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2000 Evergreen Reservoir Warmwater Survey, Grant County, Washington

Warmwater Fish Enhancement

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Washington Department of
FISH AND WILDLIFE
Fish Program
Fish Management Division

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Abstract

A total of 13 fish species were observed in Evergreen Reservoir, and bluegill *Lepomis macrochirus* was the most abundant warmwater fish species collected during the 2000 warmwater fish survey. Growth and relative weights of bluegill were above average indicating this population may be in low density. Bluegill were not observed in Evergreen Reservoir during a 1987 warmwater survey, and were found in low numbers (n = 11) in 1997. Data indicate the bluegill population in Evergreen Reservoir may have been rapidly expanding, and were beginning to recruit to quality size at the time of our survey. Yellow perch *Perca flavescens* (n = 314) was the second most abundant fish species observed during 2000, and most abundant species observed in 1997 (n = 68), and 1987 (n = 375). The PSD of yellow perch captured by gill nets in 2000 was low (8 $\pm$ 4). These data were consistent with what was observed in 1997 and 1987, and suggests few yellow perch reach quality size or larger in Evergreen Reservoir. Largemouth bass *Micropterus salmoides* abundance (n = 156) in Evergreen Reservoir increased from what was observed 1989 and 1997. Relative weights were above average with low numbers of stock-size fish observed and high PSD and RSD values, suggesting largemouth bass may be in low density.

Most warmwater fish species were found in average or above average condition. Walleye *Sander vitreum*, yellow perch (> 140 mm), and tiger muskie *Esox lucius* × *Esox masquinongy* were the only fish species observed with below average relative weights. Relative weights of walleye and yellow perch in other Columbia Basin lakes are frequently found slightly below average, and may not be an indication of poor health. Additionally, little data were available on growth and condition of tiger muskie stocked in Washington waters, and below average relative weights of tiger muskie in Evergreen Reservoir may be typical of a waterbody with this type of species composition. Most Evergreen Reservoir warmwater fish species exhibited above average growth, which was consistent with findings in 1997 and 1987. We recommend maintaining the current statewide fishing regulations on Evergreen Reservoir warmwater fish species, continue tiger muskie stocking, and conducting periodic creel census surveys as time and budget permits.

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Introduction and Background

Evergreen Reservoir lies within the Quincy Wildlife Area in Grant County, approximately 13 kilometers (8 miles) southwest of the City of Quincy, Washington (Figure 1). Constructed by the U.S. Bureau of Reclamation (BOR) in 1950, Evergreen Reservoir is supplied by irrigation water from the West Canal, and exits through an irrigation pumping station to W44A, W44B, and W44C lateral canals which irrigate block 77. Evergreen Reservoir has a surface area of 100 hectares (247 acres), mean depth of 5.8 meters (19 ft.), and volume of 4,900 acre ft. Historically, Evergreen Reservoir was managed as a mixed species fishery. Rainbow trout *Oncorhynchus mykiss* were stocked from 1958 through 1974, and additionally, the Washington Department of Fish and Wildlife (WDFW) attempted to introduce coho salmon *Oncorhynchus kisutch* (1966), Kamloop strain rainbow trout (1967), kokanee *O. nerka* (1976), and Lahontan cutthroat trout *O. clarki henshawi* (1982)(WDFW 2000). Legal-sized rainbow trout were stocked nearly every year from 1958 to 1974 (WDFW 1982). In those years, stocking legal-sized fish was economically feasible due to the low number of available trout lakes within the region. In the early 1960s, a large number of new seep lakes were formed in the Columbia Basin, which created new waters that could be stocked more economically with rainbow trout fry. Since 1977, rainbow trout stockings have been abandoned and Evergreen Reservoir has been managed as a warmwater fishery. Warmwater fish species observed in Evergreen Reservoir include: common carp *Cyprinus carpio*, yellow perch *Perca flavescens*, sculpin *Cottus spp.*, largemouth bass *Micropterus salmoides*, walleye *Sander vitreum*, lake whitefish *Coregonus clupeaformis*, pumpkinseed sunfish *Lepomis gibbosus*, bluegill *L. macrochirus*, and black crappie *Pomoxis nigromaculatus*. In 1997, tiger muskie *Esox lucius* × *Esox masquinongy* were introduced to prey upon the high densities of yellow perch within the reservoir.

In addition to fish species, Evergreen Reservoir and drainage host various birds, such as great blue heron *Ardea herodias*, gulls *Larus spp.*, terns *Sterna spp.*, Canada geese *Branta canadensis*, mallard *Anas platyrhynchos*, blue winged teal *A. discors*, cinnamon teal *A. cyanoptera*, northern shoveler *A. clypeata*, gadwall *A. strepera*, redhead *Aythya americana*, ruddy duck *Oxyura jamaicensis rubida*, ring-necked pheasant *Phasianus colchicus*, California quail *Lophortyx californicus*, chukar *Alectoris graeca*, morning dove *Zenaida macroura*, Red-winged blackbird *Agelaius phoeniceus*, meadowlark *Sturnella neglecta*, killdeer *Charadrius vociferus*, and small mammals including beaver *Castor canadensis*, muskrat *Ondatra zibethica*, and raccoon *Procyon lotor* (WDFW 1996). Various aquatic (water milfoil *Myriophyllum spp.*), sub-aquatic (cattail *Typha latifolia* and bulrush *Scirpus spp.*), and terrestrial (Russian olive *Elaeagnus angustifolia*, sagebrush *Artemisia tridentata*, bluebunch wheatgrass *Agropyron spicatum*, cheatgrass *Bromus tectorum*, Sandberg's bluegrass *Poa sandbergii*, sand dock *Rumex spp.*, and rabbitbrush *Chrysothamnus nauseosus*) vegetation are common in the area.

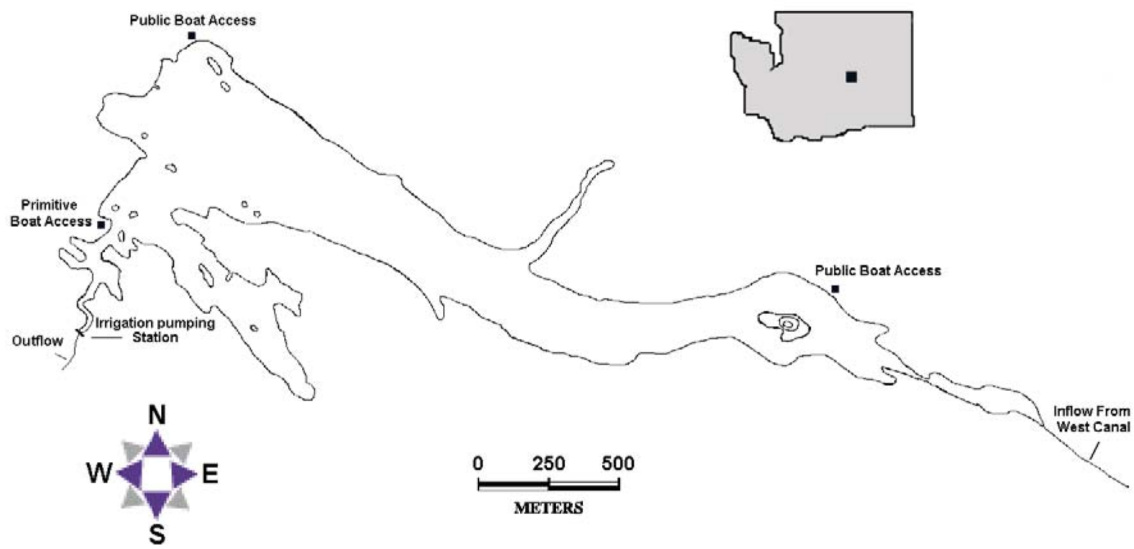

Figure 1. Map of Evergreen Reservoir (Grant County)

This survey was conducted to measure warmwater gamefish stocking success and to monitor growth, condition, reproduction, and survival of warmwater gamefish species in the reservoir. Moreover, information collected during this survey was used to identify possible management strategies that would improve the quality of fishing in Evergreen Reservoir.

Materials and Methods

Evergreen Reservoir was surveyed by a three-person-team June 13-21, 2000. All fish were collected using a boat electrofisher, gill nets, and fyke nets. The electrofisher unit consisted of a 5.5 m (18 ft.) Smith-Root GPP electrofishing boat, using a DC current of 30 to 60 cycles/sec at 3 to 4 amps power. Experimental gill nets (45.7 m x 2.4 m) of variable size (13, 19, 25, and 51 mm stretched) monofilament mesh were used. Fyke nets were constructed of a main trap (four 1.2 m aluminum rings), a single 30.3 m lead, and two 15.2 m wings. All netting material was constructed of 13 mm nylon mesh.

Sampling locations were selected by dividing the shoreline into 400 m sections determined from a map. The number of randomly selected sections surveyed was as follows: electrofisher - 15, gill nets - 8, and fyke nets - 8. Electrofishing occurred in shallow water (depth range: 0.2 - 1.5 m), adjacent to the shoreline at a rate of approximately 40.0 m/minute for 600 second intervals (Bonar et al. 2000). Gill nets were set perpendicular to the shoreline with the small-mesh end attached on or near the shore, and the large-mesh end anchored offshore. Fyke nets were set perpendicular to the shoreline with the wings extended at 70^o angles from the lead. Gill nets and fyke nets were set overnight prior to electrofishing and were pulled the following morning (one net night each). All sampling was conducted during nighttime hours when fish are most numerous along the shoreline thus maximizing the efficiency of each gear type.

