CARL BLACKWELL LAKE MANAGEMENT PLAN

Background

Lake Carl Blackwell impounds Stillwater Creek, 10 miles west of Stillwater in Payne County, Oklahoma (Figure 1). The lake covers 3,370 surface acres and was constructed in 1937 by the W.P.A. and is operated by Oklahoma State University. Flood waters flow unregulated over an open spillway. At normal pool elevation, 944 feet MSL, the lake has 59 miles of shoreline and a shoreline development ratio of 6.8:1 (the ratio between length of shoreline and surface area). The Lake has a mean depth of 16 feet at maximum depth of 46 feet, a water exchange change rate of 2.9 (inflow/storage). The watershed is dominated by cross timber area and agriculture fields. Run off from till farming and unpaved county roads are the primary sources of the lake's silt load.

Fish habitat is very limited and consists primarily of sandstone rock shorelines, riprap on the face of the dam and two berms built to protect Headquarters Cove are covered with concrete and brick rubble. Most shorelines are shallow and made up of silt or clay. Although the lakes water level is fairly stable, high seasonal turbidities, moderate silt loads and windswept shorelines prevents aquatic plant establishment. The five major coves of the lake are oriented north to south and are open to the prevailing winds.

The summer secchi disk reading in the central pool averages 33 inches. Conductivity values range from 380 to 530 µS/cm indicating moderate levels of inorganic dissolved solids. Values for pH range from 7.2 – 8.7 indicating neutral to slightly alkaline. Thermal stratification occurs throughout the lake during the summer months and usually set up at 22 feet in the lower pool. In July at the Dam up to 57% of the water column was <2 mg/L. The Oklahoma Water Resources Board (OWRB) considers Carl Blackwell to only partially meet the Fish and Wildlife Propagation (FWP) beneficial use described in the Oklahoma Water Quality Standards.

The trophic state of the reservoir measured by the OWRB using Carlson's Trophic State Index (TSI, chlorophyll-a), ranged from 53-57 indicating the lake to be eutrophic (i.e., having high primary productivity and nutrient levels).

Turbidity values vary across the lake and are highest in the upper reaches of the lake. The OWRB found that Carl Blackwell was not supporting the FWP beneficial use based on turbidity with 60% of the turbidity levels exceeding the Oklahoma Water Quality Standard of 25 NTU. Turbidity is primarily from suspended clay and plankton.

History of Fishery

Largemouth bass

The largemouth bass fishery at Carl Blackwell Lake can be described as fair to good compared to state averages. Electrofishing catch per hour (C/f) has ranged from 35 to 53 bass/hour since 1988. Total bass abundance is just above the acceptable value for a quality fishery (C/f=40) and abundance of bass >14 inches declined since 1999 to below the minimum acceptable value of 10 bass per hour (Table 2). Since shoreline cover is critical for bass recruitment attempts were made to establish native aquatic plants. Water lily tubers were planted at six locations in 2004 and water willow were planted

in 2005 at one location. Only water willow has survived and has spread modestly. Although the lake has fairly stable water levels, aquatic plants, other than water willow, have not been able to become established due to windswept orientation of the coves, high turbidity levels and herbivores.

In the spring of 2010 age and growth data were collected from the largemouth bass sample (Table 3). Growth rates were below the statewide mean except for Age 2 bass. Bass reached 14 inches after four growing seasons.

A 14-inch minimum length limit on largemouth bass has been in effect since 1991. This regulation was enacted to increase the number of spawning size bass and numbers of quality-sized bass for anglers to catch.

White Crappie

Initial gill net surveys indicated a slow growing white crappie population with only 5 percent of the crappie >8 inches in length. Age 3 fish had a mean lengths of about 7.5 inches (Table 4 and Table 5, Figure 3 and Figure 4). In order to improve this fishery, annual stockings of saugeye and hybrid striped bass were initiated in 1993.

With increased predation from these predators smaller crappie were thinned and growth rates increased. By 1999 about 30 percent of the crappie were >8 inches in length and growth rates continued to increase through 2008. According to anglers, crappie fishing has improved in recent years even though saugeye abundances declined starting in 1999 and hybrid striped bass numbers declined in 2008. Perhaps predator abundance is still adequate to control excess crappie numbers.

White bass

Prior to the introduction of hybrid striped bass, gill netting results indicated a quality white bass fishery with high catch rates of fish >12 inches in length through 1994 (Table 6, Figure 5). But white bass abundance declined starting in 1996 and remained low through 2008. A decline in white bass abundance is typical after the introduction of hybrid striped bass since they compete directly with white bass for food and space.

Hybrid Striped Bass

Lake Carl Blackwell was first stocked with hybrid stripers in 1982 with fry at the rate of 80/acre and in 1991 with reciprocal hybrids fingerlings at the rate of 0.3/acre before adequate stockings were initiated in 1993 at the standard rate of 10/acre (Table 1). Hybrid stripers are stocked annually with stocking rates that have ranged from 5 to 32 fingerlings per acre.
Higher stocking rates were used initially to more quickly build numbers to help control the large numbers of slow going crappie.

Gill net catch rates have indicated a quality fishery starting in 1996 with catch rates above acceptable levels of fish >20 inches in length. Total abundance has fluctuated considerably and only five fish were netted in 2008 (Table 7, Figure 6). Historically, Carl Blackwell has produced good numbers of hybrids larger than six pounds attracting fishing guides to the lake. The current regulation is: “Striped bass hybrids and/or white bass, 20 combined per day, of which only five (5) may be 20 inches or longer.”

