

PERFORMANCE REPORT

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FEDERAL AID PROJECT F-221-M-5

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2014 Fisheries Management Survey Report

Possum Kingdom Reservoir

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SURVEY AND MANAGEMENT SUMMARY

Fish populations in Possum Kingdom Reservoir were surveyed in 2014 using electrofishing and trap netting and in 2015 using gill netting. Historical data are presented with the 2014-2015 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:** Possum Kingdom Reservoir is a 15,588-acre impoundment located on the Brazos River approximately 76 miles west of Fort Worth. It has a primarily rocky shoreline with many boat docks. The reservoir was within 15 feet of conservation pool (1,000 ft. above mean sea level) during the survey year. In May 2015, substantial rainfall occurred and Possum Kingdom filled to capacity.
- **Management History:** Important sport fish populations include catfish, White Bass, Striped Bass, Largemouth Bass, and crappie. Possum Kingdom was managed under statewide regulations until September 1, 2002 when the Largemouth Bass minimum length limit was raised to 16 inches and the Striped Bass bag limit was lowered to two per day in response to a golden alga (*Prymnesium parvum*) fish kill that occurred in early 2001. The Striped Bass bag limit was returned to the statewide bag limit on September 1, 2012. Golden alga mortality events also reoccurred in 2003, 2007, and 2010.
- **Fish Community**
 - **Prey species:** The 2014 Gizzard Shad catch rate was below the reservoir historical average and most of the sampled shad were too big to be consumed by predators. Threadfin Shad were collected in relatively low numbers. The catch per unit effort (CPUE) for Bluegill was below historical averages.
 - **Catfishes:** The 2015 CPUE for Blue Catfish was the highest ever observed with good length structure and body condition. Channel Catfish catch rate was up over the previous two surveys and above the historical average. Body condition indices increased with increased size of Channel Catfish.
 - **Temperate bass:** White Bass CPUE was down compared to the 2013 gill net survey. Striped Bass CPUE in 2015 increased which was expected since fish have been stocked the last two years and no golden alga-caused fish kills have occurred since 2010. Length frequency for Striped Bass was impressive with fish from seven to 30 inches sampled. No Palmetto Bass were sampled during the survey but that is not surprising since they are not stocked and only enter the reservoir when water from Lake Graham goes over the spillway.
 - **Black Bass:** The 2014 Largemouth Bass electrofishing sample was slightly higher than the previous survey in 2012. No Spotted or Smallmouth Bass have been observed since the 2002 survey. There were good numbers of legal-length bass sampled and many just under legal length, which will recruit to legal length within the year based on past growth rates. Few smaller bass were sampled.
 - **Crappie:** The 2014 Black and White Crappie CPUE's were the lowest catch rates documented at the reservoir. Only one White Crappie was sampled and no Black Crappie were sampled. This confirms the anecdotal angler reports we received reporting a lack of crappie in the reservoir.
- **Management Strategies:** Catfish, Striped and White Bass, and Largemouth Bass all provide good fishable populations and should be promoted to increase angler effort. Annual stockings of Striped Bass will continue to be requested, though the rates will change depending on survey results. Florida Largemouth Bass fingerlings were stocked from 2011-2014.

INTRODUCTION

This document is a summary of fisheries data collected from Possum Kingdom Reservoir in 2014-2015. The purpose 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 important sport fish and prey species. Historical data is also presented for comparison.

Reservoir Description

Possum Kingdom Reservoir is a 15,588-acre impoundment constructed in 1941 on the Brazos River. It is located in Palo Pinto County approximately 76 miles west of Fort Worth and is operated and controlled by the Brazos River Authority (BRA). Primary uses include flood control and recreation. Mean depth is 37 feet, shoreline development index is 14.4, and conductivity was 2,482 $\mu\text{S}/\text{cm}$ (Table 1). Primary habitats at time of sampling consisted of rocky shorelines, boat docks, and aquatic vegetation. The reservoir was within one foot of conservation pool in 2011 and consistently declined since to 16 feet below in the spring of 2015 (Figure 1). In May 2015, substantial rainfall occurred and Possum Kingdom filled to near capacity. Additional descriptive characteristics for Possum Kingdom are in Table 1.

Angler Access

At conservation pool, boat access consists of nine public boat ramps (Table 2) and 15 private ramps. At the recent low of 16 feet below conservation pool, boat access was almost exclusively limited to four ramps maintained by the BRA. The BRA extended the ramps or built alternative deep water ramps at access points to maintain boat access. Two of the public boat ramps (North D&D and Sandy Beach) charged a \$3 per-person entrance fee on weekends and holidays from mid-May to mid-September. Private ramp fees ranged from free to \$35. On January 1, 2006, a mandatory Water Recreational User Permit program for boats was initiated by BRA. The fees were set as follows: annual \$50.00 (\$35.00 if over 65 or active duty/retired military), one day \$5.00, 3-day \$12.00 and 5-day \$20.00. The permit was available at local vendors, the BRA lake office or ticket dispensers at the major boat ramps. These fees were scheduled to end August 31, 2015. Bank fishing was available at the public access points including the boat ramps. Two fishing piers were also present on the reservoir, although they were out of the water during the survey period.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Howell and Mauk 2011) included:

1. To alter negative angler attitudes that had resulted in decreased fishing effort despite improved fish populations for most species, the district would publicize the improved fisheries findings from regularly scheduled and additional surveys through several media outlets.

Action: A statewide news release was issued in 2013 and 2015 that were picked up by various media sources about the health of the fish populations and what anglers should expect. The TPWD web site was maintained and updated with new reservoir information. Interesting bass tournament results and other catches were featured on the District's Facebook page.

2. The previously important Striped Bass fishery had been drastically reduced by golden alga induced impacts so a more aggressive stocking plan of annual stockings at a rate of 15/acre was planned.

Action: Continued requesting annual stockings of Striped Bass fingerlings at the maximum rate of 15/acre. Did not stock in either 2011 or 2012 because of a lack of available fish but stocked in 2013, 2014, and 2015 at a higher rate than 15/acre.

3. Invasive species threaten aquatic habitats and organisms in Texas and can adversely affect Possum Kingdom Reservoir ecologically, environmentally, and economically. To combat their possible introduction, the 2011 Management Plan called for cooperation with the Brazos River Authority on signage, talk to businesses around the reservoir and provided them with material on invasive species, educate the public, monitor inter-basin transfers, and maintain and check zebra mussel samplers near highly utilized boat ramps.

Action: The Brazos River Authority posted appropriate signage at access points around the reservoir. District staff contacted area businesses including marina owners, resorts, and the Chamber of Commerce to make them aware of invasive species, and provide them with posters and literature so that they can, in turn educate others. Different forms of media including news releases and Facebook were used to educate the public. When giving a presentation to the Hells Gate and Mineral Wells Bass Clubs about the reservoir, invasives were discussed. Historically, the district maintained zebra mussel samplers near highly-utilized boat ramps, but the recent drought conditions and resulting low reservoir elevations had left them out of the water with nowhere to place them. Rock-kick samples are conducted regularly for zebra mussels.

4. After the first golden alga caused fish kill occurred in 2001, the Striped Bass bag limit was reduced from five fish to two to spread the harvest out. It became apparent over the years that little harvest was occurring and that golden alga was killing the Striped Bass. It was decided that returning the bag limit to five would be beneficial to anglers since they could harvest and consume fish instead of having so many fish die due to golden alga.

Action: Made regulation change proposal in 2011 to return to statewide five fish daily bag limit for Striped Bass at Possum Kingdom. It was formally adopted September 1, 2012.

Harvest regulation history: Sport fish species in Possum Kingdom Reservoir were historically managed using statewide regulations. However, on September 1, 2002, in response to the golden alga fish kill of 2001, the Largemouth Bass minimum length limit was raised from 14 to 16 inches and the Striped Bass daily bag limit was decreased from five to two fish 18 inches or greater to aid in recovery of the fishery.

Stocking history: Since the initial golden alga fish kill in 2001, an aggressive stocking program, involving multiple species, has occurred in response to golden alga caused fish kills in 2003, 2007, and 2010. Blue Catfish, Channel Catfish, Striped Bass, Smallmouth Bass, and Largemouth Bass (Northern and Florida) have all been stocked since 2001. The complete stocking history is in Table 4.

Vegetation/habitat management history: Possum Kingdom Reservoir has no significant vegetation/habitat management history. Noxious vegetation has not been a problem at the reservoir. Native vegetation plantings occurred in 2013 and were doing well until the reservoir elevation dropped to the point that the plants and cages were out of the water.

Water transfer: No interbasin transfers are known to exist. Possum Kingdom Reservoir has been used primarily for water supply by the BRA. There were 19 entities that had water supply contracts with BRA that allowed them to remove water from Possum Kingdom Reservoir for different types of uses. Two of these contracts were for industrial purposes, five were for municipal purposes, four were for mining purposes, and eight were for irrigation purposes. Some lakeside property owners also used water from the reservoir for domestic purposes, and there was small water users located along the West Central Brazos Water Distribution System that used raw water pumped from Possum Kingdom Reservoir. BRA is currently in discussions with the City of Abilene regarding potential future use of water from Possum Kingdom. In addition to withdrawals for water used directly from the reservoir, water has also been released downstream to pass excess runoff during high flow events, to provide for environmental flows, and for periodic water supply needs.

METHODS

Fishes were collected by electrofishing (2.0 hours at 24 five-minute stations), gill netting (15 net nights at 15 stations), and trap netting (15 net nights at 15 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 and trap nets, as the number of fish caught 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 2014).

A structural habitat survey was conducted in 2014. Vegetation surveys were conducted in 2002, 2006, 2010, and 2014 to monitor vegetation types and coverage. Habitat was assessed with the digital shapefile method (TPWD, Inland Fisheries Division, unpublished manual revised 2014).

Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD), terminology modified by Guy et al. (2007)], and condition indices [relative weights (W_r)] were calculated for target fishes according to Anderson and Neumann (1996). The index of vulnerability (IOV) was calculated for Gizzard Shad (DiCenzo et al. 1996). Standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE statistics.

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

RESULTS AND DISCUSSION

Habitat: A physical habitat survey conducted August 2014 indicated the littoral zone habitat consisted primarily of natural or rocky shoreline (Table 5). The reservoir was 15.5 feet below conservation pool at time of survey. No aquatic vegetation was observed probably because of the low elevation but aquatic vegetation has been decreasing over the last few years. Submersed vegetation went from an estimated 205 acres in 2006, to less than an acre in 2010, to no vegetation in the 2014 survey (Table 6). Emergent vegetation went from an estimated 461 acres to 0 acres during the same time interval. The loss of vegetation was due to receding waters during the prolonged drought. Aquatic vegetation is expected to regeminate at restored water elevations.