Additional electrofishing effort was expended to increase the sample size of tiger muskie during the survey. Electrofishing targeting tiger muskie was conducted using a slightly different technique than was used throughout the rest of the survey. WDFW personnel slowly motored through shallow, vegetated coves with the work lights on, but pedal off. When a tiger muskie was observed, which often times sat motionless directly above submerged vegetation, the electrofisher was positioned so that the fish would encounter the electrical field and become immobilized when pedal-on status was executed.

All fish were identified to species, measured in millimeters (mm) to total length (TL) from anterior most part of head to the tip of the compressed caudal fin, and weighed to the nearest gram (g). Total length data were used to construct length-frequency histograms and to evaluate the size structure of the warmwater species in the reservoir. Warmwater fish species were assigned to a 10 mm size group based on total length, and scale samples were collected from the first five fish in each size group (Bonar et al. 2000). Scale samples were mounted on adhesive data cards and pressed onto acetate slides using a Carver® laboratory press (Fletcher et al. 1993) Water chemistry data were collected at 1 meter (m) increments from the area of greatest depth.

A Hydrolab® was used to collect information on dissolved oxygen (milligrams per liter)(mg/l), temperature (degrees Celsius)(°C), pH, and conductivity (micro siemens per centimeter)(μS/cm).

Species composition, by weight in kilograms (kg) and number, was determined from fish captured. Fish less than one year old were excluded from all analyses. Eliminating fish less than one year of age, i.e., young-of-the-year (YOY), prevents distortions in species composition that fluctuate between sampling locations, sampling method, and specific timing of hatches (Fletcher et al. 1993).

Catch per unit effort (CPUE) of each sampling gear was determined for each warmwater fish species collected. The CPUE of electrofishing was determined by dividing the number of fish captured by the total amount of time electrofished. Similarly, CPUE of gill nets and fyke nets was determined by dividing the number of fish captured by the total time that the nets were deployed. Since CPUE is standardized, it can be useful in comparing catch rates between lakes or between sampling dates on the same water.

A relative weight (W_r) index was used to evaluate the condition of fish in Evergreen Reservoir. Relative weight of a fish is the relationship between the actual weight of a fish at a given length to the national average weight (standard weight W_s) of a fish of the same species and length. As presented by Anderson and Neumann (1996), a W_r of 100 generally indicates that the fish is in a condition similar to the national average for that species and length. The index is defined as $W_r = W/W_s \times 100$, where W is the weight (g) of an individual fish and W_s is the standard weight of a fish of the same total length (mm). W_s was derived from a standard weight-length ($\log_{10}$) relationship that was defined for each species of interest in Anderson and Neumann (1996). Minimum lengths were used for each species as variability in size can be significant for small fish (YOY). Relative weights less than 50 were also excluded from our analysis as we suspected unreliable weight measurements.

Age and growth of warmwater species were evaluated using procedures described by Fletcher et al. (1993). All samples were evaluated using both the direct proportion method (Fletcher et al. 1993) and Lee's modification of the direct proportion method (Carlander 1982). Mean back-calculated lengths-at-age for all warmwater species were then compared to those of Eastern Washington and/or statewide averages (Fletcher et al. 1993), and Minnesota averages (walleye only)(Carlander 1997). The proportional stock density (PSD) of each warmwater fish species was determined following procedures outlined in Anderson and Neumann (1996). PSD uses two measurements, stock length and quality length, to provide useful information about the proportion of various size fish in a population. Stock length is defined as the minimum size of a fish that provides recreational value or the approximate length when fish reach maturity (Table 1). Quality length is defined as the minimum size of a fish that most anglers like to catch or begin keeping. PSD is calculated using the number of quality sized fish, divided by the number of stock sized fish, and multiplied by 100. Stock and quality lengths, which vary by species, are based on percentages of world-record lengths. Stock length is 20-26 percent of the world record length, whereas quality length is 36-41 percent of the world record length.

Relative stock density (RSD) of each warmwater fish species was examined using the five-cell model proposed by Gabelhouse (1984). In addition to stock and quality lengths, the Gabelhouse model adds preferred, memorable, and trophy categories. Preferred length (RSD-P) is defined as the minimum size of fish anglers would prefer to catch. Memorable (RSD-M) length refers to the minimum size fish anglers remember catching, and trophy length (RSD-T) refers to the minimum size fish worthy of acknowledgment. Preferred, memorable, and trophy length fish are also based on percentages of world record lengths. Preferred length is 45-55 percent of world record length, memorable length is 59-64 percent of world record length, and trophy length is 74-80 percent of world record length. RSD differs from PSD in that it is more sensitive to changes in year class strength. RSD is calculated as the number of fish within the specified length category, divided by the total number of stock length fish, multiplied by 100. Eighty percent confidence intervals for PSD and RSD were selected from tables in Gustafson (1988).

Where applicable, data collected from the June 2000, warmwater fish survey, were compared to data collected by Peninsula College Fisheries Program during May 4 - 7, 1987, and a warmwater electrofishing survey conducted by WDFW personnel on November 11, 1997.

Table 1. Minimum total length (mm) categories of warmwater fish used to calculate PSD and RSD values (Willis et al. 1993).

	Length Category				
Species	**Stock**	**Quality**	**Preferred**	**Memorable**	**Trophy**
Black crappie	130	200	250	300	380
White crappie	130	200	250	300	380
Bluegill	80	150	200	250	300
Yellow perch	130	200	250	300	380
Largemouth bass	200	300	380	510	630
Smallmouth bass	180	280	350	430	510
Walleye	250	380	510	630	760
Channel catfish	280	410	610	710	910
Brown bullhead	150	230	300	390	460
Yellow bullhead	150	230	300	390	460

Results and Discussion

Species Composition

Thirteen fish species were collected during the June 2000 warmwater fish survey (Table 2). Bluegill were captured in highest abundance, followed by yellow perch. Common carp contributed to the highest percent biomass collected, while walleye were found in second highest percent biomass. Species observed during the June 2000 warmwater fish survey were similar to those found in 1987 by Walton and Wirt (1989) and during an electrofishing survey in 1997 (WDFW, Evergreen Reservoir file data). The most notable differences in composition were the increase in abundance of bluegill, largemouth bass, walleye, and sculpin observed during 2000 relative to the two previous surveys. These changes may be a result, in part, of differences in sampling techniques used in the different surveys. In contrast to increases of abundance of certain species, lake whitefish were found to comprise 15 percent of the total fish (n=85) observed during the 1987 survey, and have not been observed since. Bluegill were not observed during the 1987 survey, were found in low abundance during the 1997 survey, and in highest abundance during the 2000 warmwater fish survey. Yellow perch were found in highest or second highest abundance in each warmwater fish survey. Common carp were observed in similar numbers during the 1987 and 2000 surveys, but not during the 1997 survey, likely a result of ineffective collection rather than absence.

Table 2. Species composition by weight, number, and size range of fish captured at Evergreen Reservoir during a warmwater fish survey in June 2000.

	Species Composition					
	Weight		Number		Size Range (mm TL)	
Type of Fish	kg	%	No.	%	Min	Max
Brown bullhead	6.7	2.3	21	1.6	93	357
Black crappie	2.2	0.8	18	1.4	83	237
Bluegill	13.1	4.5	340	26.0	75	204
Pumpkinseed sunfish	1.9	0.6	78	6.0	69	146
Largemouth bass	29.9	10.2	156	11.9	65	518
Smallmouth bass	3.8	1.3	20	1.5	76	399
Walleye	74.7	25.6	97	7.4	185	710
Yellow perch	11.3	3.9	314	24.0	60	210
Tiger muskie	21.2	7.3	8	0.6	615	820
Rainbow trout	0.4	0.1	8	0.6	143	173
Largescale sucker	12.2	4.2	11	0.8	417	510
Sculpin	1.4	0.5	211	16.1	24	147
Carp	112.7	38.7	27	2.1	575	755

Catch-Per-Unit-Effort (CPUE)

During the 2000 warmwater survey, boat electrofisher catch rates were highest for bluegill, sculpin, and yellow perch, and gill net catch rates were highest for yellow perch and walleye (Table 3). Fyke net catch rates were highest for yellow perch and pumpkinseed; however, all species captured using fyke nets were in low abundance.

Yellow perch (92.9 fish/hr) followed by largemouth bass (90.1fish/hr) and bluegill (15.5 fish/hr) were the most frequently captured fish species during the 1997 warmwater fish survey of Evergreen Reservoir (WDFW, Evergreen Reservoir file data, 1997). The high CPUE of bluegill during the 2000 warmwater fish survey was not expected given the low CPUE observed in 1997, and the absence of bluegill from the 1987 survey samples (Walton and Wirt 1989). While CPUE of bluegill observed in 1997 was low, the limited electrofishing effort (42.6 minutes) may have contributed to this low catch rate if bluegill abundance was low in areas surveyed. Additionally, the electrofishing effort expended in 1997 was approximately one-third that of the 2000 survey. Catch-per-unit-effort data collected from the 1987 warmwater survey was not compared in this analysis as data was not recorded.

Table 3. Mean catch per unit effort by sampling method (excluding YOY), including 80 percent confidence intervals, for fish collected from Evergreen Reservoir in June 2000.