Age and growth data indicates hybrids reach 13.5 inches by the fall of their second year (Age 1) and 17.7 inches by age 2. Growth has been consistent for age 1 fish but more variable for older

fish (Table 8). The availability of smaller size shad probably accounts for slowing of growth in age 3 and age 4 fish.

Saugeye

Saugeye were first stocked in 1993 to control the slow growing crappie population. Gill netting surveys indicates total Saugeye abundance increased to record levels by 1997 before decreasing to a record low in 2008 (Table 9, Figure7). The drop off in catch rates is probably the result of reduced stocking rates initiated in 2004 (Table 10). However, total abundance exceeded the minimum acceptable values for a quality fishery from 1995 through 2004, and abundance of Saugeye >16 inches exceeded minimum acceptable values from 1995 through 2008. The current regulation is five (5) Saugeye/walleye per day with a minimum length limit of 18 inches.

Age and growth data shows Saugeye reaching legal harvestable size (18 inches) after three growing seasons. Overall, growth rates are acceptable and exceed the regional mean (Table 10).

Fall night electrofishing is used to collect age 0 saugeye and evaluates year class strength. Data from this gear indicates acceptable survival rates of stocked fish. Catch rates (number caught per hour) ranged from 29-105(Table 11, Figure 8).

Gizzard Shad

The primary forage species in Carl Blackwell Lake is gizzard shad. Total shad abundance by gill netting has been fairly stable and well above the minimum value of 4.8/day. However, abundance of shad <8 inches has been acceptable but with a declining trend from 1999 to 2008 (Table 12, Figure 9). Sinking shad nets were used for three years to collect age 0 shad and indicated an increasing trend from 2001 to 2008. Relative weights (W_r) and growth rates of most predators indicated adequate forage abundance (Tables 2-10).

Threats to Fishery

The presence of zebra mussels in Lake Carl Blackwell was confirmed in 2010. Zebra mussels compete directly with shad as well as all planktivorous young game and forage fishes. It will be several years before the full impact of this mussel is known. The spread of Zebra mussels is usually by boaters from an infested body of water. Anglers and boaters can clean off boats, motors and trailers and empty bait bucket and live wells it the same place where they were filled to prevent the transport of aquatic invaders.

Anglers need to be aware of the proximity of white perch to Carl Blackwell Lake. White perch is a nuisance species closely related to white bass and can have very server effects on our native fisheries. Reproducing populations occur in Kaw, Keystone and Sooner Lakes. White perch are very prolific and can take over a lake with their overwhelming numbers by competing with other predators for food and space. They reproduce before white bass, are egg predators and rarely exceed 12 inches in length. Anglers must be careful not to mistake white perch for white bass since the two species are similar in appearance. Never stock fish from one body of water to another!

Poor water quality conditions can also be detrimental to a lake. High turbidity levels can reduce the amount of light reaching lower levels which inhibits growth of phytoplankton and aquatic plants. The Oklahoma Water Resources Board (OWRB) found 60 percent of the turbidity values they

collected were above the Oklahoma Water Quality Standard of 25 NTU. True color values exceeded the standard of 70 units in 60 percent of the values. Colloidal clay soils in the watershed, extensive shallow areas and strong prevailing winds contribute to the turbidity.

Management Objectives

Largemouth Bass

The sampling goal is to increased the total bass catch rate to >50/hour and a catch rate of bass >14 inches to >15/hour. Increased recruitment is the key to improving the fishery. Shoreline escape cover is very limited for age 0 bass but is critical for increased survival. Additional efforts of introductions of native aquatic plants may not be successful based on previous attempts on other Oklahoma lakes but should not be ruled out in the future if additional research provides guidance. An effort to sink shallow brush piles in three to five feet of water into the most protected part of each major cove will provide cover for young bass. Bass sampling every two years is recommended to evaluate changes in the bass population.

White Crappie

The primary goal is to maintain crappie growth rates at 2008 levels, that is, reaching 10 inches at age 3. This goal is achieved by adjusting stocking rates of Saugeye. Stocking rates for Saugeye should be at the standard recommended rate of 20/acre, however, if growth rates of saugeye decrease, stocking rates should be reduced to 10/acre. Gill net sampling every two years is needed to ascertain the need for adjusting the stocking rates. Trap netting every three years is needed to acquire better data on the changes in the crappie fishery. Trap nets are superior to gill nets in evaluating crappie.

Hybrid Striped Bass

Stocking rates need to be adjusted to maintain a total gill net catch rate of >2.4/day and 0.5/day for hybrids >20 inches in length. Usually stocking rates are doubled to 20/acre when abundance falls below the recommended catch rate. Gill net surveys conducted every two years should be adequate to evaluate this fishery. Also, age data should be collected from all samples to monitor any changes in growth rates.

Saugeye

Annual stockings of Saugeye at 20/acre are necessary to maintain control of the crappie population that has a

tendency to be slow growing and over abundant. However, if growth rates of saugeye decrease, stocking rates should be reduced to 10/acre. Total saugeye catch rates by gill netting should be >2.4/day and >0.5/day for fish >16 inches. At this level of abundance, crappie growth rates should be maintained. Gill net surveys every two years, along with the collections of age data, should be adequate to monitor this fishery.