Prey species: Electrofishing catch rates of Gizzard Shad (Fig. 2), Threadfin Shad, and Bluegill (Fig. 3) were 117.0/h, 1.0/h, and 103.0/h, respectively. The previous survey in 2012 had catch rates of 287.0/h for Gizzard Shad, 15.5/h for Threadfin Shad and 54.0/h for Bluegill. The index of vulnerability for Gizzard Shad was 13%, down from both the 2012 (46%), and 2010 surveys (82%). The drop in IOV indicates the Gizzard Shad that are present are too large to be consumed by many of the existing predators. While the CPUE of Gizzard Shad declined, it was similar to what it was before golden alga fish kills first occurred in 2001. After the kills, Gizzard Shad CPUE greatly increased because of the lack of predators to keep the population controlled. Threadfin Shad have never been a major component of the prey base at Possum Kingdom. Bluegill abundance increased. Their abundance has varied greatly as they have been a species that appears to be negatively influenced by any golden alga toxicity event that occurs. While not very abundant, the Redear Sunfish population has been increasing and were sampled at the rate of 6.5/h, including two specimens greater than ten inches (Fig.4).

Blue Catfish: The 2015 Blue Catfish gill net CPUE (4.7/nn) had more than doubled from the previous survey conducted in 2013 (1.8/nn; Figure 5) and more than five times the CPUE of 2011 (0.9/nn). It was the highest CPUE for Blue Catfish during any gill net survey performed at Possum Kingdom and well above the historical average (1.0/nn). Most of the fish sampled were greater than 12 inches with catfish up to 35 inches sampled. W_r values generally increased as Blue Catfish size increased with W_r ranging from 81 to 123. Almost all inch groups above 16 inches exhibited good to excellent body condition.

Channel Catfish: The 2015 Channel Catfish gill net CPUE (3.4/nn; Fig. 6) was similar to the previous two surveys and was above the historical average (2.6/nn). Like Blue Catfish, the W_r increased with an increase of length. Relative weight ranged from 77 to 112.

White Bass: The 2015 gill net catch rate for White Bass was 1.7/nn, which was down from 6.4/nn in 2013, and 5.5/nn sampled in 2011 (Fig. 7). Fish ranged in size from seven to 15 inches. Relative weight for White Bass ranged from 82 to 96. The decrease in catch rate might have been caused by interspecific competition with Striped Bass, which have become more abundant.

Striped Bass: Striped Bass relative abundance showed a marked increase (2.3/nn; Fig. 8) from the two previous gill net surveys of 2013 (0.1/nn) and 2011 (0.2/nn). Striped Bass lengths ranged from seven to 30 inches. Relative weights ranged from 91 to 111 indicating good body condition. Historically, this is a species that is more negatively affected by the sporadic golden alga fish kills that have occurred since 2001 than most other species. This has resulted in great fluctuations in catch rates over time and presents great management challenges in providing a consistent angling experience for the public. This season's sampling indicated the best population structure since before the first golden alga fish kill. During spring of 2015, multiple public contacts have indicated a sentiment of lowering bag limits to insure that over-fishing does not occur. Until we have sufficient evidence that overfishing is occurring and a prolonged period without golden alga-caused fish kills occur, the present statewide regulations should remain in effect.

Largemouth Bass: The electrofishing CPUE of Largemouth Bass was 34.0/h in 2014, which was below the historical average (59.9/h) for the reservoir, but increased from the previous 2012 survey (23.5/h). Largemouth Bass body condition was considered good (relative weights above 90) for bass above eight inches in length (Figure 9). This season's sample included larger bass (up to 22 inches) than have been traditionally collected, and many bass are expected to reach legal length in 2015. The reservoir was stocked in the spring of 2014 but few smaller bass were sampled potentially indicating poor survival of the stocked fingerlings. May of 2015 brought substantial rainfall and filled Possum Kingdom. The increased water levels inundated many terrestrial plants that grew on the previously exposed lake bottom. This increase in habitat should result in greater survival of stocked and naturally reproduced fingerlings in 2015 as compared to 2014.

Crappie: The trap netting catch rate of White Crappie was 0.1/nn in 2014, the lowest CPUE ever at this reservoir (Figure 10). For the first time since random sampling became standard procedure, Black Crappie were not collected in the sample. These data corroborate anecdotal evidence from anglers about an inability to catch crappie in 2014. Anglers reported to have done well in 2013. The drought and resulting low reservoir elevations at time of sampling may have biased the trap net survey findings. Anglers are already reporting better catches of crappie after the reservoir elevation neared full pool.

Fisheries management plan for Possum Kingdom Reservoir, Texas

Prepared - July 2015

ISSUE 1: The Striped Bass population has rebounded after the last golden alga-caused fish kill in 2010. Historically, this had been an important species economically, sustaining several full time guides on the reservoir. We are starting to observe a return of guides and anglers targeting this species. Some anglers are voicing fear of over exploitation and asking for regulation changes to protect larger Striped Bass.

MANAGEMENT STRATEGIES

1. Continue annual Striped Bass fingerling stockings at the maximum rate of 15/acre if Striped Bass growth rates, relative weights, and prey availability continue to be sufficient.
2. Monitor the population through gill netting every other year. Collect age and growth data the next gill net survey.
3. With the possibility of a golden alga caused fish kill occurring, bag and length restrictions should remain the state-wide regulations. If a few more years pass with no major golden alga fish kills occurring, then would be the time to collect population data and creel information to determine if regulation changes are needed.

ISSUE 2: The Largemouth Bass population has rebounded after the last golden alga-caused fish kill in 2010. It has been stocked annually from 2011 to the present. Historically, this had been an important species economically with several tournaments fishing the reservoir. Frequency of Largemouth Bass tournaments have increased in recent years.

MANAGEMENT STRATEGY

1. Monitor the population by performing an electrofishing survey every other year. Collect age and growth data and genetic information the next electrofishing survey.

ISSUE 3: Possum Kingdom is nearly 75 years old and significant habitat degradation has occurred. The reservoir fisheries habitat has declined in structural habitat and native aquatic vegetation has disappeared. Staff partnered with the Hells Gate Bass Club and the Mineral Wells Bass Club to establish two Chapters of Friends of Reservoirs (FOR). FOR awarded a competitive grant to the Chapters to improve habitat through deployment of artificial structural habitats and native aquatic plant reintroduction. Artificial habitats were deployed and native plants were reintroduced into the reservoir in 2013 and were scheduled to be completed in 2014. However, the reservoir elevation dropped to 15 feet below normal pool. The completed plantings died and it was decided not to complete the plantings until the reservoir elevation rebounded.

MANAGEMENT STRATEGY

1. With adequate reservoir elevations, conduct native aquatic plant reintroductions and deploy additional artificial structures.

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.

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 and literature so that they can in turn educate others.
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.
6. Maintain zebra mussel samplers near highly utilized boat ramps.

SAMPLING SCHEDULE JUSTIFICATION:

The proposed sampling schedule includes additional electrofishing in 2016 and 2017 and mandatory monitoring in 2018-2019 (Table 9). Additional electrofishing survey in 2016 and gill net survey is necessary to maintain consistent data for trend information on these heavily used Largemouth Bass and Striped Bass fisheries, respectively. Trap net surveys are only necessary every four years to ensure presence or absence of crappie spp.

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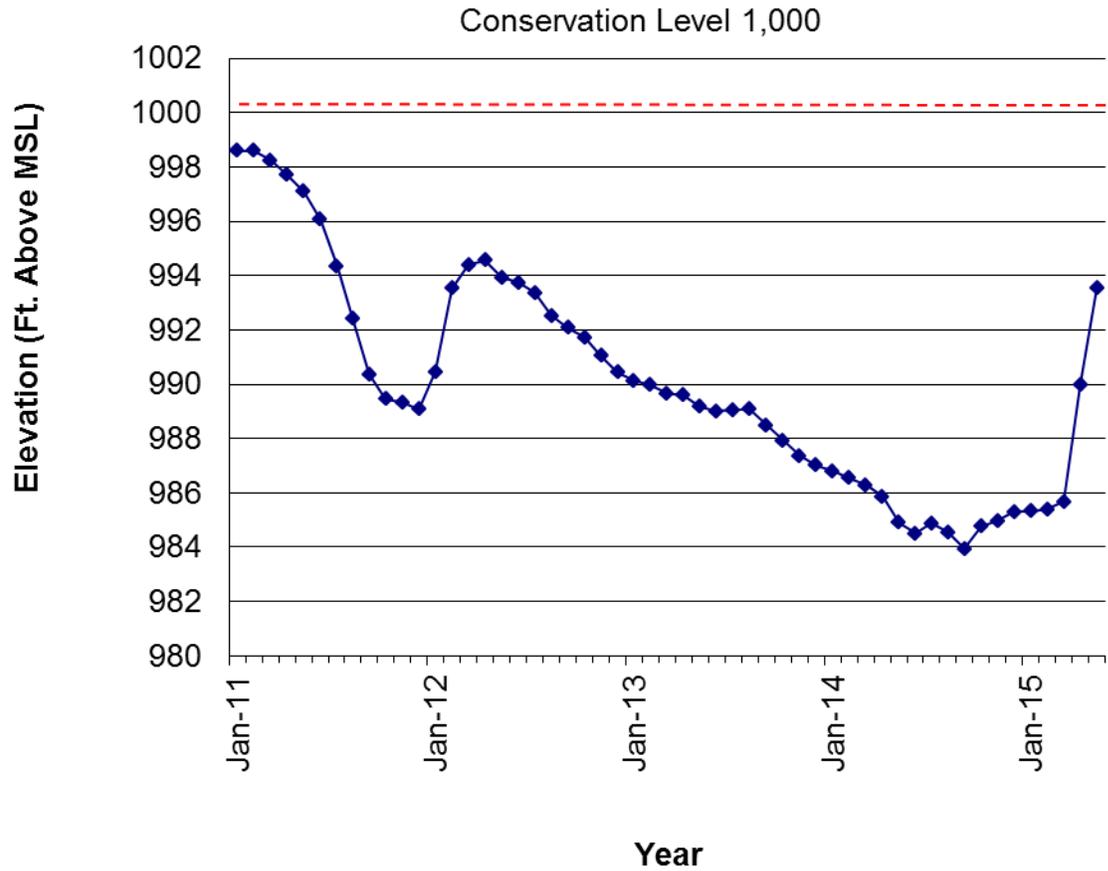


Figure 1. Monthly water level elevation averages in feet above mean sea level (MSL) recorded for Possum Kingdom Reservoir, Texas.