	Gear Type								
	Electrofisher			Gill Nets			Fyke Nets		
Species	No. Hour	CI (+/-)	No. Sites	No. Night	CI (+/-)	Net Nights	No. Night	CI (+/-)	Net Nights
Brown bullhead	4.4	2.0	15	1.0	0.7	8	0.1	0.2	8
Black crappie	1.6	1.2	15	0.5	0.3	8	1.3	0.8	8
Bluegill	133.0	36.8	15	0.5	0.5	8	0.1	0.2	8
Pumpkinseed sunfish	20.7	8.4	15	1.4	0.3	8	1.9	1.2	8
Largemouth bass	59.8	18.2	15	0.6	0.3	8	0	0	8
Smallmouth bass	7.1	3.0	15	0.3	0.2	8	0	0	8
Walleye	24.4	10.7	15	4.4	0.8	8	0	0	8
Yellow perch	80.0	40.1	15	11.0	2.9	8	3.0	1.6	8
Tiger muskie	2.0	1.2	15	0.4	0.3	8	0	0	8
Largescale sucker	1.6	1.1	15	0.9	0.7	8	0	0	8
Sculpin, unknown	83.2	27.6	15	0	0	8	0	0	8
Carp	6.4	6.1	15	1.4	0.4	8	0	0	8

Stock Density Indices

The PSD for largemouth bass collected by electrofishing was 57 (± 12) with an RSD of 39 (± 12) (Table 4). According to Willis et al. (1993), largemouth bass populations with PSDs between 50 and 80 with RSDs between 30 and 60 are typically lower density, faster growing populations. While the number of stock sized largemouth bass (n = 28) was lower than needed for an accurate analysis, this is consistent with what was found in 1997 (PSD = 61 (± 10) and RSD = 50 (± 10)), and with 2000 age and growth data (WDFW, Evergreen Reservoir file data, 1997)(Table 6). Stock density indices were not calculated by Walton and Wirt (1989); numbers of stock length fish collected in 1997 were too low.

The PSD for bluegill collected by electrofishing was 13 (± 2) (Table 4). Bluegill were not observed in Evergreen Reservoir by Walton and Wirt (1989) and were found in low abundance in the 1997 warmwater fish survey (WDFW, Evergreen Reservoir file data, 1997). Age and growth data for bluegill collected during 2000 show bluegill to age 5, though only two fish were observed at age 5 (Table 8). These data suggest the high number of stock length bluegill (n = 325) with a low PSD (13 (± 2) for electrofishing) may be a result of this expanding population having just begun to reach quality length, rather than suggesting a high density, slow growing population.

The number of stock length walleye captured by gill nets was low (Table 4). Walleye captured by boat electrofisher during 2000 were the only predator observed in high enough numbers (n = 60) (PSD 49 ± 8) for a confident analysis. This was surprising since larger size walleye are typically captured more effectively by gill nets than boat electrofisher. The PSD of yellow perch collected by gill nets was low, indicating few fish had reached quality size or larger. The number of stock length and larger predators collected during the 2000 survey was low overall, and it is unknown why panfish PSD's were not higher given their relatively low numbers.

Table 4. Stock density indices, including 80 percent confidence interval, for warmwater fishes collected by electrofishing, gill netting, fyke netting, and combined gear types from Evergreen Reservoir (Grant County) during June 2000. PSD = proportional stock density, RSD = relative stock density, RSD-P = relative stock density of preferred fish, RSD-M = relative stock density of memorable fish, and RSD-T = relative stock density of trophy fish.

Species	#Stock Length	PSD	RSD-P	RSD-M	RSD-T
		Electrofisher			
Bluegill	325	13 (± 2)	1 (± 1)	0	0
Black crappie	3	33 (± 35)	0	0	0
Pumpkinseed sunfish	51	0	0	0	0
Largemouth bass	28	57 (± 12)	39 (± 12)	0	0
Smallmouth bass	11	18 (± 15)	18 (± 15)		
Walleye	60	40 (± 8)	2 (± 2)	2 (± 2)	
Yellow perch	78	0	0	0	0
		Gill Nets			
Bluegill	4	0	0	0	0
Black crappie	4	25 (± 28)	0	0	0
Pumpkinseed sunfish	11	0	0	0	0
Largemouth bass	5	100	0	0	0
Smallmouth bass	2	50 (± 45)	50 (± 45)	0	0
Walleye	35	91 (± 6)	49 (± 11)	9 (± 6)	0
Yellow perch	83	8 (± 4)	0	0	0
		Fyke Nets			
Black crappie	10	60 (± 20)	0	0	0
Pumpkinseed sunfish	13	0	0	0	0

Water Chemistry

Dissolved oxygen levels varied and were found in the acceptable range for good health and vigorous growth of warmwater fish species in the top 10 meters of the water column (Table 6). Most species require 5 ppm oxygen, but can tolerate levels as low as 1 or 2 ppm for short periods of time before becoming stressed and cease feeding (Willis et al. 1990). Lower dissolved oxygen levels found below 12 meters were not expected to hinder warmwater fish populations in Evergreen Reservoir, as most warmwater fish species inhabit shallower depths. Temperatures ranged from 14.8^{o}C at the bottom to 20.2^{o}C at the surface with no stratification present at the time of our survey, and pH levels were found within desirable levels for warmwater fish species (6.5 to 9.0) as defined by Swingle (1969).

Table 5. Water chemistry data from Evergreen Reservoir collected mid-day during June 2000.

Location	Depth (m)	Temp (^oC)	pH	Dissolved O_2	Conductivity
June					
Center Reservoir	Surface	20.2	8.73	5.19	138.6
	1	18.4	8.75	5.43	138.1
	2	18.1	8.75	5.45	137.9
	3	17.9	8.72	5.39	137.9
	4	17.7	8.65	5.47	136.9
	5	17.4	8.58	5.44	137.0
	6	17.2	8.54	5.44	136.7
	7	17.1	8.52	5.43	136.8
	8	17.0	8.51	5.35	138.0
	9	16.8	8.31	5.23	139.6
	10	16.6	8.29	5.06	140.4
	11	16.5	8.24	4.92	141.0
	12	16.5	8.22	4.91	141.0
	13	16.1	8.05	4.44	144.0
	14	15.1	7.81	3.46	152.8
	Bottom	14.8	7.72	2.54	155.8

Largemouth Bass

Largemouth bass ranged from age 1 to 12 with age 2 being the most abundant age class evaluated (Table 6). The number of ages 6 to 12 largemouth bass evaluated was low, and growth for most age classes was below average. The below average growth was likely due to non-weighted direct proportion averages, as growth at age was above average except for age 7 fish. Age 5 largemouth bass were not represented in our sample. Ages 1, 2, 4, and 7 largemouth bass were collected during the 1997 warmwater fish survey, and growth was found above average (WDFW, Evergreen Reservoir file data, 1997). While low numbers of largemouth bass (n = 9) were observed in 1987 by Walton and Wirt (1989), relative weights were found to be higher when compared to those of Long Lake, Billy Clapp Lake, Crescent Lake, and Scootney Reservoir. Total lengths of largemouth bass collected at Evergreen Reservoir ranged from 65mm to 518 mm in 2000 (Table 2, Figure 2), and from 70 mm to 500 mm in 1997 (Figure 3). Relative weights for largemouth bass were found to be above average for both, 1997 and 2000 warmwater fish surveys (Figures 4 and 5).

Largemouth bass abundance in Evergreen Reservoir appeared to increase from what was observed by Walton and Wirt (1989) and the 1997 warmwater fish survey (WDFW, Evergreen Reservoir file data, 1997). However, variation in sampling gears and sampling effort among surveys may be responsible, in part, for this increase. Largemouth bass in Evergreen Reservoir during 2000 were fourth highest in abundance, with ages 1 and 2 fish in highest abundance (Tables 2 and 6, Figure 2). Relative weights were above average for most largemouth bass (Figure 4) with low numbers of stock-size fish observed and high PSD and RSD values (Table 4). These data indicate largemouth bass in Evergreen Reservoir were found in relatively low abundance and food competition was not likely at the time of our survey.

Table 6. Age and growth of largemouth bass captured at Evergreen Reservoir during June 2000. Shaded values are mean back-calculated lengths using the direct proportion method (Fletcher et al. 1993), and unshaded values are mean back-calculated lengths using Lee's modification of the direct proportion method (Carlander 1982).