Table 1. Species, number and size of fish stocked in Lake Carl Blackwell, 1982 - 2010.

DATE	SPECIES	NUMBER	SIZE
1982	Hybrid stripers	297,000	Fry
1983	Hybrid stripers	230,000	Fry
1984	Hybrid stripers	250,000	Fry
1991	Hybrid stripers(Reciprocal)	1,000	3 inch
1993	Saugeye	68,000	1.5 inch
1993	Hybrid stripers	34,615	1.25 inch
1994	Saugeye	66,652	1.5 inch
1994	Hybrid stripers	67,600	1.5 inch
1995	Saugeye	75,940	1.5 inch
1995	Striped Bass Hybrids	67,600	1.5 inch
1996	Saugeye	68,200	1.75 inch
1996	Striped Bass Hybrids	65,000	1.25 inch
1997	Saugeye	67,500	1.5 inch
1997	Striped bass hybrids	67,570	1.75 inch
1998	Saugeye	69,563	1.5 inch
1998	Striped bass hybrids	21,800	2.0 inch
1999	Saugeye	140,425	1.75 inch
1999	Striped bass hybrids	108,506	1.25 inch
2000	Saugeye	23,100	2.0 inch
2000	Hybrid stripers	67,500	2.0 inch
2001	Saugeye	68,060	2.0 inch
2001	Hybrid stripers	32,600	38-51mm
2002	Saugeye	68,750	1.25 inch
2002	Hybrid stripers	33,880	1.75 inch
2003	Saugeye	68,010	1.5 inch
2003	Hybrid stripers	33,740	1.5 inch
2004	Saugeye	34,600	1.5 inch
2004	Hybrid stripers	34,800	1.5 inch
2005	Saugeye	33,500	1.5 inch
2005	Hybrid stripers	16,900	1.5 inch
2006	Saugeye	33,800	2.0 inch
2007	Hybrid stripers	17,487	1.5 inch
2008	Saugeye	34,100	1.5 inch
2008	Hybrid stripers	17,116	1.5 inch
2009	Saugeye	34,386	1.5 inch
2009	Hybrid stripers	66,587	1.5 inch
2010	Saugeye	34,000	1.5 inch
2010	Hybrid stripers	67,600	1.5 inch

Table 2. Total number (No.), catch rates per hour (C/f), and relative weights (W_r) by size groups of **largemouth bass** collected by spring electrofishing from Lake Carl Blackwell. Numbers in parentheses represent acceptable C/f values for a quality fishery. Acceptable W_r values are $\geq$90.

	Total (≥40)		<8 in. (15-45)		8-12 in. (15-30)		≥12 in. (≥15)		≥14 in. (≥10)	
Year	No.	C/f	C/f	W_r	C/f	W_r	C/f	W_r	C/f	W_r
1988	186	41.2	17.5	84	10.6	89	13.1	98	4.9	103
1995	149	45.6	20.2	87	6.1	85	19.3	95	13.2	98
1997	152	34.3	4.7	90	6.6	85	23.0	95	19.0	96
1999	152	49.5	19.2	88	13.7	84	16.6	96	15.0	96
2003	135	30.0	6.9	102	9.1	93	14.0	91	6.9	93
2006	238	52.9	17.3	94	12.0	93	24.4	93	6.0	93
2010	156	34.7	12.2	92	8.0	90	15.1	91	7.3	91

Table 3. Age, number, mean length at age and % of sample of **largemouth bass** collected by spring electrofishing from Carl Blackwell Lake in 2010.

AGE	NUMBER	MEAN LENGTH IN.	% OF SAMPLE	STATEWIDE MEAN
1	52	6.5	35	7.0
2	29	11.2	20	10.4
3	27	12.8	18	13.8
4	13	14.0	9	15.9
5	19	14.9	13	16.9
6	4	15.9	3	17.8
7	3	19.2	2	19.1

Table 4. Total number (No.), catch rates per day (C/f), and relative weights (W_r) by size groups of **crappie** collected by gill netting from Lake Carl Blackwell. Numbers in parentheses represent acceptable C/f values for a quality fishery. Acceptable W_r values are ≥90.

	Total (≥4.8)		<8 in. (1.2-7.2)		≥8 in. (≥1.9)		≥10 in. (≥1.0)	
Year	No.	C/f	C/f	W_r	C/f	W_r	C/f	W_r
1990	100	22.8	21.6	92	1.4	86	0.5	92
1993	86	15.8	14.9	85	1.0	84	0.5	85
1994	133	27.1	24.7	89	2.4	78	1.2	81
1995	85	16.8	14.9	86	1.7	85	1.4	86
1996	89	17.8	16.8	88	1.4	77	1.0	81
1997	16	3.4	0.2	89	1.2	94	1.2	94
1999	45	10.1	7.2	84	2.9	86	2.4	89
2001	64	18.7	11.0	84	7.7	87	3.8	90
2004	56	12.5	7.7	87	4.3	86	1.7	85
2008	209	48.5	40.6	91	7.7	87	5.3	87
2011	40	9.4	3.3		6.1		1.6	

Table 5. Mean length at age of **crappie** collected by gill netting from Lake Carl Blackwell. Numbers in parentheses represent values for acceptable growth rates.