Table 1. Characteristics of Possum Kingdom Reservoir, Texas.

Characteristic	Description
Year constructed	1941
Controlling authority	Brazos River Authority
County	Palo Pinto
Reservoir type	Mainstem
Shoreline Development Index (SDI)	14.4
Conductivity	2,482 $\mu\text{S}/\text{cm}$

Table 2. Boat ramp characteristics for Possum Kingdom Reservoir, Texas, August, 2014. Reservoir elevation at time of survey was 984.5 feet above mean sea level. Most ramps have over-flow parking available besides the parking capacity listed. Only public ramps are listed below, there are private ramps that charge a fee to launch but the majority were out of the water at time of survey.

Boat ramp	Latitude Longitude (dd)	Public	Parking capacity (N)	Elevation at end of boat ramp (ft)	Condition
Public Ramp	32.8913 -98.4703	Y	54	UNK	Good
Public Ramp Low Water	32.8921 -98.4689	Y	11	981	Currently under water
North D & D	32.8846 -98.4892	Y	17	979	Good
Sandy Beach	32.8886 -98.5235	Y	10	UNK	Good
Bugs Beach	32.8754 -98.5041	Y	15	UNK	Good
South D & D	32.8831 98.4863	Y	60	UNK	Good
Scenic Cove	32.8846 -98.4507	Y	27	UNK	Good
Scenic Cove Low Water	32.8884 -98.4484	Y	20	982	Currently under water
State Park	32.8804 -98.8754	Y	20	983	Good
Elm Creek	32.9089 -98.4961	Y	15	UNK	Good

Table 3. Harvest regulations for Possum Kingdom Reservoir, Texas.

Species	Bag Limit	Length Limit (inches)
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 ^a	18 - inch minimum
Bass, Smallmouth	5 ^c	14 - inch minimum
Bass, Spotted	5 ^c	None
Bass, Largemouth	5 ^c	16 - inch minimum ^b
Crappie: White and Black Crappie, their hybrids and subspecies	25	10 - inch minimum

a Striped Bass bag limit changed from 2 to 5 on September 1, 2012.

b Largemouth Bass minimum length limit changed from 14 to 16 inches on September 1, 2002.

c Daily bag for Largemouth Bass, Smallmouth Bass, and Spotted Bass = 5 fish in any combination

Table 4. Stocking history of Possum Kingdom Reservoir, Texas. UNK = unknown; FRY = fry; FGL = fingerling; AFGL = advanced fingerling; ADL = adult.

Year	Number	Size	Year	Number	Size
	<u>Blue Catfish</u>			<u>Striped Bass</u>	
2002	70,995	FGL	1976	100,000	UNK
			1978	95,300	UNK
	<u>Channel Catfish</u>		1981	93,924	UNK
1972	2,800	AFGL	1983	198,990	UNK
2001	8,692	AFGL	1986	36,700	FGL
2001	426,256	FGL	1986	123,250	FRY
2010	89,973	FGL	1987	217,740	FGL
2013	<u>88,840</u>	FGL	1988	198,635	FRY
Total	616,561		1989	70,661	FGL
			1989	125,544	FRY
	<u>Florida Largemouth Bass</u>		1990	201,729	FGL
1973	265,500	FRY	1991	212,726	FGL
1975	35,300	FRY	1993	98,475	FGL
1976	113,727	FGL	1993	5,115,522	FRY
1978	98,230	FGL	1994	98,366	FGL
1978	174,270	FRY	1995	99,000	FGL
2000	443,020	FGL	1995	3,000,000	FRY
2001	443,251	FGL	1997	155,700	FGL
2002	77	ADL	1998	144,800	FGL
2002	442,454	FGL	1999	178,235	FGL
2003	664,519	FGL	2000	126,304	FGL
2011	391,188	FGL	2001	118,168	FGL
2013	391,908	FGL	2001	3,185,000	FRY
2014	295,709	FGL	2002	354,838	FGL
2015	213,209	FGL	2003	108,804	FGL
Total	3,759,153		2003	2,488,196	FRY
			2004	92,423	FGL
	<u>Northern Largemouth Bass</u>		2004	2,129,409	FRY
1966	70,000	UNK	2005	156,355	FGL
1970	360,000	FRY	2005	547,112	FRY
1972	426,640	FRY	2006	242,351	FGL
1972	278,983	UNK	2006	387,435	FRY
2005	<u>223,690</u>	FGL	2007	362,392	FGL
Total	1,359,313		2007	881,862	FRY
			2008	234,655	FGL

Table 4. Continued

<u>Smallmouth Bass</u>			<u>Striped Bass</u>		
1978	162,000	UNK	2010	119,510	FGL
1984	131	ADL	2013	100,958	FGL
1987	30	ADL	2013	944,540	FRY
1988	51	ADL	2014	410,970	FGL
1998	71	ADL	2015	<u>267,748</u>	FGL
1998	259,100	FGL	Total	24,092,483	
2001	20	ADL			
2002	500	AFGL			
2002	38,286	FGL	1980	<u>8,600</u>	
2003	<u>63,839</u>	FGL			
Total	707,118				
			<u>Threadfin Shad</u>		
			1964	105,000	FRY
			1965	500,000	FRY
			1973	6,005,000	FRY
			1974	6,400,000	FRY
			1975	<u>3,000,000</u>	FRY
			<u>Walleye</u>		
			1964	105,000	FRY
			1965	500,000	FRY
			1973	6,005,000	FRY
			1974	6,400,000	FRY
			1975	<u>3,000,000</u>	FRY
			Total		
				160,100,000	

Table 5. Survey of structural habitat types, Possum Kingdom Reservoir, Texas, 2014. Shoreline habitat type units are in miles and boat docks and standing timber is acres.

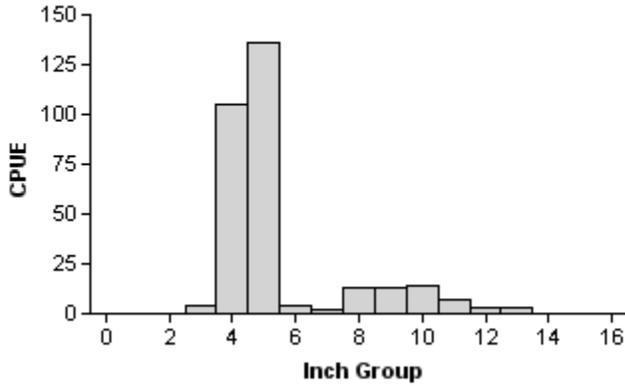
Habitat type	Estimate	% of total
Bluff	13.4 miles	12.9
Natural	42.0 miles	40.3
Rocky	48.7 miles	46.8
Boat Docks	303.0 acres	3.0
Standing timber	425.0 acres	4.3

Table 6. Survey of aquatic vegetation, Possum Kingdom Reservoir, Texas, 2002 - 2014. Surface area (acres) is listed with percent of total reservoir surface area in parentheses.

Vegetation	2002	2006	2010	2014
Native submersed	367.0 (2.4)	205.0 (1.3)	0.7 (<0.1)	0.0
Native floating-leaved	0.0	0.0	0.0	0.0
Native emergent	124.2 (0.8)	461.0 (3.9)	10.9 (0.1)	0.0
Non-native	0.0	0.0	0.0	0.0

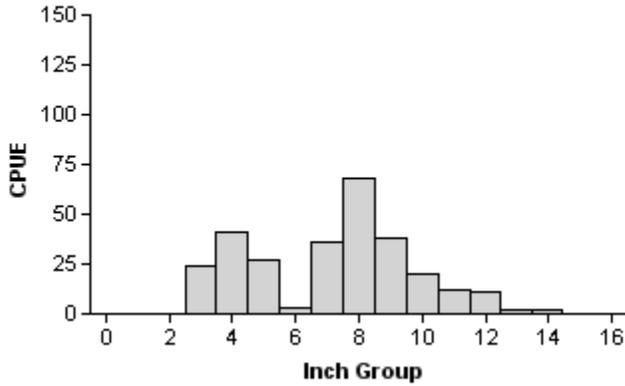
Gizzard Shad

2010



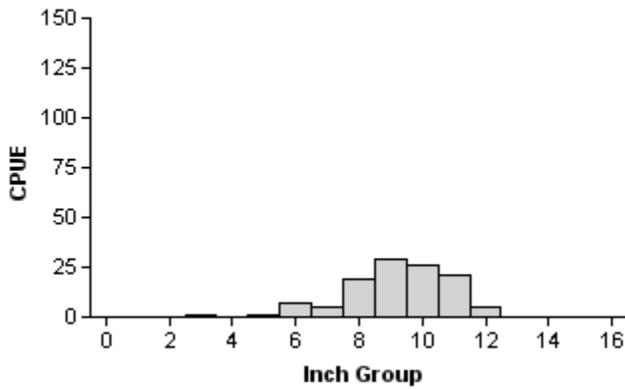
Effort = 2.0
 Total CPUE = 306.5 (22; 613)
 IOV = 82 (6)

2012



Effort = 2.0
 Total CPUE = 287.0 (17; 574)
 IOV = 46 (7.8)

2014



Effort = 2.0
 Total CPUE = 117.0 (24; 234)
 IOV = 13 (2.8)

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, Possum Kingdom Reservoir, Texas, 2010, 2012, and 2014.