		Mean length (mm) at age											
Year Class	# Fish	1	2	3	4	5	6	7	8	9	10	11	12
1999	23	78.4											
		80.6											
1998	41	68.3	212.4										
		80.5	209.5										
1997	6	65.6	187.0	283.6									
		81.1	194.2	284.0									
1996	8	70.5	195.2	311.6	366.5								
		86.7	204.6	314.6	366.5								
1995	0												
1994	2	72.4	183.8	291.4	368.2	401.3	423.0						
		88.9	195.1	297.6	370.8	402.3	423.0						
1993	3	52.1	149.2	250.2	334.4	368.2	402.0	420.0					
		69.6	162.1	258.3	338.5	370.6	402.8	420.0					
1992	3	76.5	199.3	271.2	339.5	378.4	404.2	423.7	442.0				
		93.0	210.2	278.9	344.1	381.3	405.9	424.6	442.0				
1991	1	79.0	216.9	316.1	349.2	384.1	411.7	431.9	450.3	465.0			
		95.6	227.5	322.5	354.2	387.6	414.0	433.3	450.9	465.0			
1990	1	53.0	173.1	272.8	330.5	346.1	375.7	397.6	419.4	438.1	449.0		
		70.6	185.3	280.7	335.8	350.7	379.0	399.8	420.7	438.6	449.0		
1989	0												
1988	1	55.6	94.6	135.1	210.2	304.8	360.3	418.9	465.4	483.5	500.0	510.5	518.0
		73.4	110.9	149.9	222.1	313.0	366.4	422.7	467.5	484.8	500.7	510.8	518.0
Direct P. means		55.9	146.5	213.2	255.4	272.9	339.6	348.7	355.4	346.6	316.3	510.5	518.0
Lee's means		81.3	203.4	287.2	349.1	373.8	402.9	421.1	444.2	462.8	474.8	510.8	518.0
E. Wash. Ave.		68.8	135.6	189.2	248.9	300.0	351.5	421.6	437.6	NA	NA	NA	NA

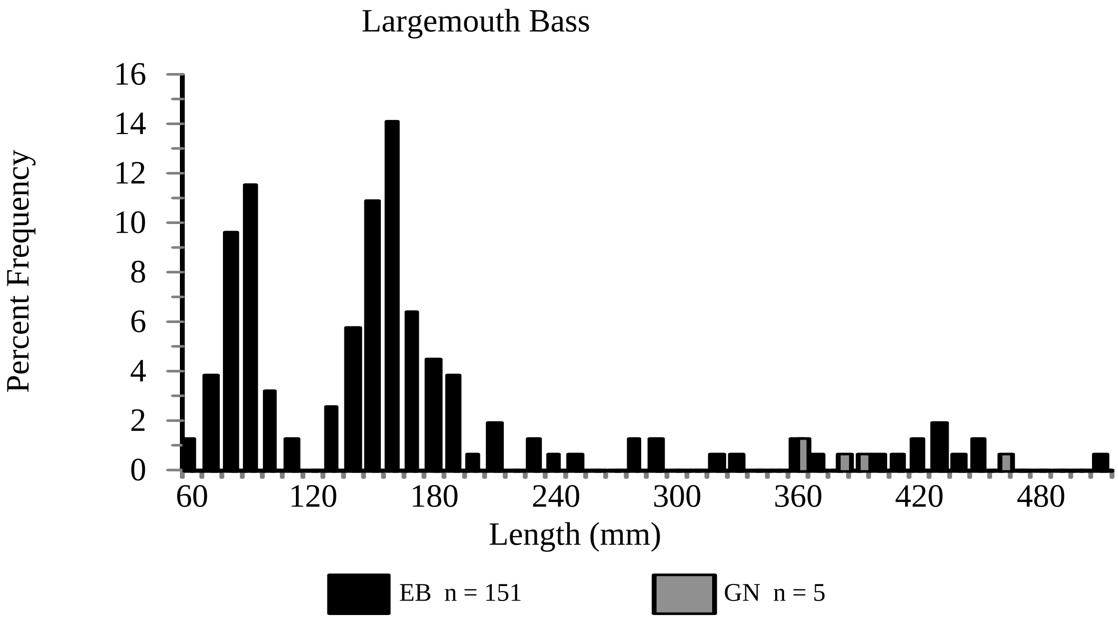

Figure 2. Length frequency of largemouth bass captured by electrofisher (EB) and gill nets (GN) in Evergreen Reservoir during June 2000.

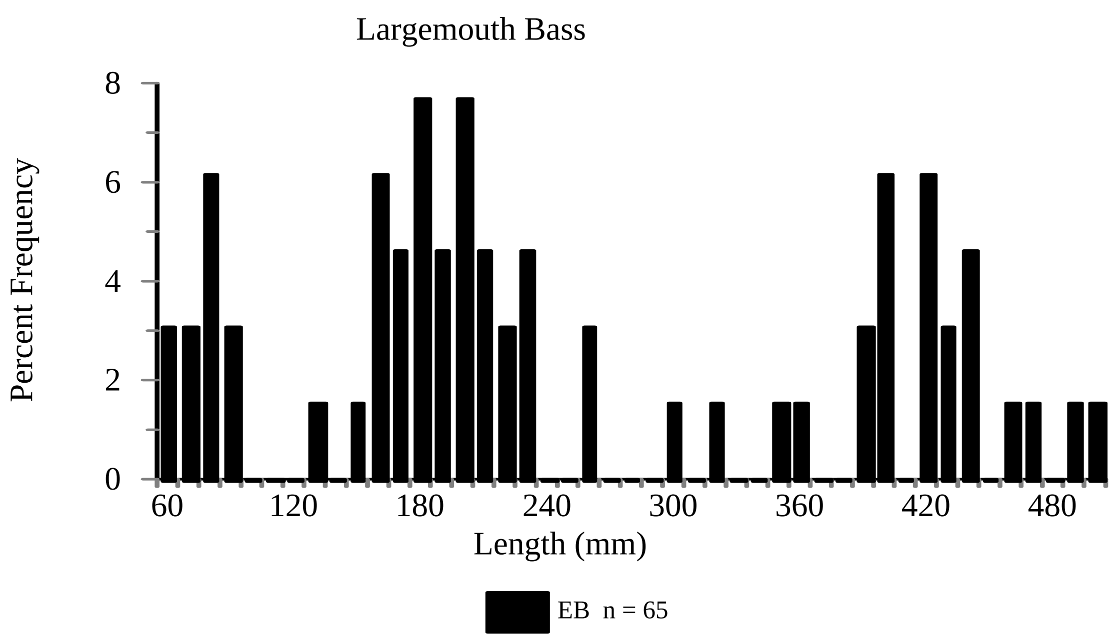

Figure 3. Length frequency of largemouth bass captured by electrofisher (EB) in Evergreen Reservoir during November 1997.

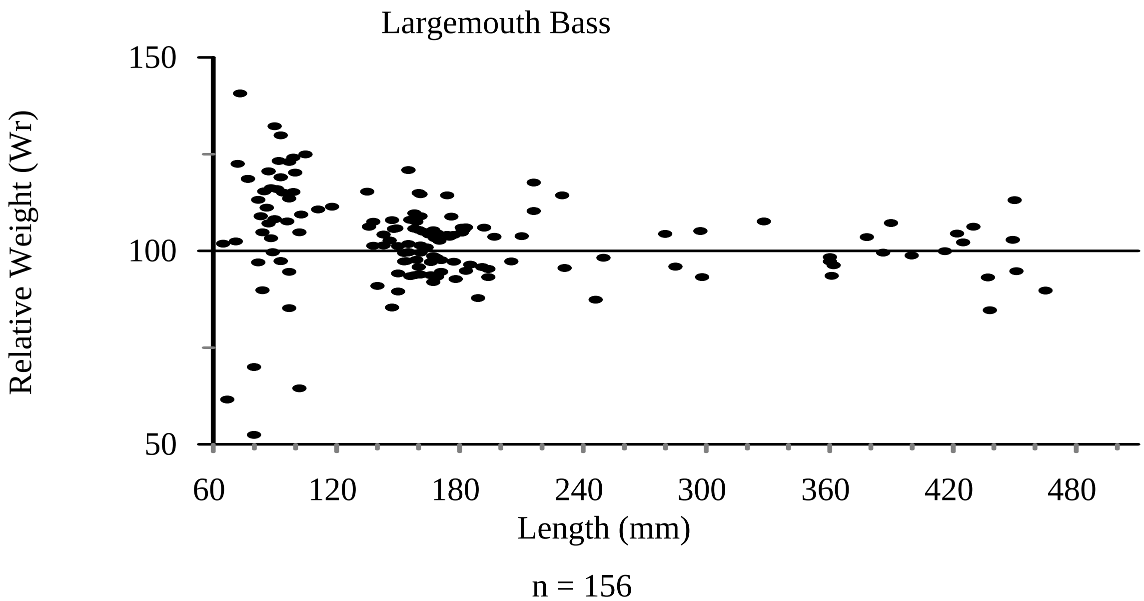

Figure 4. Relative weights of largemouth bass captured by electrofisher (EB) and gill nets (GN) in Evergreen Reservoir during June 2000, as compared to the national average, W_r = 100 (Anderson and Neumann 1996).

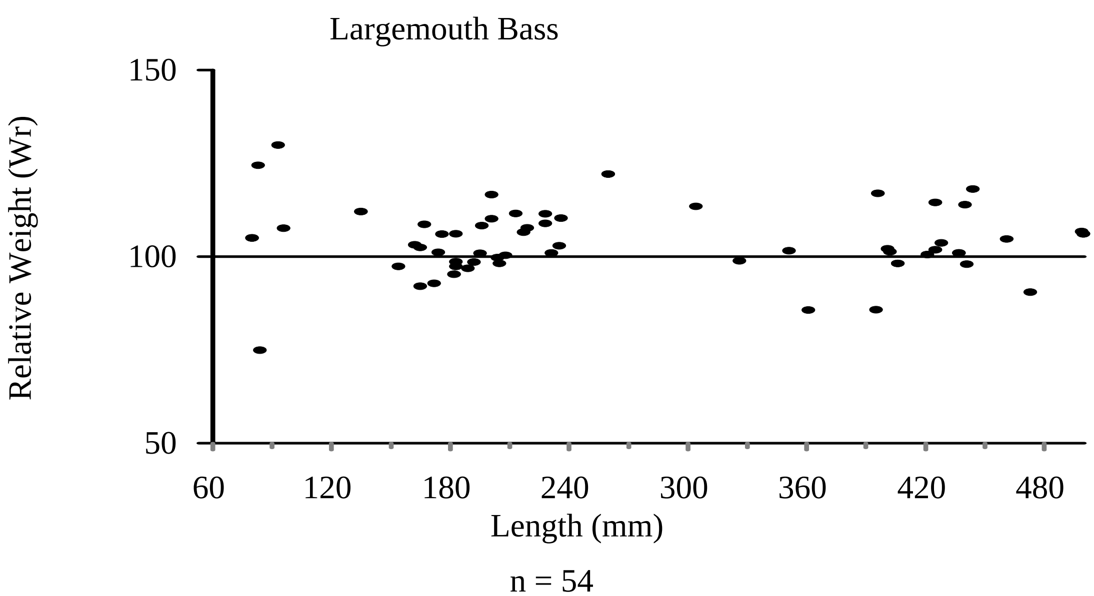

Figure 5. Relative weights of largemouth bass captured by electrofisher (EB) in Evergreen Reservoir during November 1997, as compared to the national average, W_r = 100 (Anderson and Neumann 1996).