Year	Age 1 (≥6.3 in.)	Age 2 (≥8 in.)	Age 3 (≥9 in.)	Age 4 (≥10 in.)
1993	5.6	6.5	7.2	6.9
1994	5.6	7.0	10.8	8.2
1995	5.4	6.5	7.6	8.8
1996	5.5	6.5	7.4	7.4
1997	6.2	6.5	8.5	
1999	6.4	7.2	8.5	12.1
2001	6.1	7.2	8.4	9.1
2004	6.6	8.6	9.6	10.0
2008	6.8	9.6	10.5	10.2
2011	6.7	8.7	10.0	10.2

Table 6. Total number (No.), catch rates per day (C/f), and relative weights (W_r) by size groups of **white bass** collected by gill netting from Lake Carl Blackwell. Numbers in parentheses represent acceptable C/f values for a quality fishery. Acceptable W_r values are ≥90.

	Total (≥4.8)		<8 in. (≥1.2)		8-12 in. (1.2-7.2)		≥12 in. (≥2.4)	
Year	No.	C/f	C/f	W_r	C/f	W_r	C/f	W_r
1990	32	7.4	1.4	87	1.9	89	4.1	91
1993	52	9.6	0.7	83	4.6	88	4.6	91
1994	45	9.1	0.7	85	3.1	78	5.3	84
1995	44	8.6	0.2	83	4.1	91	4.3	86
1996	12	2.4	0.7	82			1.7	90
1997	3	0.7			0.2	80	0.5	83
1999	6	1.4	0.7	79	0.7	90		
2001	21	6.2	4.1	86	0.5	88	1.4	86
2004	5	1.2	0.2	83	0.7	80	0.2	85
2008	6	1.4	0.7	90	0.7	89		
2011	3	0.7			0.7			

Table 7. Total number (No.), catch rates per day (C/f), and relative weights (W_r) by size groups of **striped bass x white bass hybrids** collected by gill netting from Lake Carl Blackwell. Numbers in parentheses represent acceptable C/f values for a quality fishery. Acceptable W_r values are ≥90.

	Total (≥2.4)		<12 in. (≥0.7)		12-20 in. (≥1.2)		≥20 in. (≥0.5)	
Year	No.	C/f	C/f	W_r	C/f	W_r	C/f	W_r
1993	42	7.7	7.2	83	0.5	75	0.2	91
1994	28	5.8	0.5	145	5.3	83		
1995	31	6.0	2.2	77	3.8	87		
1996	90	17.5	2.6	76	13.0	84	1.9	94
1997	36	7.7	1.4	80	3.8	81	2.4	91
1999	16	3.6	1.2	79	1.98	82	0.7	92
2001	32	9.4	0.2	89	7.4	79	1.7	90
2004	95	21.6	1.4	82	17.5	76	2.6	77
2008	5	1.2	0.2	83	0.7	86	0.2	79
2011	20	4.7	0.2		4.2		0.2	

Table 8. Mean length at age of **striped bass hybrid** collected by gill netting from Lake Carl Blackwell, 1993 to 2008. Numbers in parentheses represent regional mean values for each age.

Year	Age 1 (14.5 in)	Age 2 (17.9in)	Age 3 (19.6 in)	Age 4 (21.6 in)
1993		20.3		
1994	13.5			
1995	14.3	17.2		
1996	13.8	19.9	21.9	
1997	13.3	19.1		24.1
1999	14.3	15.7	18.3	20.1
2001	13.2	16.2	19.8	23.3
2004	13.1	15.2	16.4	18.0
2008	13.5			17.8
2011	10.7	14.1	17.9	
Mean	**13.5**	**17.7**	**19.1**	**20.6**

Table 9. Total number (No.), catch rates per day (C/f), and relative weights (W_r) by size groups of **saugeye** collected by gill netting from Lake Carl Blackwell. Numbers in parentheses represent acceptable C/f values for a quality fishery. Acceptable W_r values are $\geq$90.

	Total (>2.4)		<12 in ($\geq$1.4)		12-16 in ($\geq$.5)		$\geq$16 in ($\geq$.5)	
Year	No.	C/f	C/f	W_r	C/f	W_r	C/f	W_r
1993	4	0.7	0.7	94				
1994	3	0.7	0.2	86	0.2	84	0.2	86
1995	14	2.9	0.5	80	1.2	77	1.2	89
1996	49	9.6	2.9	93	1.0	85	5.8	93
1997	83	18.0	3.1	90	3.4	94	11.8	96
1999	72	16.1	4.3	88	3.6	92	8.4	88
2001	28	8.2	3.1	83	1.0	84	4.1	85
2004	22	4.8	0.5	83	1.0	86	3.4	82
2008	9	2.2					2.2	85
2011	12	2.8					2.8	

Table 10. Mean length (mm) at age of **saugeye** collected by gill netting from Lake Carl Blackwell, 1994 to 2008. Numbers in parentheses represent regional mean values for each age.