Bluegill

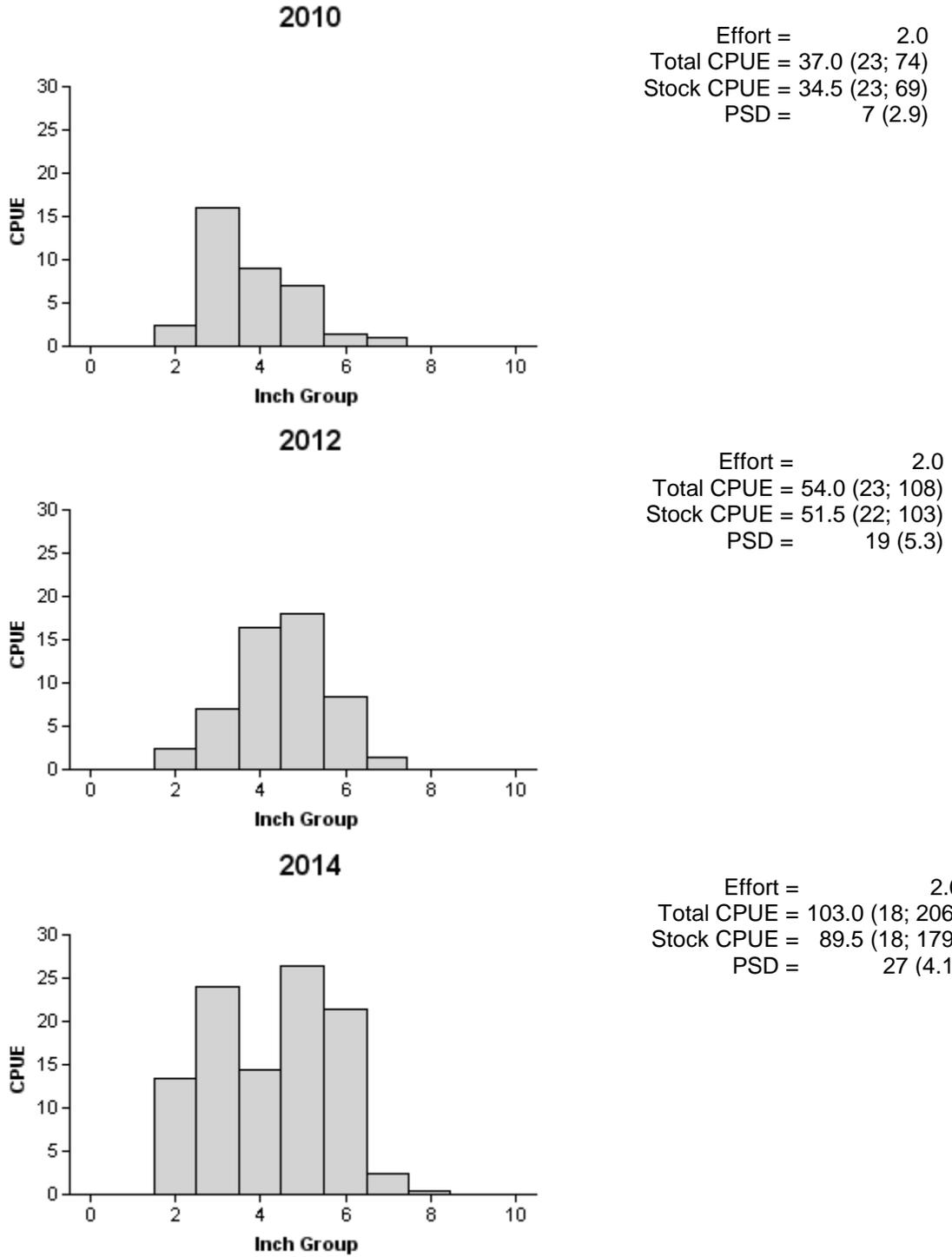


Figure 3. Number of Bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Possum Kingdom Reservoir, Texas, 2010, 2012, and 2014.

Redear Sunfish

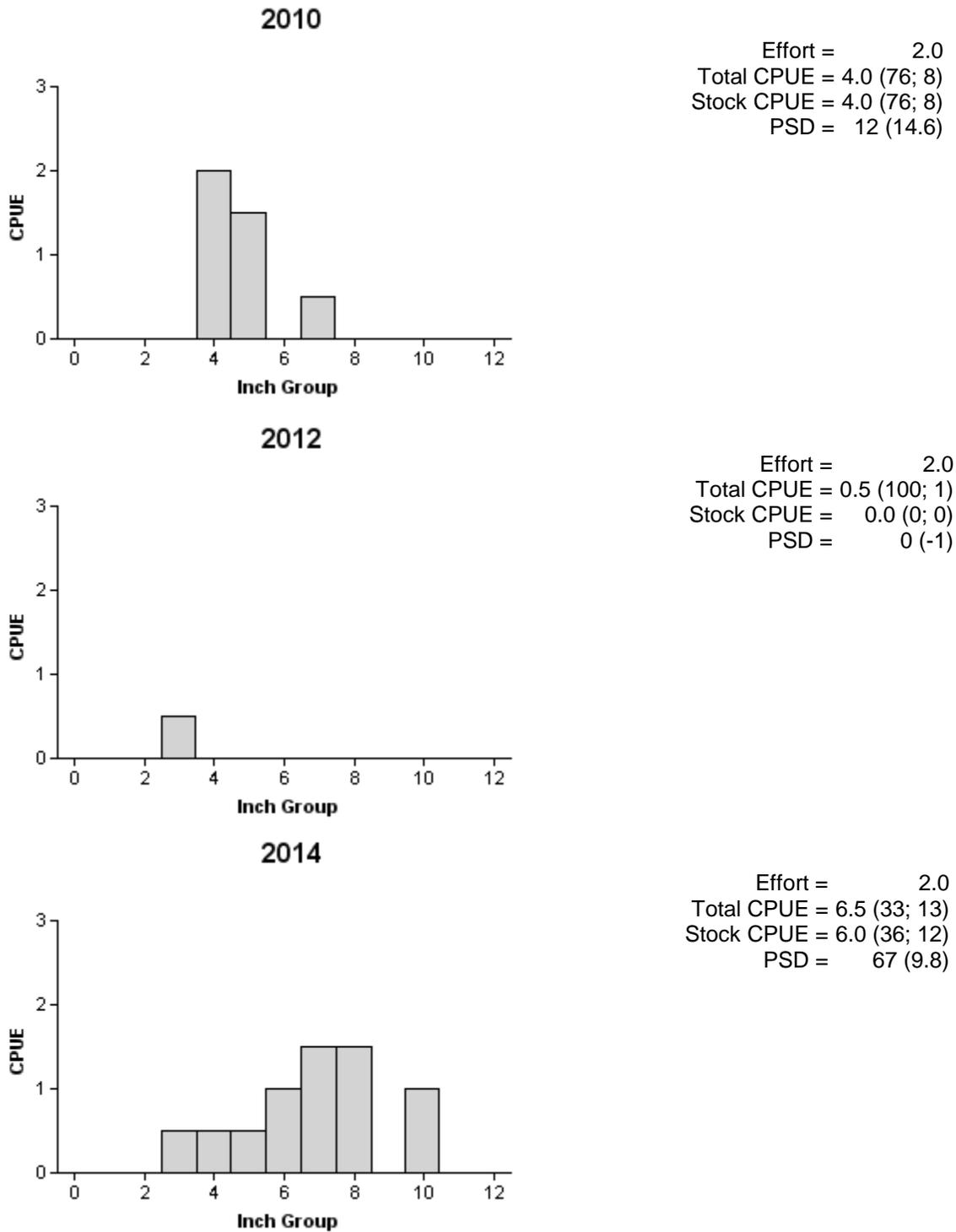


Figure 4. Number of Redear Sunfish caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Possum Kingdom Reservoir, Texas, 2010, 2012, and 2014.

Blue Catfish

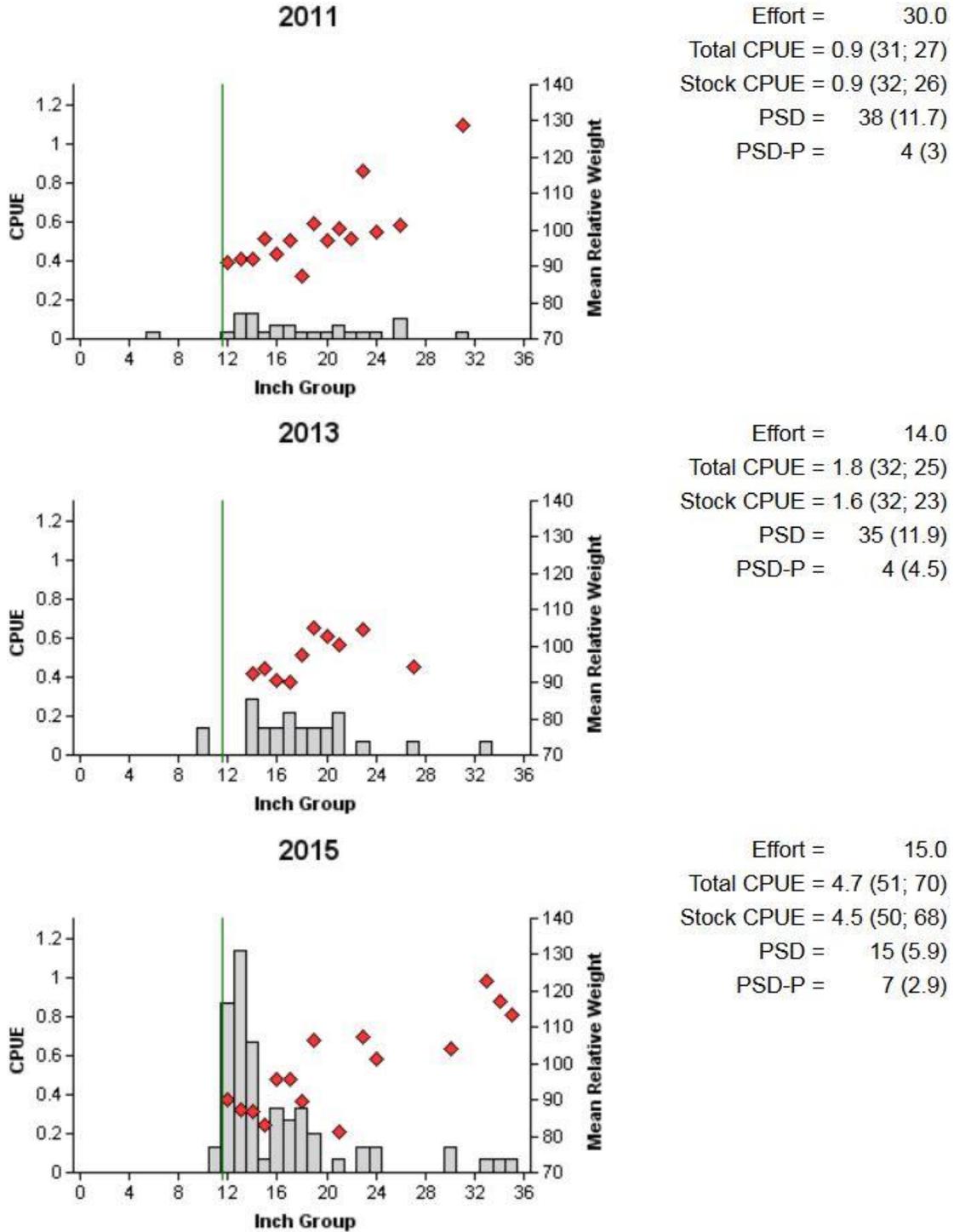


Figure 5. Number of Blue Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for winter gill netting surveys, Possum Kingdom Reservoir, Texas, 2011, 2013, and 2015. Line indicates minimum length limit at time of sampling.