Smallmouth Bass

Smallmouth bass were found in low abundance in Evergreen Reservoir during 2000 (Table 2). Ages of smallmouth bass ranged from 1 to 4 with age 2 being the most abundant age class evaluated (Table 7). With the exception of age 2, the number of fish evaluated for each age class was too small for an assessment of growth. Given age 1 fish are typically the most abundant age class collected in warmwater surveys, we would have expected to observe a higher number of age 1 smallmouth bass in our samples. While numbers were low, growth of smallmouth bass was above average for those fish evaluated with the exception of age 1. Smallmouth bass were not observed by Walton and Wirt (1989), and only one fish was observed during the 1997 warmwater survey (WDFW, Evergreen Reservoir file data, 1997). Smallmouth bass ranged from 76 mm to 399 mm in total length (Figure 6). Relative weights of smallmouth bass in Evergreen Reservoir were found above average overall (Figure 7). Of the twenty smallmouth bass observed in our survey, eleven were of stock length or larger (Table 4). The low number of stock length smallmouth bass collected prevented an accurate assessment of stock density indices. Approximately 60 percent of the shoreline observed in Evergreen Reservoir was of riprap or cobble substrate suitable for smallmouth bass, suggesting they have not yet taken advantage of the available habitat. While the number of smallmouth bass appears to be increasing in Evergreen Reservoir since the 1997 warmwater fish survey, we would have expected to observe a higher number of these fish given the available habitat.

Table 7. Age and growth of smallmouth bass captured at Evergreen Reservoir during June 2000. Shaded values are mean back-calculated lengths using the direct proportion method (Fletcher et al. 1993), and unshaded values are mean back-calculated lengths using Lee's modification of the direct proportion method (Carlander 1982).

		Mean length (mm) at age			
Year Class	**# Fish**	**1**	**2**	**3**	**4**
1999	2	72.1			
		75.2			
1998	12	65.6	173.3		
		88.5	176.3		
1997	1	53.7	164.3	245.6	
		81.4	176.9	247.2	
1996	2	57.8	176.3	298.3	377.0
		87.5	195.0	305.7	377.0
Direct P. means		62.3	171.3	271.9	377.0
Lee's means		86.4	178.8	286.2	377.0
State Average		70.4	146.3	211.8	268.0

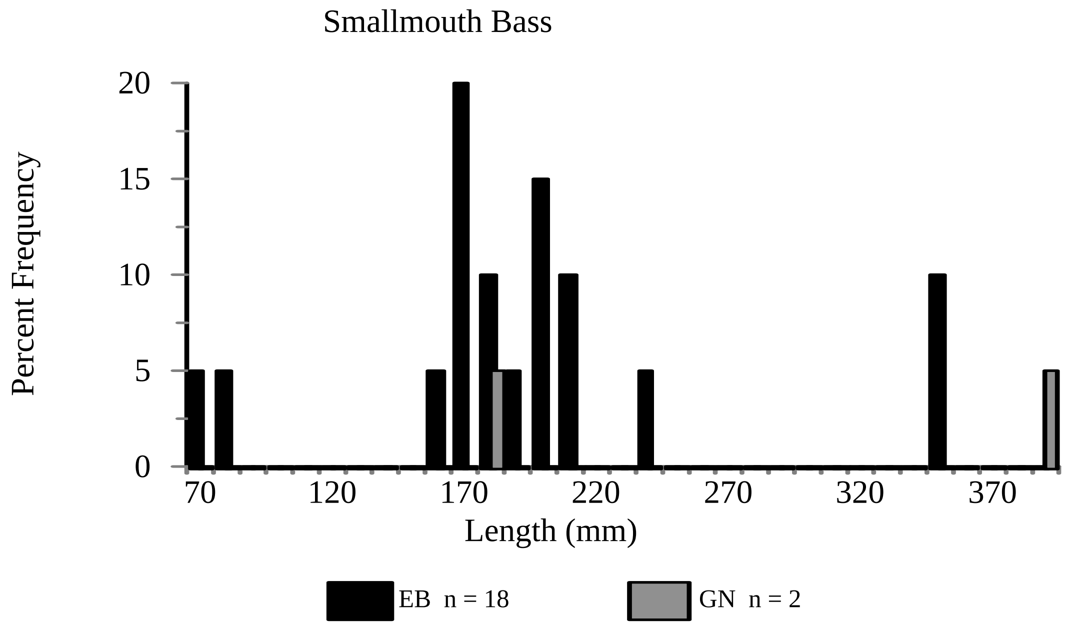

Figure 6. Length frequency of smallmouth bass captured by electrofisher (EB) and gill nets (GN) in Evergreen Reservoir during June 2000.

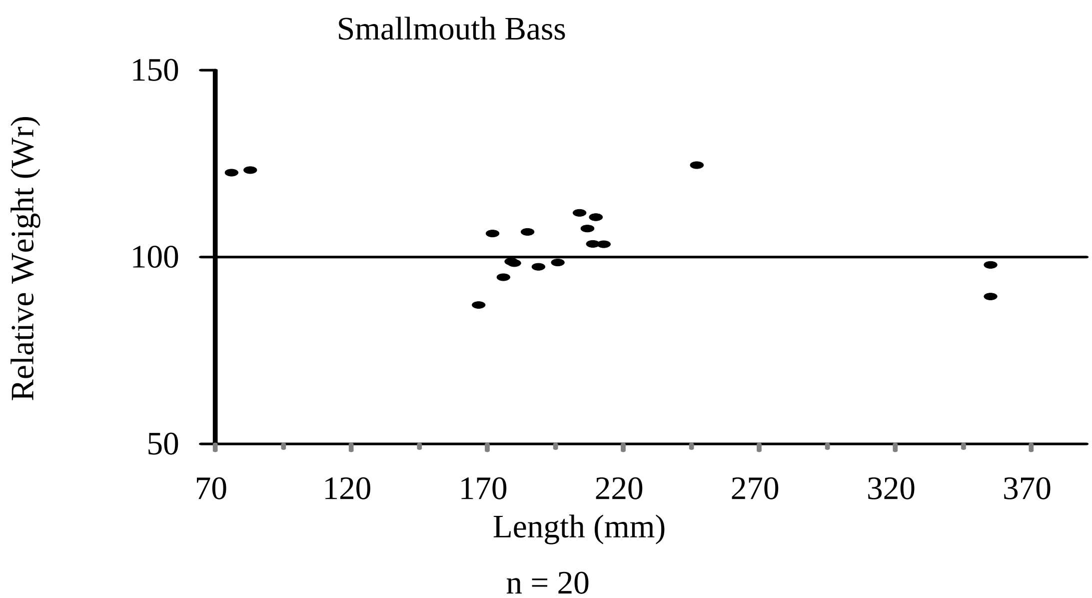

Figure 7. Relative weights of smallmouth bass captured by electrofisher (EB) and gill nets (GN) in Evergreen Reservoir during June 2000, as compared to the national average, W_r = 100 (Anderson and Neumann 1996).

Bluegill

Bluegill was the most abundant fish species observed in Evergreen Reservoir during 2000 (Table 2). Ages of bluegill ranged from 2 to 5 with age 2 being the most abundant age class evaluated (Table 8). Growth of age 3 to 5 bluegill collected in Evergreen Reservoir during 2000 were above average, though samples sizes of these ages were low. Bluegill were not observed by Walton and Wirt (1989), and were found in low densities (n = 11) during the 1997 warmwater fish survey (WDFW, Evergreen Reservoir file data, 1997). Only ages 1 and 3 bluegill were observed in 1997, and growth was below average. Bluegill ranged in length from 75 mm to 204 mm during 2000 (Table 2, Figure 8). Bluegill ranged from 87 mm to 169 mm in length during the 1997 warmwater fish survey (Figure 9). Relative weights of bluegill in Evergreen Reservoir in 2000 were above average for most fish, which is consistent with findings observed in 1997 (Figures 10 and 11).

The bluegill population in Evergreen Reservoir appears to be increasing in size from what was observed in 1997. The large number of stock-length bluegill observed during 2000, combined with low PSD and RSD values, suggest these fish were just beginning to reach quality size (Table 4). Additionally, the above average relative weights observed for bluegill may suggest this population was in low enough density that food competition was not a limiting factor at the time of our survey (Figure 10). The absence of age 1 bluegill from our samples was unexpected, as age 1 fish are typically the most abundant age collected (Table 8).

Table 8. Age and growth of bluegill captured at Evergreen Reservoir during June 2000. Shaded values are mean back-calculated lengths using the direct proportion method (Fletcher et al. 1993), and unshaded values are mean back-calculated lengths using Lee's modification of the direct proportion method (Carlander 1982).

