort Parker Reservoir capacity is unknown at this time, dredging operations initiated by the town of Groesbeck in 1994 were begun to remove 930 acre-feet of deposited silt in and adjacent to the Navasota River channel within the reservoir. Those efforts were abandoned in 2002 with little success. Studies of the other two reservoirs have also shown significant losses in volume since impoundment. For example, according to recent TWDB surveys, Aquilla loses 84 to 218 acre-feet of reservoir volume each year while Limestone has lost an estimated 9,652 acre-feet since impoundment. As stated above, the rate of loss within Mexia Reservoir has been estimated at 22 acre-feet of volume each year since impoundment. This relatively rapid loss of habitat is the single most important issue facing these reservoirs. Currently, the upper one-third of Mexia Reservoir is too shallow to access by boat, and fisheries management activities have been restricted to the lower two-thirds of reservoir for nearly a decade. Without action in the next couple of decades, it is likely that impacts to the fishery due to sedimentation in these four reservoirs will only become more severe.

Summary

Although Inland Fisheries Management staff can identify symptoms of larger, watershed-wide issues with the limnological, habitat and fisheries data we collect, we are not equipped logistically or financially to remedy problems on this scale. The objective of this appendix is to describe the status of Mexia Reservoir and its fisheries, to provide the information to the Habitat Branch of the Inland Fisheries Division for their review and consideration, and to request their expertise in securing grant funding from organizations such as the SARP and RFHP to promote BMPs or other work to reduce or reverse the effects of erosion and sedimentation within this watershed.