Channel Catfish

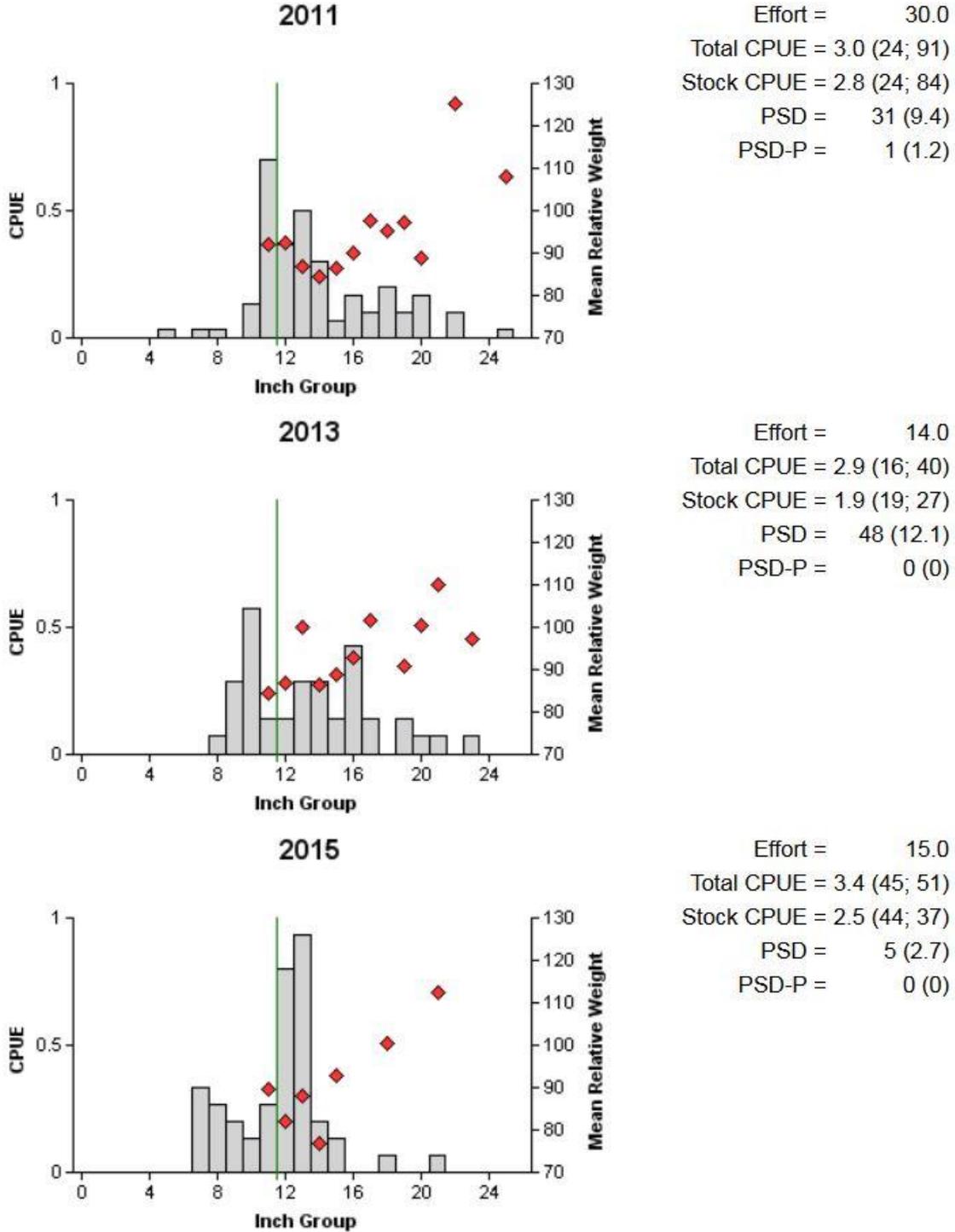


Figure 6. Number of Channel Catfish caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for winter gill netting surveys, Possum Kingdom Reservoir, Texas, 2011, 2013, and 2015. Line indicates minimum length limit at time of sampling.

White Bass

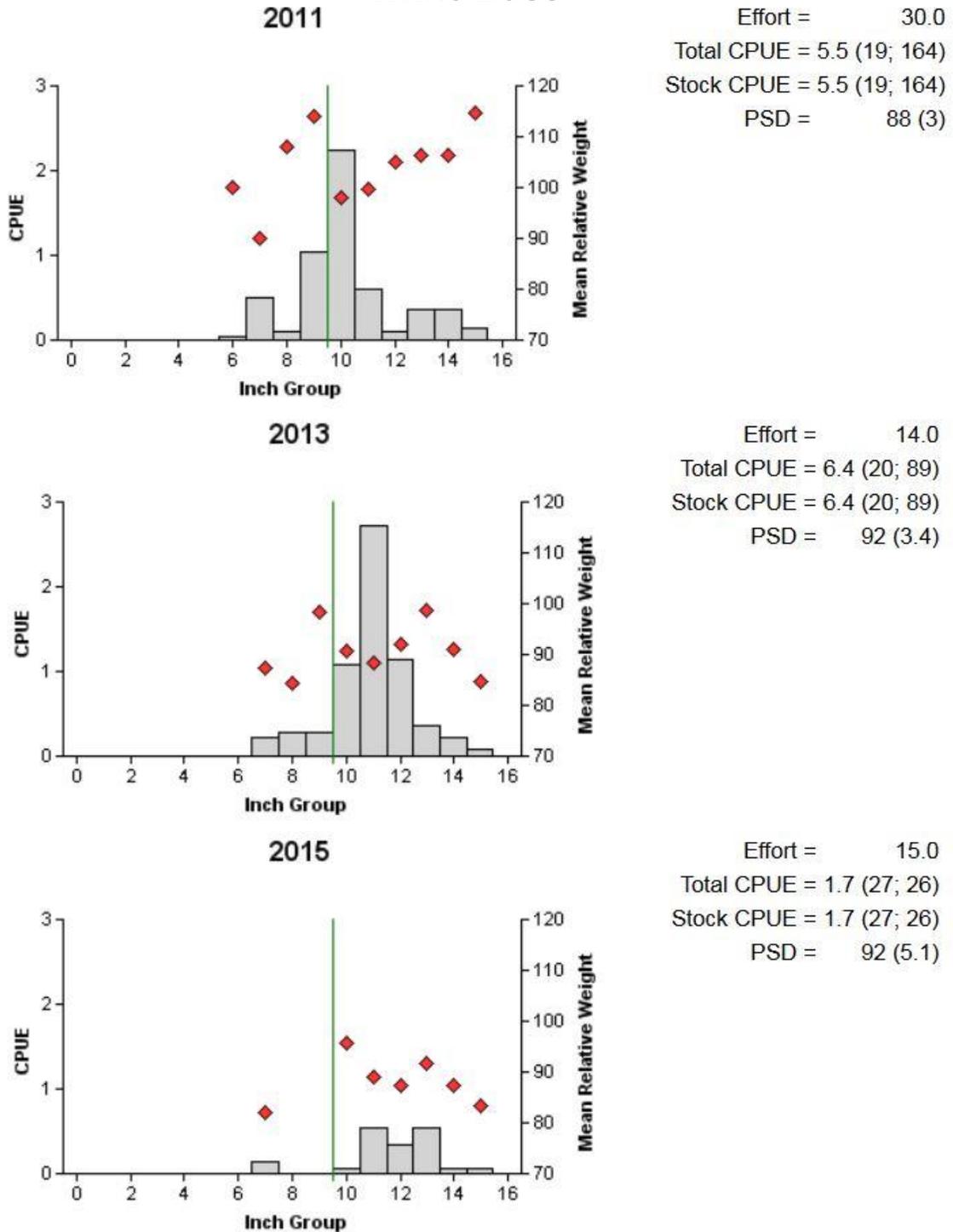


Figure 7. Number of White Bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for winter gill netting surveys, Possum Kingdom Reservoir, Texas, 2011, 2013, and 2015. Line indicates minimum length limit at time of sampling.

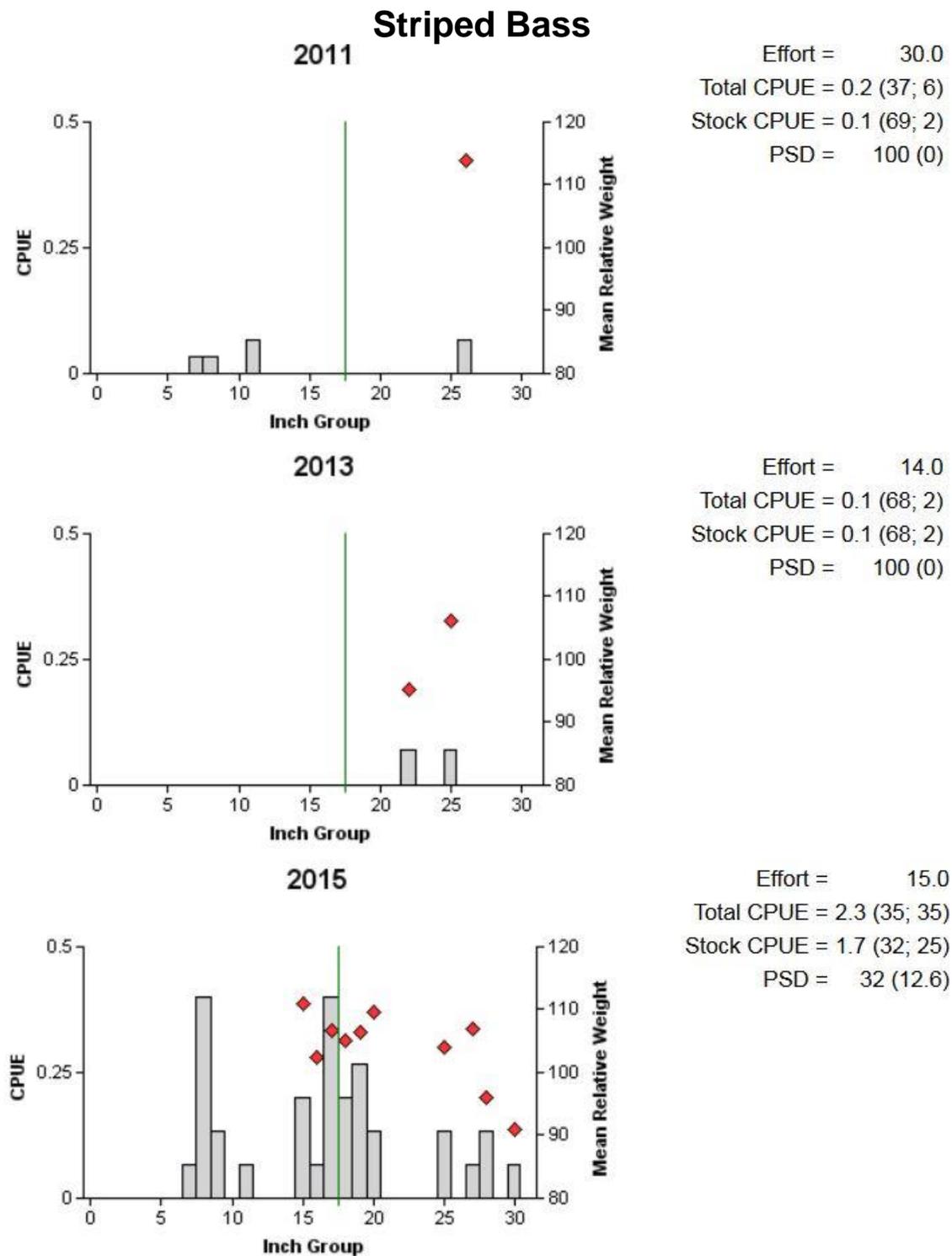


Figure 8. Number of Striped Bass caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for winter gill netting surveys, Possum Kingdom Reservoir, Texas, 2011, 2013, and 2015. Line indicates minimum length limit at time of sampling.