		Mean length (mm) at age				
Year Class	**# Fish**	**1**	**2**	**3**	**4**	**5**
1999	0					
1998	37	41.3	117.9			
		53.7	116.3			
1997	20	21.4	77.9	155.9		
		38.8	88.2	156.4		
1996	6	21.9	63.3	136.4	182.5	
		39.5	76.3	141.5	182.5	
1995	2	28.5	79.8	130.5	172.5	200.0
		45.7	91.8	137.4	175.2	200.0
Direct P. means		22.6	84.7	140.9	177.5	200.0
Lee's means		47.6	103.2	151.9	180.7	200.0
State Average		37.3	96.8	132.1	148.3	169.9

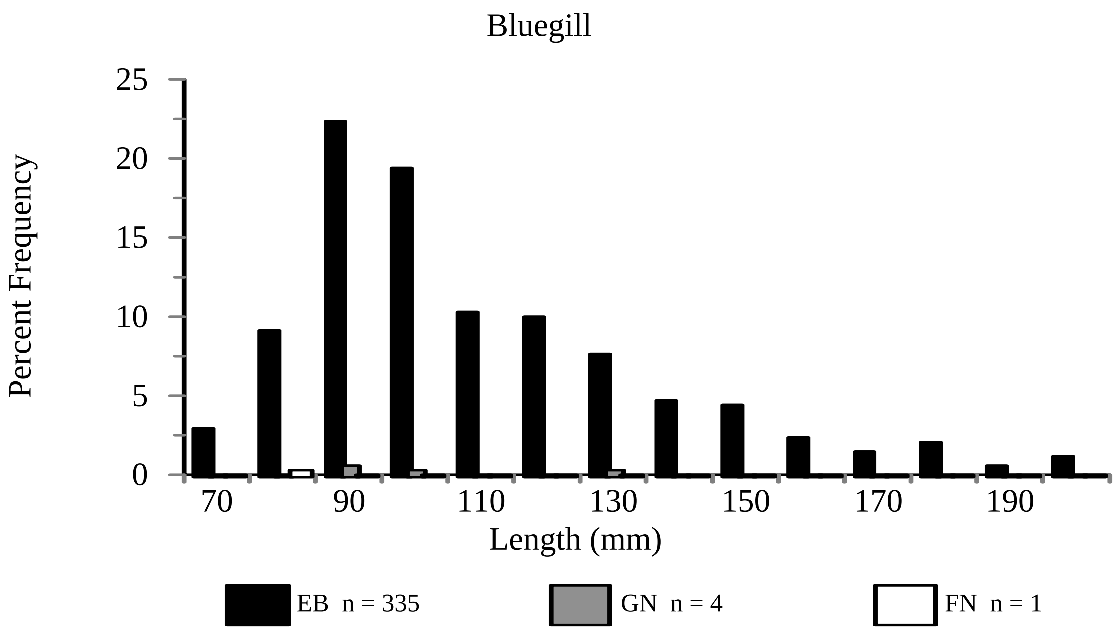

Figure 8. Length frequency of bluegill captured by electrofisher (EB), gill nets (GN), and fyke nets (FN) in Evergreen Reservoir during June 2000.

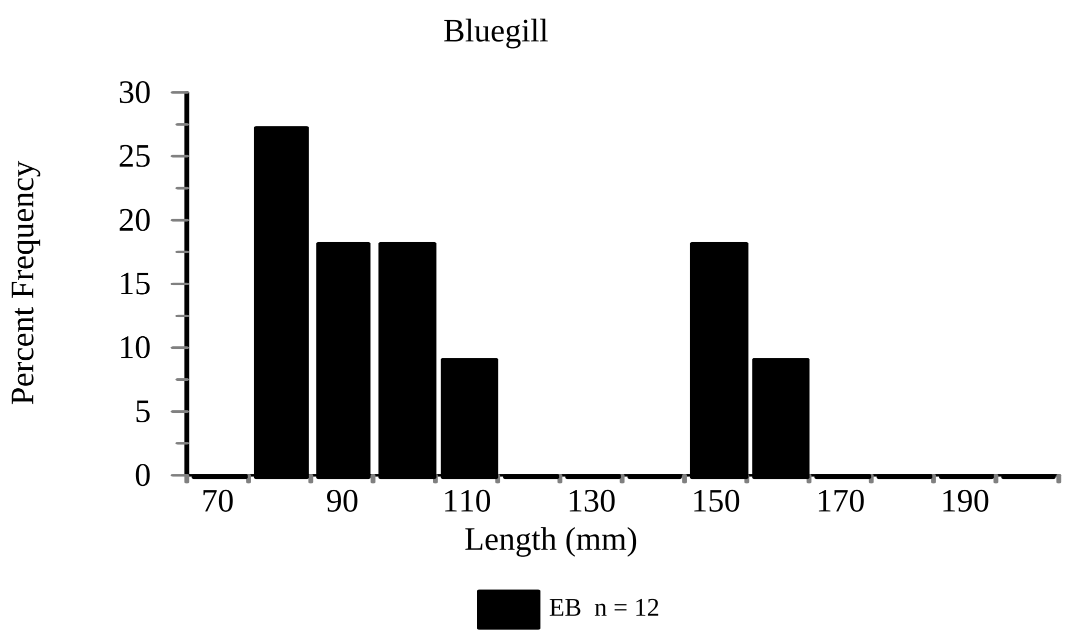

Figure 9. Length frequency of bluegill captured by electrofisher (EB) in Evergreen Reservoir during November 1997.

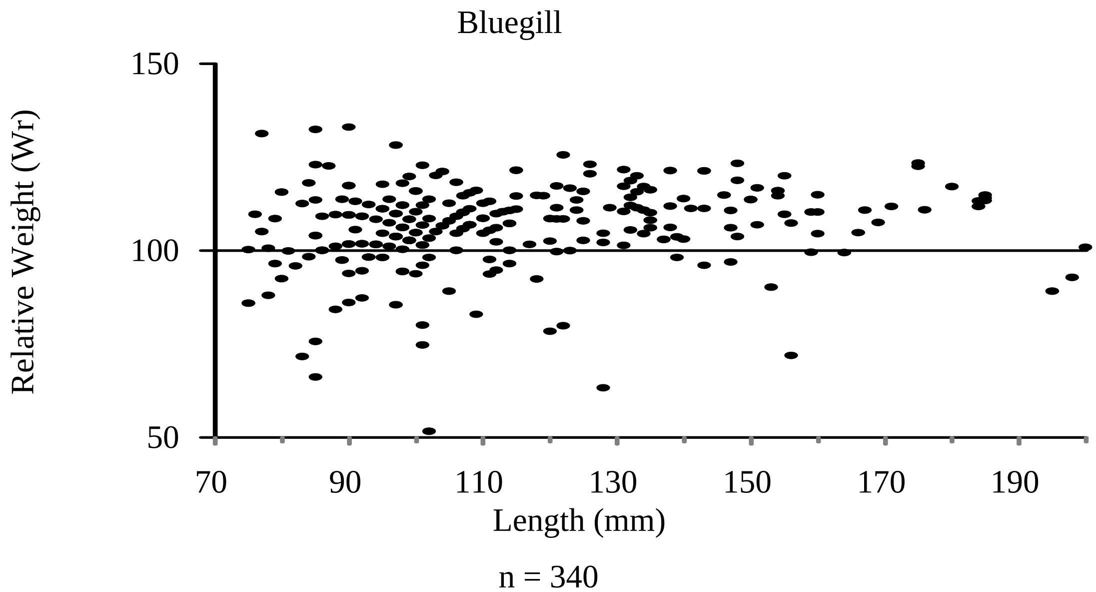

Figure 10. Relative weights of bluegill captured by electrofisher (EB), gill nets (GN), and fyke nets (FN) in Evergreen Reservoir during June 2000, as compared to the national average, W_r = 100 (Anderson and Neumann 1996).

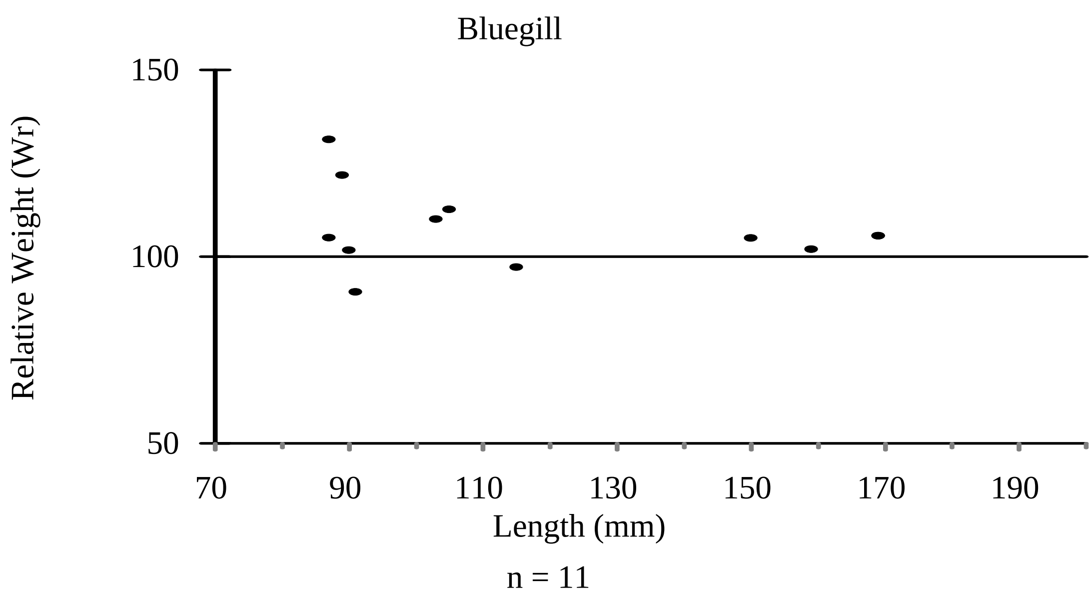

Figure 11. Relative weights of bluegill captured by electrofisher (EB) in Evergreen Reservoir during November 1997, as compared to the national average, W_r = 100 (Anderson and Neumann 1996).