Year	Age 1 (14.0 in)	Age 2 (17.2 in)	Age 3 (20.0 in)	Age 4 (21.6 in)
1994	15.9			
1995	13.6	19.7		
1996	14.1	18.3	22.4	
1997	14.0	19.3	21.3	24.0
1999	13.7	17.4	21.9	25.6
2001	11.3	16.3	20.6	23.3
2004	13.0	16.1	19.6	
2008		18.2	18.6	21.1
2011	16.0	18.9	21.1	
Mean	**13.7**	**17.9**	**20.7**	**23.5**

Table 11. Total number (No.), catch rates per hour (C/f), and relative weights (W_r) by size groups of **saugeye** collected by fall night electrofishing from Lake Carl Blackwell. Numbers in parentheses represent acceptable C/f values for a quality fishery. Acceptable W_r values are $\geq$90.

	Total ($\geq$15)		<12 in. ($\geq$10)		12-16in. ($\geq$3)		$\geq$16 in. ($\geq$2)	
Year	No.	C/f	C/f	W_r	C/f	W_r	C/f	W_r
1993	82	32.0	32.0	91				
1994	119	55.6	52.8	88	2.8	80		
1995	119	46.3	35.4	88	8.9	78	1.9	85
1996	193	88.5	83.5	93	1.4	74	3.7	86
1997	195	84.8	77.0	88	7.8	70		
1998	136	63.9	59.2	85	4.2	78	0.5	69
2000	139	74.7	62.4	87	10.8	77	1.6	78
2002	105	105.0	85.0	88	18.0	79	2.0	71
2004	76	76.0	51.0	88	21.0	76	4.0	70
2010	29	29.0	20.0	90	4.0	77	3.0	75

Table 12. Total number (No.), catch rates per day(C/f), and relative weights (W_r) by size groups of **gizzard shad** collected by spring electrofishing and gill netting from Lake Carl Blackwell. Numbers in parentheses represent acceptable C/f values for a quality fishery. Acceptable W_r values are $\geq$90.

	Total[1] (≥40)		<8 in[1] (≥20)		Total[2] (≥4.8)		<8 in[2] (≥2.4)		Age 0[3] -	
Year	No.	C/f	C/f	W_r	C/f	W_r	C/f	W_r	No.	C/f
1988	328	72.73	45.01							
1990					16.8		14.4			
1993					47.3		31.7			
1994					11.0		7.4			
1995	162	80.20	46.54		22.3		20.2			
1996					29.0		24.5			
1997	156	81.68	39.79		11.5		9.4			
1999	161	161.0	84.00		16.1		6.7			
2001					13.0		3.6		6	1.7
2004					33.6		2.4		41	9.1
2008					37.4		21.1		85	17.8
2011					14.8		5.9			

[1] Spring electrofishing
[2] Gill netting

Figure 1


Oklahoma State University
Land Utilization and
Research Area
PAYNE
51
51C
Karsten Creek
Golf Course