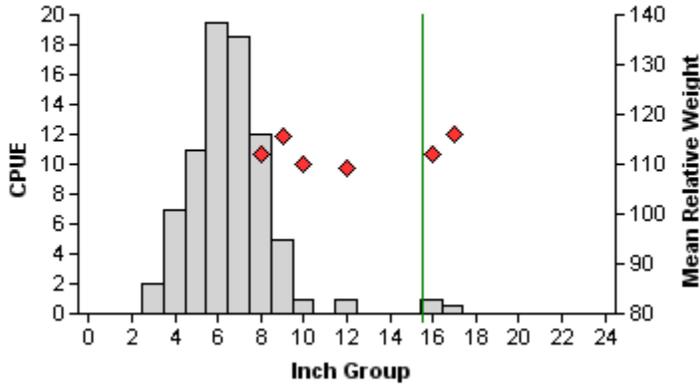
Table 7. Mean length at age of capture for Striped Bass (sexes combined) collected in gill netting surveys, Possum Kingdom Reservoir, Texas, in 1999, 2001, 2002, 2003, 2005, 2007, and 2009. Sample sizes are in parentheses. Ages determined using otoliths.

Year	Length (inches) at Age					
	1	2	3	4	5	6
1999		12.4(54)		22.0(9)	23.2(6)	27.6(1)
2001	9.6(10)	15.7(10)		18.4(19)		
2002		18.5(4)			22.8(11)	
2003	9.5(15)	14.1(16)				24.9(22)
2005	11.6(20)	19.6(6)	22.8(4)			
2007		17.7(20)				
2009	10.1(6)	16.1(33)				
Averages*	13.4	19.3	23.4	26.3	28.3	29.8

* Ecological region 5 averages from Prentice (1987); lengths derived for February 15.

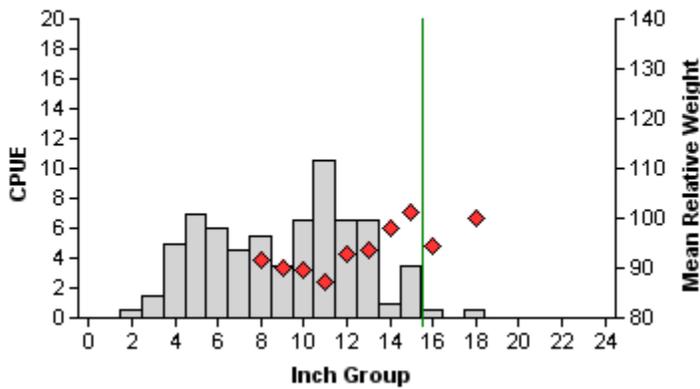
Largemouth Bass

2005



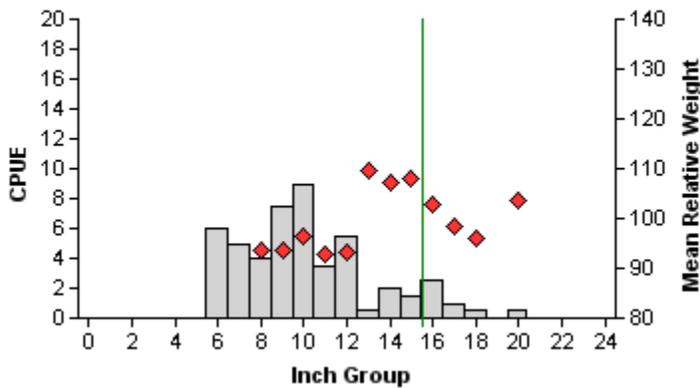
Effort = 2.0
 Total CPUE = 78.5 (21; 157)
 Stock CPUE = 20.5 (27; 41)
 PSD = 12 (6.2)
 PSD-16 = 7 (3.8)

2006



Effort = 2.0
 Total CPUE = 69.0 (23; 138)
 Stock CPUE = 44.5 (25; 89)
 PSD = 42 (7.3)
 PSD-16 = 2 (1.4)

2008

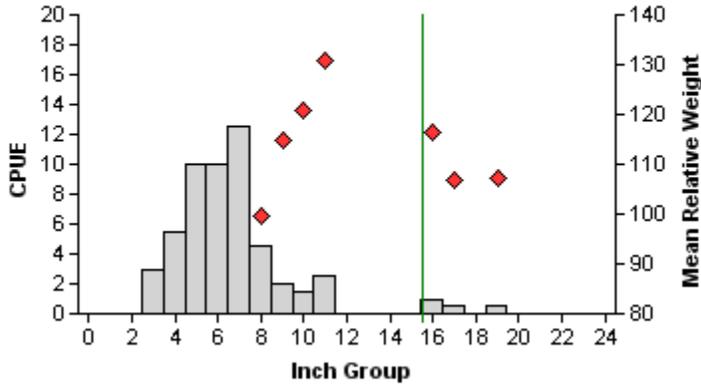


Effort = 2.0
 Total CPUE = 49.0 (23; 98)
 Stock CPUE = 38.0 (23; 76)
 PSD = 37 (5.2)
 PSD-16 = 12 (4.9)

Figure 9. Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Possum Kingdom Reservoir, Texas, 2005, 2006, and 2008. Line indicates minimum length limit at time of sampling.

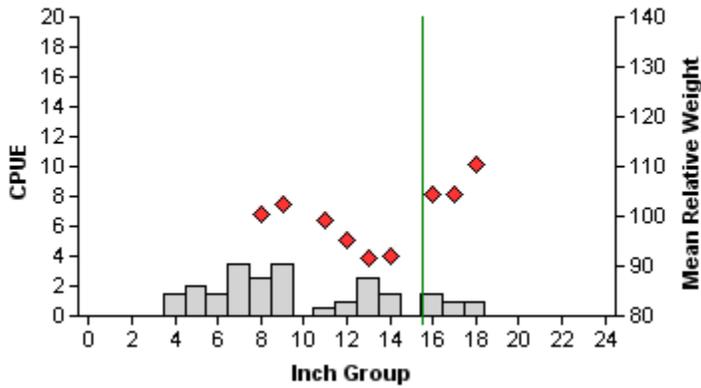
Largemouth Bass

2010



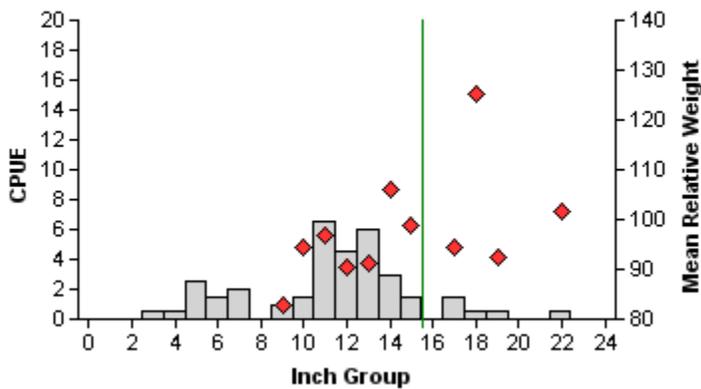
Effort = 2.0
 Total CPUE = 53.5 (14; 107)
 Stock CPUE = 12.5 (28; 25)
 PSD = 16 (13.8)
 PSD-16 = 16 (13.8)

2012



Effort = 2.0
 Total CPUE = 23.5 (28; 47)
 Stock CPUE = 15.0 (30; 30)
 PSD = 57 (14.1)
 PSD-16 = 23 (8.7)

2014



Effort = 2.0
 Total CPUE = 34.0 (18; 68)
 Stock CPUE = 27.0 (22; 54)
 PSD = 67 (10.8)
 PSD-16 = 11 (4.6)

Figure 9 (continued). Number of Largemouth Bass caught per hour (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Possum Kingdom Reservoir, Texas, 2010, 2012, and 2014. Line indicates minimum length limit at time of sampling.

Largemouth Bass

Table 8. Results of genetic analysis of Largemouth Bass collected by fall electrofishing, Possum Kingdom Reservoir, Texas, 1999, 2001, 2002, 2003, 2004, 2005, 2006 and 2010. 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		
1999	28	4	21	3	50.0	14.3
2001	30	3	21	6	40.8	10
2002	30	7	15	8	50.8	23.3
2003	31	21	9	1	84.7	67.7
2004	49	12	34	3	62.6	24.5
2005	2	1	1	0	75	50
2006	30	2	28	0	60	7
2010	30	1	28	1	53	3