Black Crappie

Black crappie were found in low abundance (n = 18) during the 2000 warmwater fish survey (Table 2). Ages ranged from 1 to 3 with age 2 being the most abundant age class evaluated (Table 9). As with smallmouth bass, largemouth bass, walleye, and bluegill, we observed higher numbers of age 2 fish than age 1 fish, which was unexpected. Growth of black crappie was above the statewide average for all age classes; however, the number of age 1 black crappie observed was too low for an accurate assessment. Age 1 black crappie were the only age class analyzed during the 1997 warmwater survey, and were found to be above average for growth (WDFW, Evergreen Reservoir file data, 1997). Low numbers of black crappie (n = 23) were observed by Walton and Wirt (1989), and growth was above average for all age classes evaluated, 1 to 5. Lengths of black crappie collected at Evergreen Reservoir in 2000 ranged from 83 mm to 237 mm (Figure 12), and 70 mm to 173 mm during the 1997 survey. Black crappie observed in 1987 ranged in length from 157 mm to 252 mm. Relative weights of black crappie during the 2000 warmwater survey were above average, which is consistent with the 1997 findings. Walton and Wirt (1989) found relative weights of black crappie from Evergreen Reservoir were average when compared to relative weights of black crappie from Soda Lake, Long Lake, Crescent Lake, and Scootney Reservoir.

Personal communications with Evergreen Reservoir anglers indicate the black crappie population may be somewhat larger than the densities we observed. However, low densities of black crappie have been observed during warmwater fish surveys in 1987, 1997, and 2000. In addition to the low number of black crappie observed in the 2000 warmwater survey, above average relative weights and low CPUE suggest this population may be in low density (Figure 13, Table 3).

Table 9. Age and growth of black crappie captured at Evergreen Reservoir during June 2000. Shaded values are mean back-calculated lengths using the direct proportion method (Fletcher et al. 1993), and unshaded values are mean back-calculated lengths using Lee's modification of the direct proportion method (Carlander 1982).

		Mean length (mm) at age		
Year Class	**# Fish**	**1**	**2**	**3**
1999	1	61.9		
		70.8		
1998	9	66.0	160.2	
		87.9	163.3	
1997	8	49.8	152.0	220.4
		76.8	162.9	220.4
Direct P. means		59.2	156.1	220.4
Lee's means		82.0	163.1	220.4
State Average		46.0	111.2	156.7

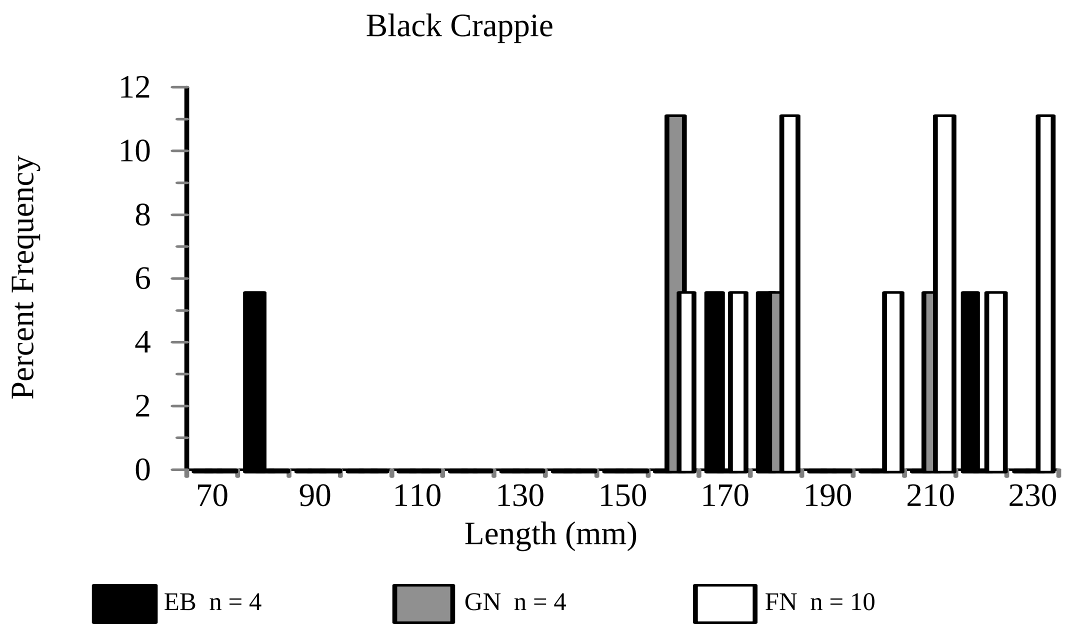

Figure 12. Length frequency of black crappie captured by electrofisher (EB), gill nets (GN), and fyke nets (FN) in Evergreen Reservoir during June 2000.

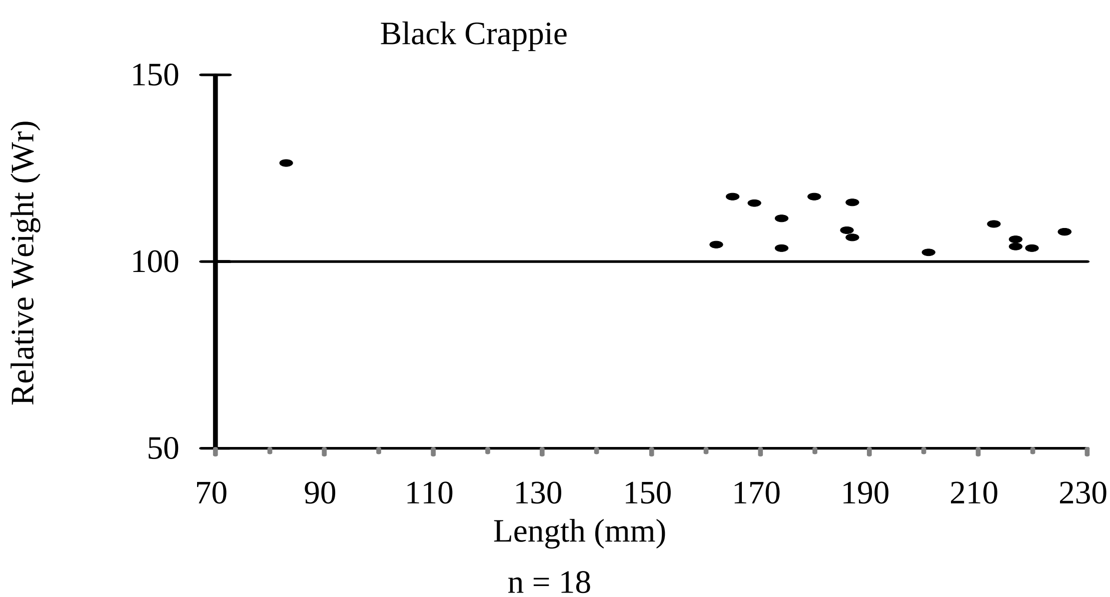

Figure 13. Relative weights of black crappie captured by electrofisher (EB), gill nets (GN), and fyke nets (FN) in Evergreen Reservoir during June 2000, as compared to the national average, W_r = 100 (Anderson and Neumann 1996).

Pumpkinseed Sunfish

A total of 78 pumpkinseed were collected during the 2000 warmwater fish survey (Table 2). Additionally, low numbers of pumpkinseed were observed during the 1997 (N = 4)(WDFW, Evergreen Reservoir file data, 1997) and 1987 (N = 8)(Walton and Wirt 1989) warmwater fish surveys. Age and growth was not evaluated for pumpkinseed during the 2000 or 1987 warmwater fish surveys. Age and growth data were evaluated during the 1997 survey; however, the number of fish evaluated (n = 3) was to low for a confident assessment; ages 1 and 3 fish were found to have above average growth. Pumpkinseed ranged in length from 69 mm to 146 mm in 2000 (Figure 14), 109 mm to 159 mm in 1997, and from 120 mm to 160 mm in 1987. When compared to length at age data collected in 1997, length frequency data evaluated in 2000 suggests that age 1 pumpkinseed in Evergreen Reservoir were in low numbers similar to bluegill, black crappie, smallmouth bass, and walleye. Due to the prolific nature of pumpkinseed, it was expected to observe a higher number of 30 - 70 mm (Approximately age 1) pumpkinseed in our samples. Pumpkinseed relative weights were above average during 2000 (Figure 15), and average during 1997. As with other warmwater fish species observed in Evergreen Reservoir, pumpkinseed appear to be in low density, and food competition was not likely inhibiting expansion of this population.