Figure 2

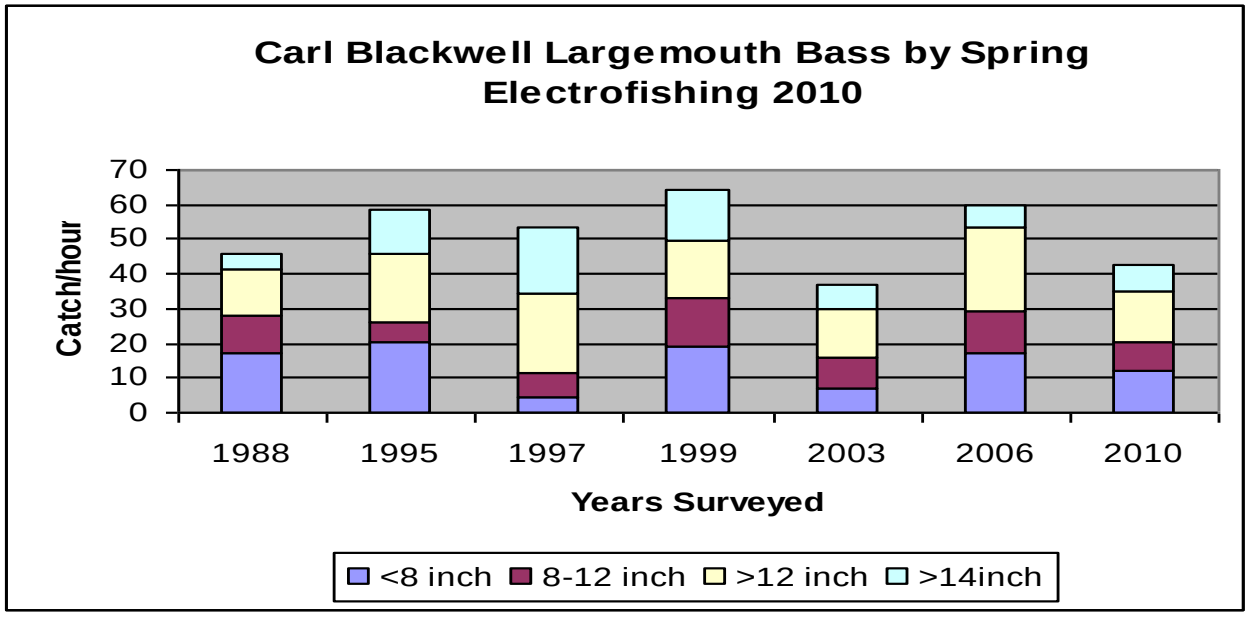

Figure 3

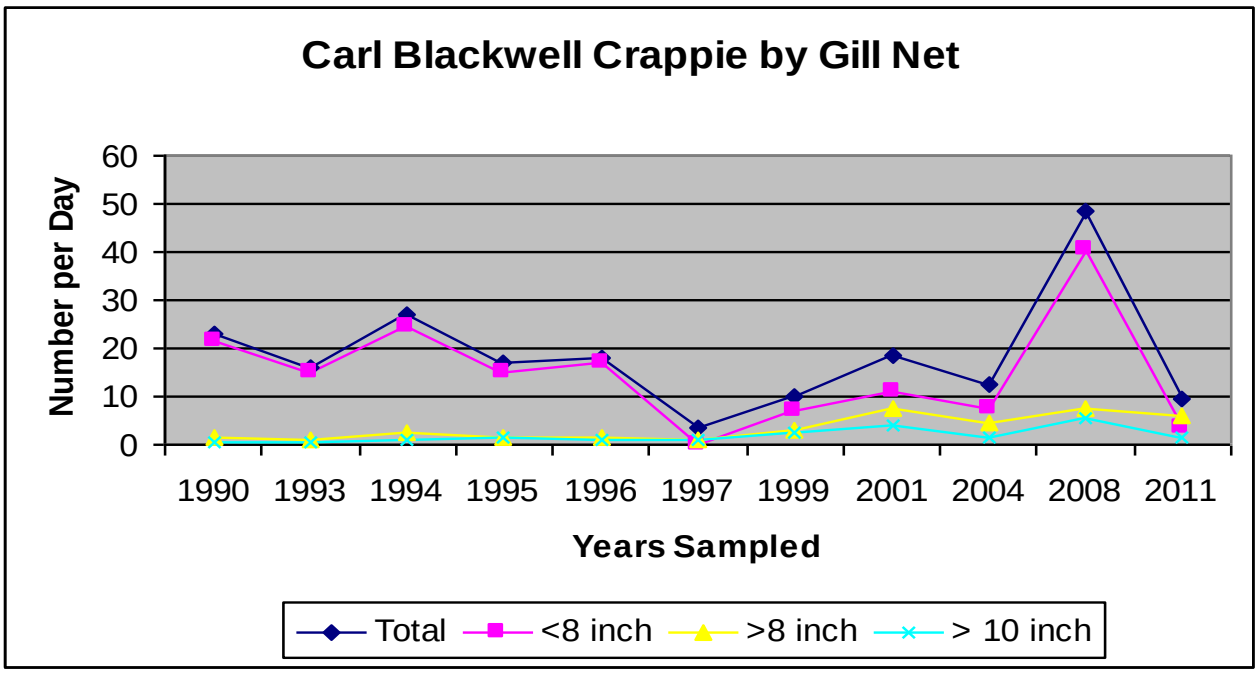

Figure 4