White Crappie

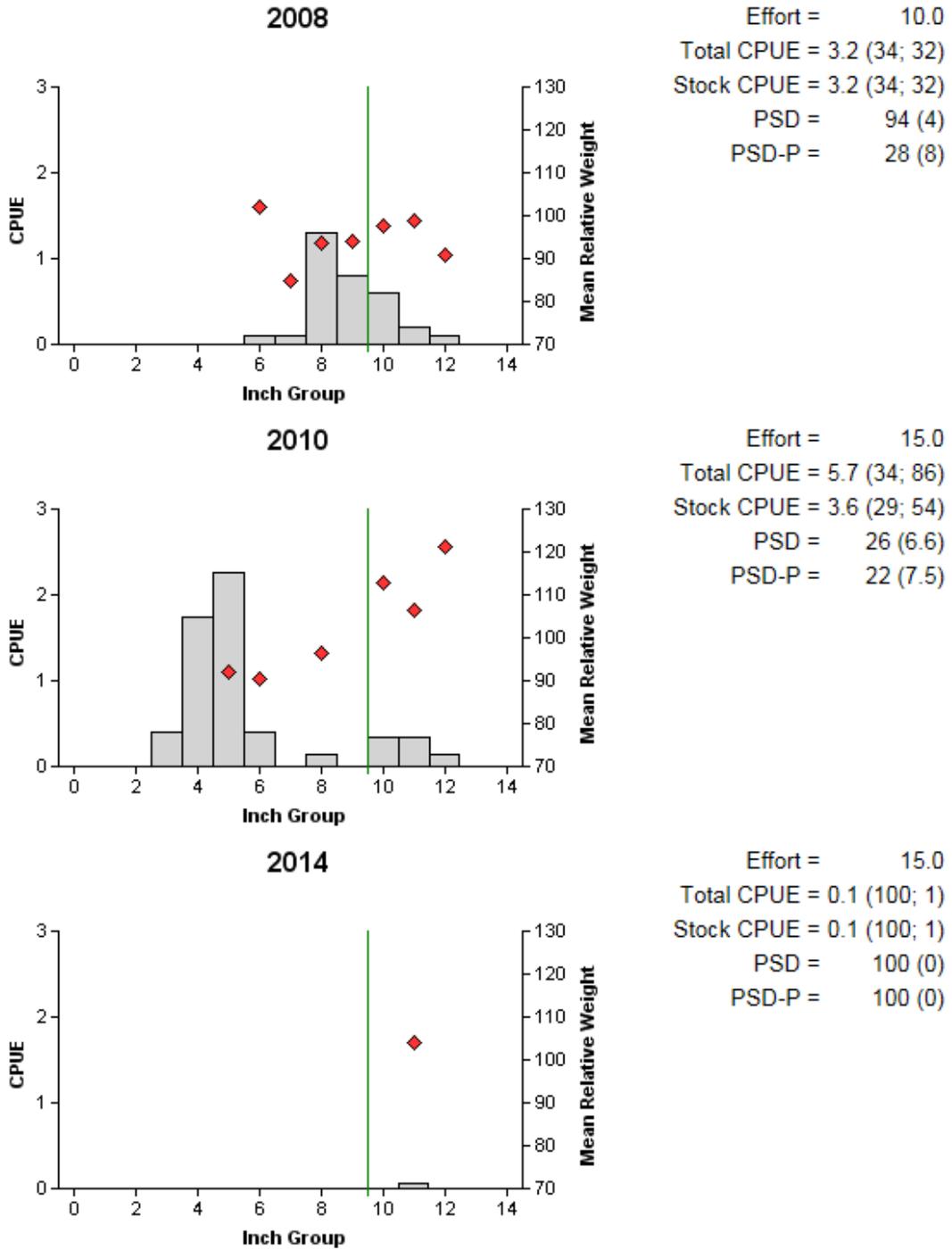


Figure 10. Number of White Crappie caught per net night (CPUE, bars), mean relative weight (diamonds), and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap netting surveys, Possum Kingdom Reservoir, Texas, 2008, 2010, and 2014. Line indicates minimum length limit at time of sampling.

Table 9. Proposed sampling schedule for Possum Kingdom Reservoir, Texas. Survey period is June through May. Gill netting surveys are conducted in the winter, while electrofishing and trap netting surveys are conducted in the fall. Standard survey denoted by S and additional survey denoted by A.

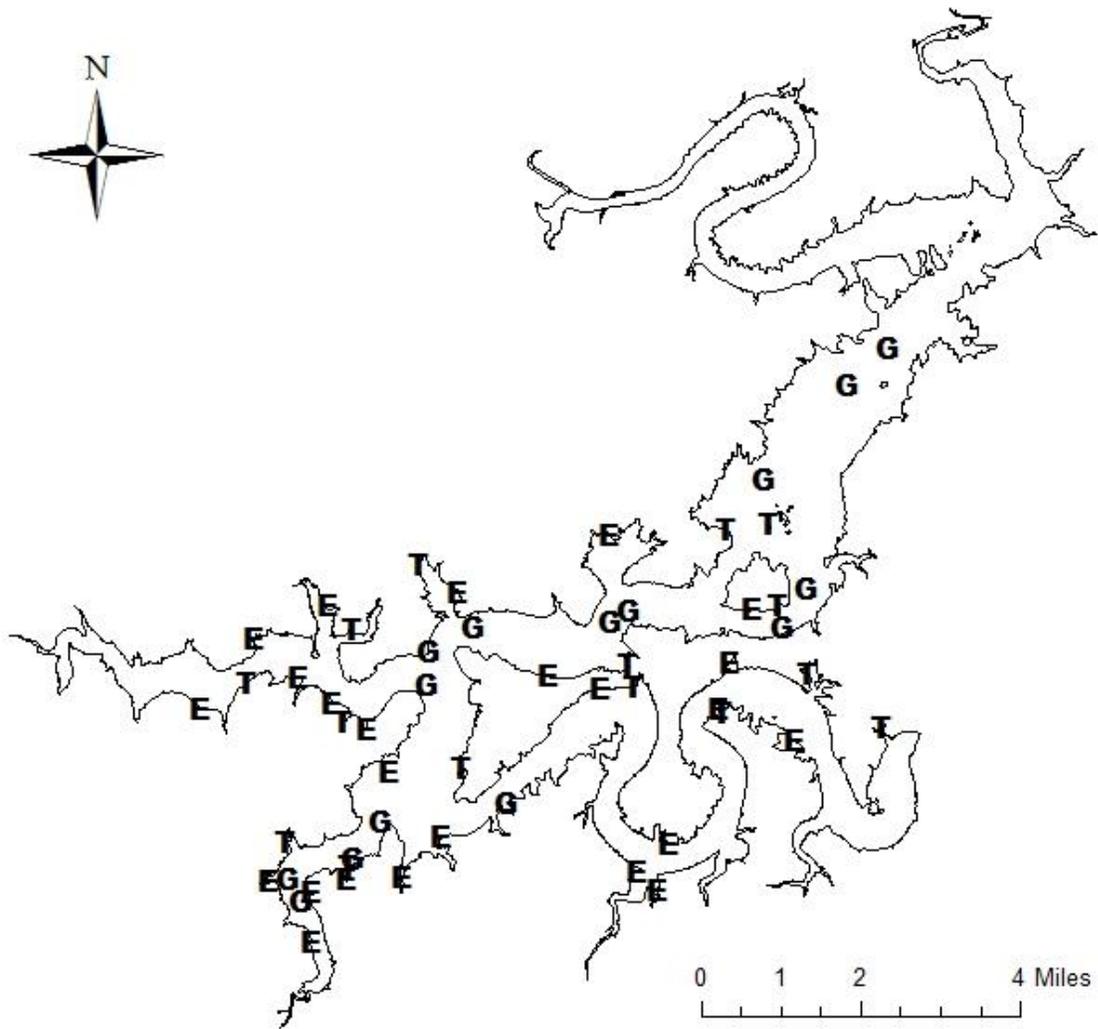
Survey year	Electrofishing Fall(Spring)	Trap net	Gill net	Habitat			Creel survey	Report
				Structural	Vegetation	Access		
2015-2016								
2016-2017	A		A					
2017-2018								
2018-2019	S	S	S		S	S		S

APPENDIX A

Number (N) and catch rate (CPUE) of all species collected from all gear types from Possum Kingdom Reservoir, Texas, 2014-2015. Sampling effort was 15 net nights for gill netting, 15 net nights for trap netting, and 2 hours for electrofishing.

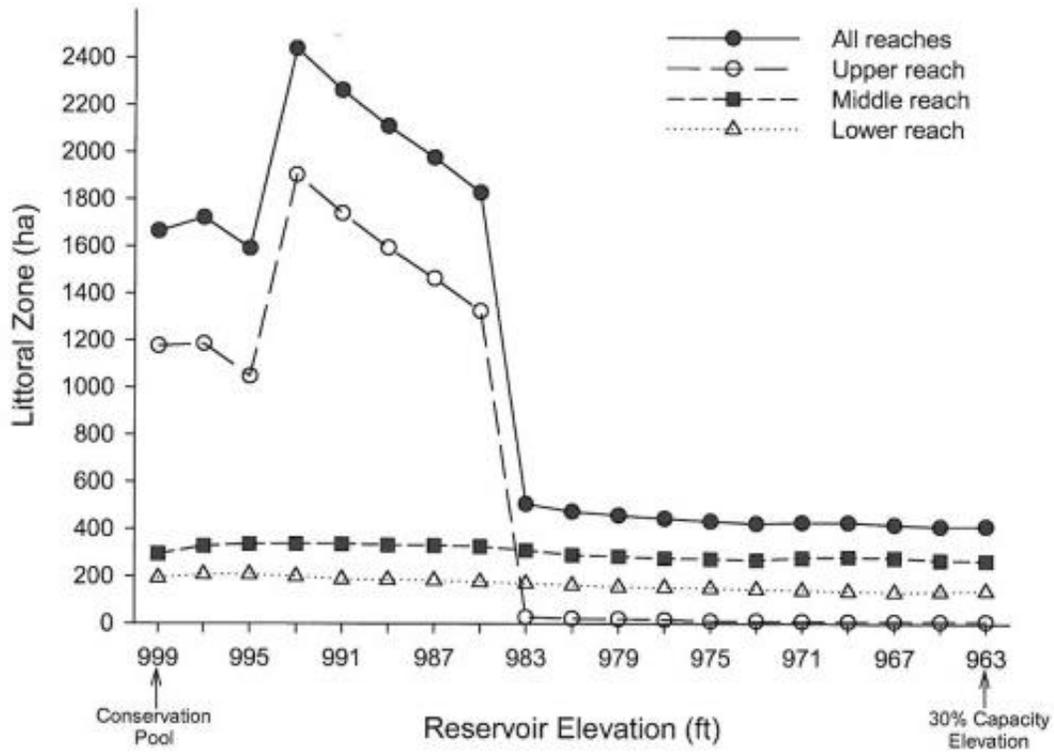
Species	Gill Netting		Trap Netting		Electrofishing	
	N	CPUE	N	CPUE	N	CPUE
Longnose Gar	2	0.1				
Gizzard Shad	213	14.2			234	117.0
Threadfin Shad			15	1.0	2	1.0
Common Carp	31	2.1				
River Carpsucker	22	1.5				
Smallmouth Buffalo	15	1.0				
Blue Catfish	70	4.7				
Channel Catfish	51	3.4				
White Bass	26	1.7	5	1.3		
Striped Bass	35	2.3				
Green Sunfish			1	0.1	18	9.0
Warmouth					1	0.5
Bluegill			55	3.7	206	103.0
Longear Sunfish					7	3.5
Redear Sunfish			3	0.2	13	6.5
Largemouth Bass			1	0.1	68	34.0
White Crappie			1	0.1		
Freshwater Drum	7	0.5				

27
APPENDIX B



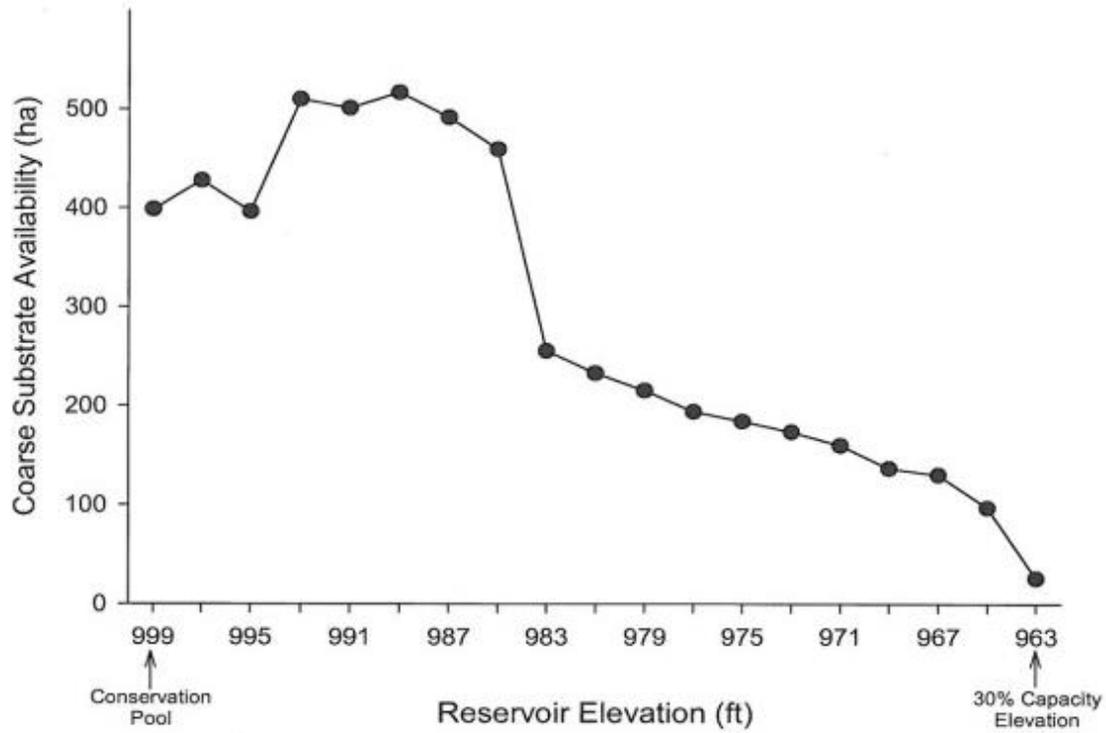
Location of sampling sites, Possum Kingdom Reservoir, Texas, 2014-2015. Trap net, gill net, and electrofishing stations are indicated by T, G, and E, respectively. Water level was near 15 feet below full pool when sampling.

APPENDIX C



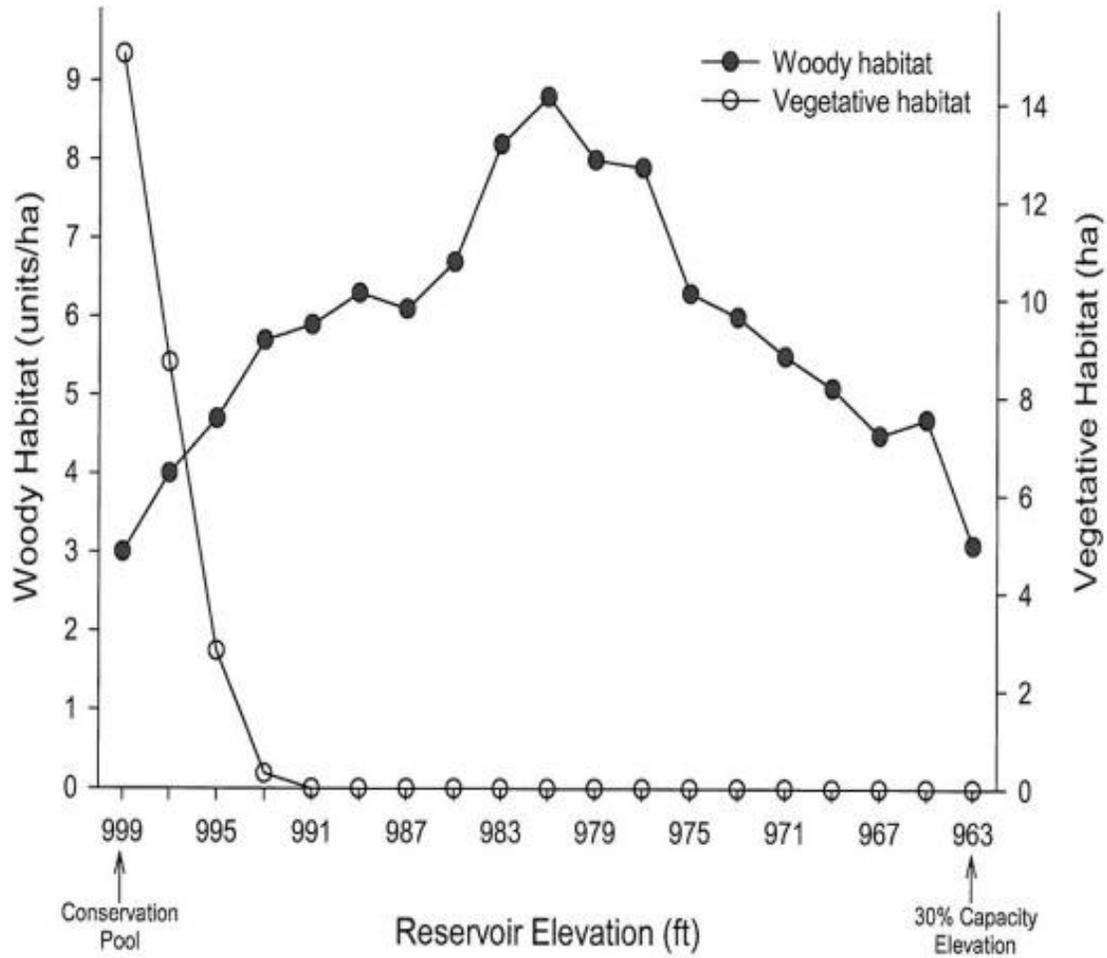
Elevation specific littoral zone (<10 ft. water depth) coverage in Possum Kingdom Reservoir, Texas, for upper, middle, and lower reservoir reaches and all reaches combined.

APPENDIX D



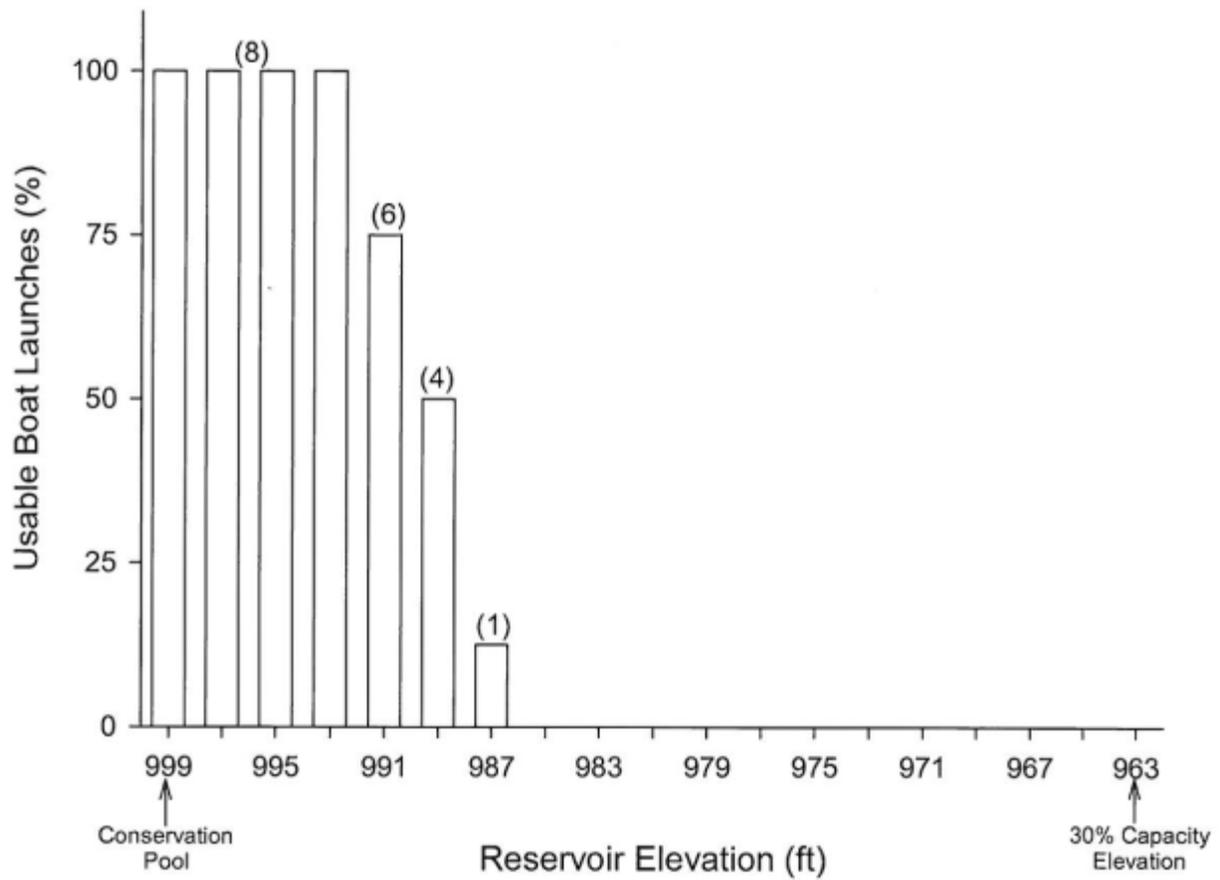
Elevation specific littoral zone (<10 ft. water depth) coarse substrate availability in Possum Kingdom reservoir, Texas.

APPENDIX E



Elevation specific littoral zone (<10 ft. water depth) woody habitat availability in Possum Kingdom Reservoir, Texas. Woody habitat was defined as one inundated standing tree, downed tree, or brush pile attractor.

APPENDIX F



Elevation specific boat accessibility in Possum Kingdom Reservoir, Texas. The number of usable boat launches provided above each bar.