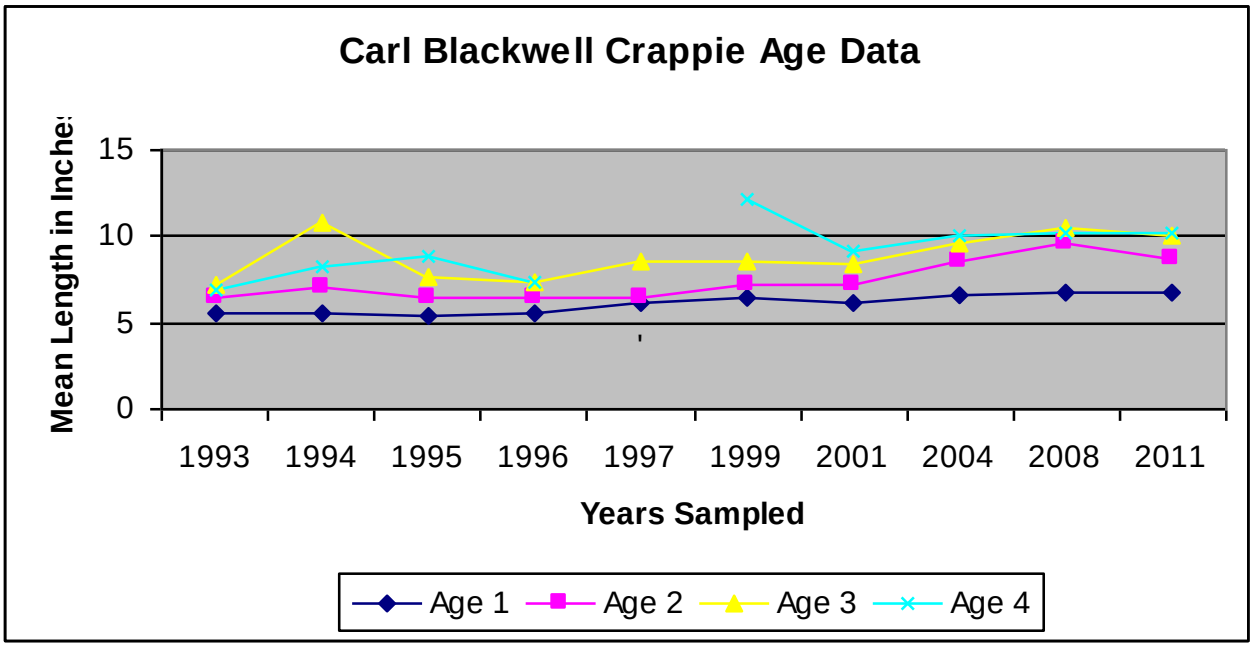

Figure 5

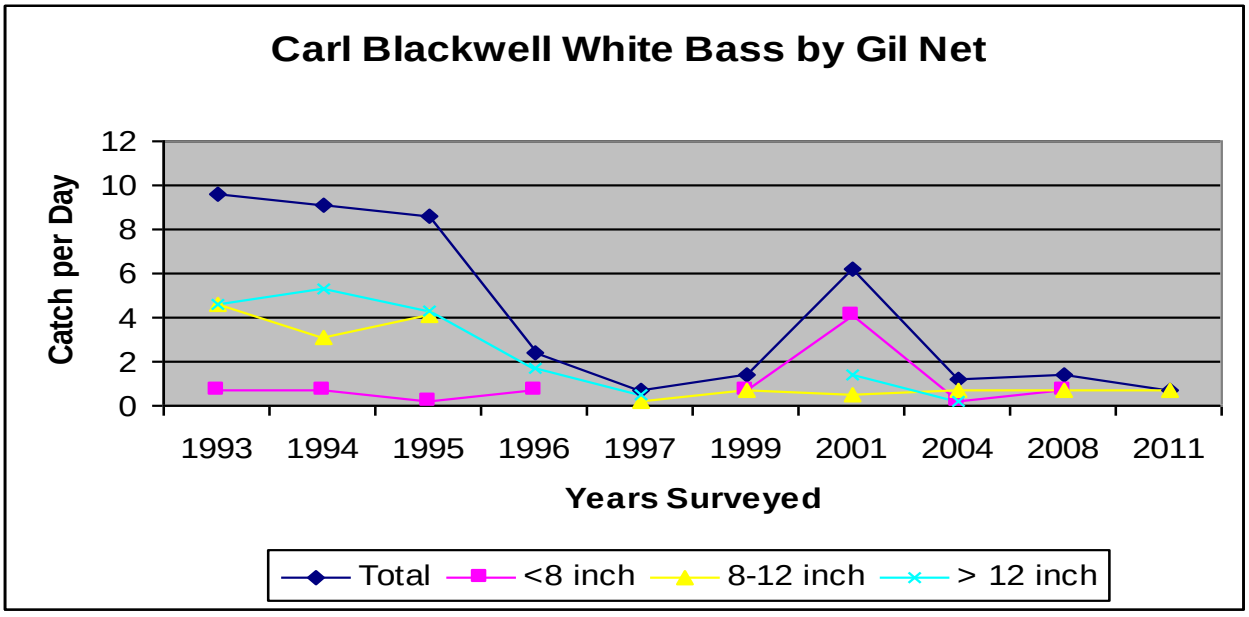

Figure 6

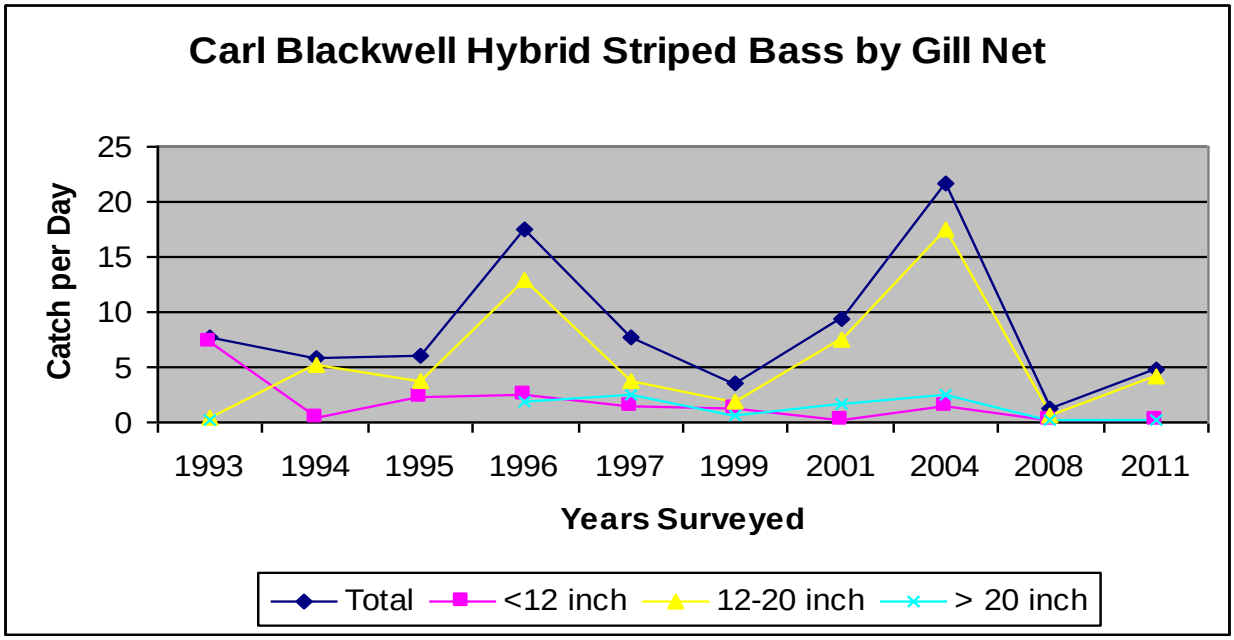

Figure 7

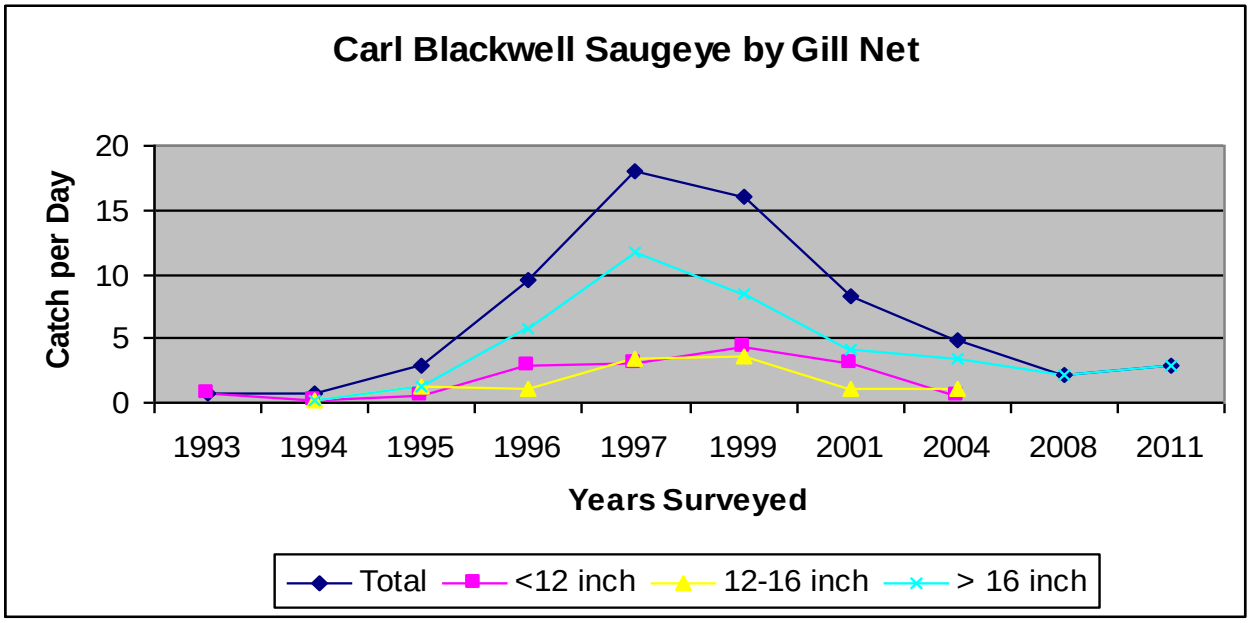

Figure 8

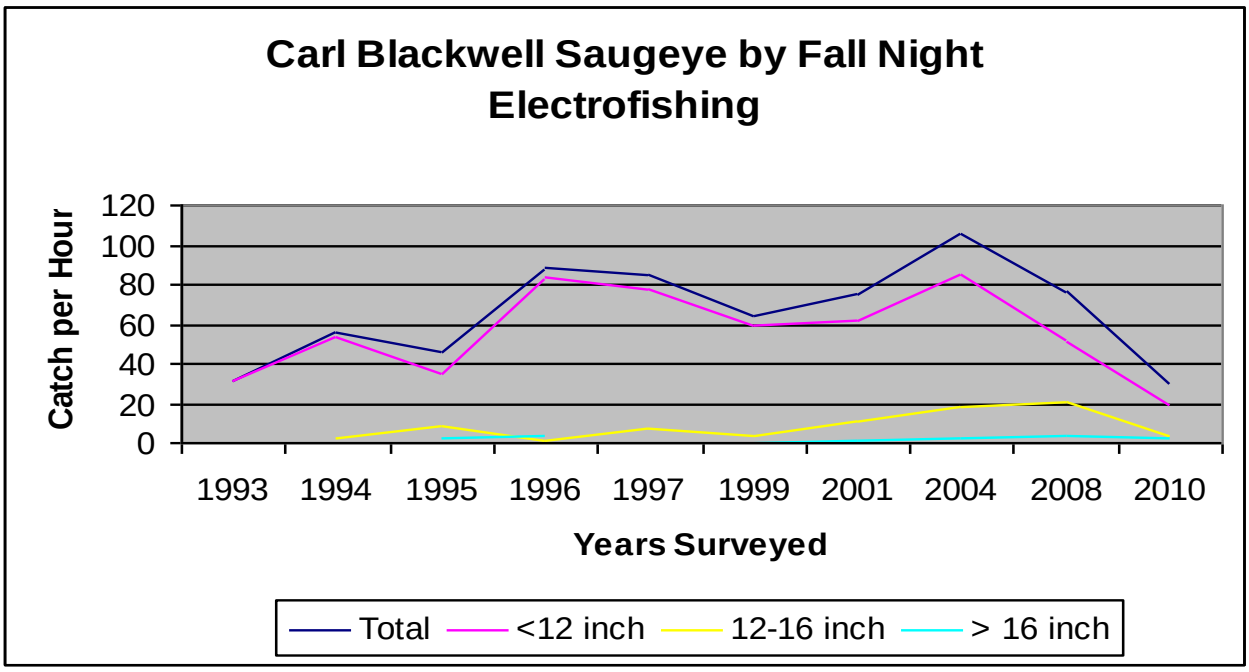

Figure 9