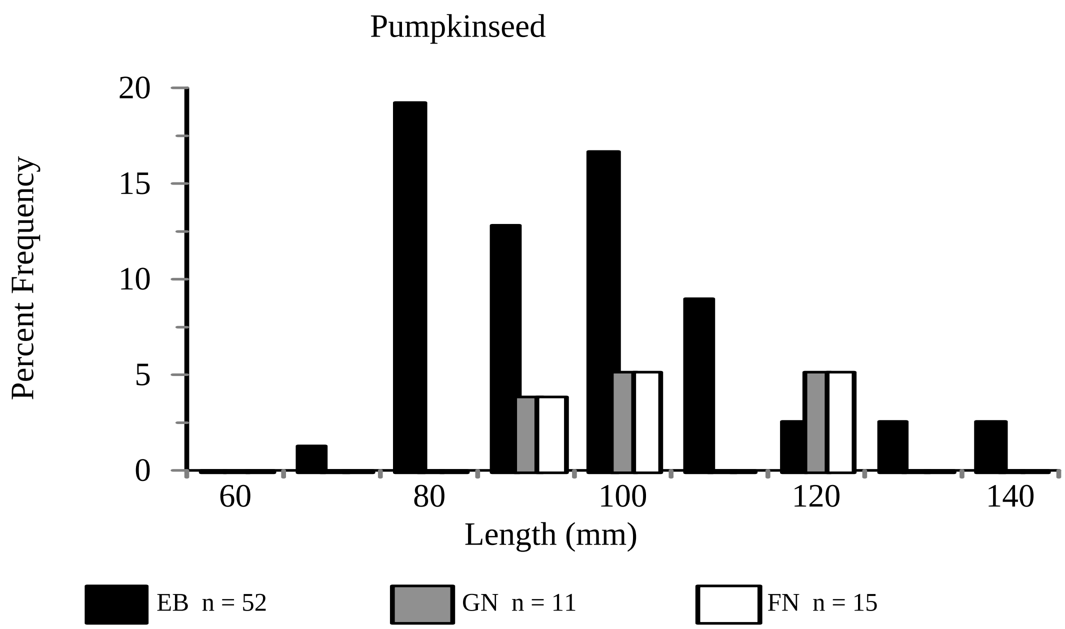

Figure 14. Length frequency of pumpkinseed captured by electrofisher (EB), gill nets (GN), and fyke nets (FN) in Evergreen Reservoir during June 2000.

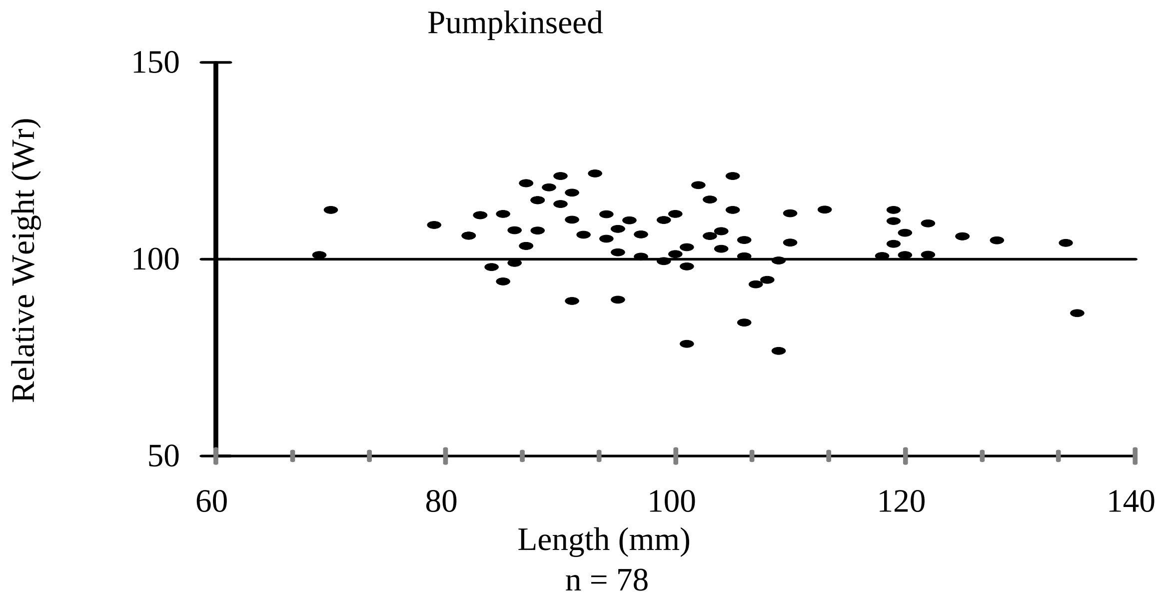

Figure 15. Relative weights of pumpkinseed captured by electrofisher (EB), gill nets (GN), and fyke nets (FN) in Evergreen Reservoir during June 2000, as compared to the national average, W_r = 100 (Anderson and Neumann 1996).

Yellow Perch

Yellow perch was the second most abundant species observed (n = 314) during the 2000 warmwater fish survey (Table 2), and was the most abundant fish species observed in 1987 (n = 375) and in 1997 (n = 68) (Walton and Wirt 1989, WDFW, Evergreen Reservoir file data, 1997). Ages of yellow perch during 2000 ranged from age 1 to 4 with Age 1 being the most abundant age evaluated (Table 10). Yellow perch was the only warmwater fish species evaluated in Evergreen Reservoir in which age 1 fish were the most abundant age evaluated, which was expected since the youngest age class is typically more numerous than older age classes. Growth of yellow perch during 2000 and 1987 was found to be above average for all ages except age 4 fish during 1987. Additionally, Ages 1 to 3 were evaluated for growth during 1997, and while low in number, was below average for all ages. Yellow perch ranged in length from 60 mm to 210 mm during 2000 (Figure 16), 54 mm to 165 mm in 1997 (Figure 17), and 95 mm to 220 mm in 1987. Length frequency data from these surveys, combined with the 2000 stock density indices evaluation (Table 4), suggest few yellow perch reach lengths greater than 220 mm (8.7 inches) in Evergreen Reservoir. Relative weights for yellow perch collected during 2000 were average for most fish less than 110 mm in length and slightly below average for fish larger than 140 mm in length (Figure 18). Yellow perch relative weights were below average in 1997. Relative weights appear to coincide with growth in 1997 and 2000, exhibiting above average growth when relative weights were higher, and below average growth as relative weights fell below average. This may be an indication of size or density dependant competition for the available food source, or year-to-year fluctuations in productivity within Evergreen Reservoir.

Table 10. Age and growth of yellow perch captured at Evergreen Reservoir during June 2000. Shaded values are mean back-calculated lengths using the direct proportion method (Fletcher et al. 1993), and unshaded values are mean back-calculated lengths using Lee's modification of the direct proportion method (Carlander 1982).

		Mean length (mm) at age			
Year Class	**# Fish**	**1**	**2**	**3**	**4**
1999	24	67.5			
		84.8			
1998	21	70.7	133.1		
		86.4	136.4		
1997	17	57.3	140.6	186.8	
		78.2	148.4	187.2	
1996	2	59.8	113.8	159.9	187.5
		80.3	125.6	164.3	187.5
Direct P. means		63.8	129.2	173.3	187.5
Lee's means		82.9	140.9	184.8	187.5
State Average		59.7	119.9	152.1	192.5

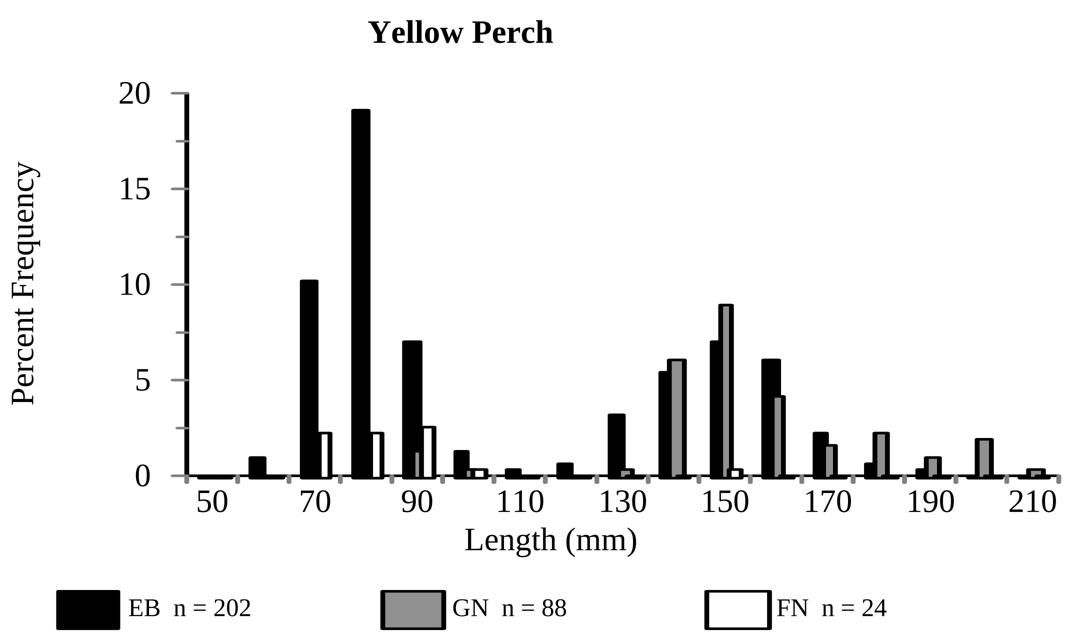

Figure 16. Length frequency of yellow perch captured by electrofisher (EB), gill nets (GN), and fyke nets (FN) in Evergreen Reservoir during June 2000.

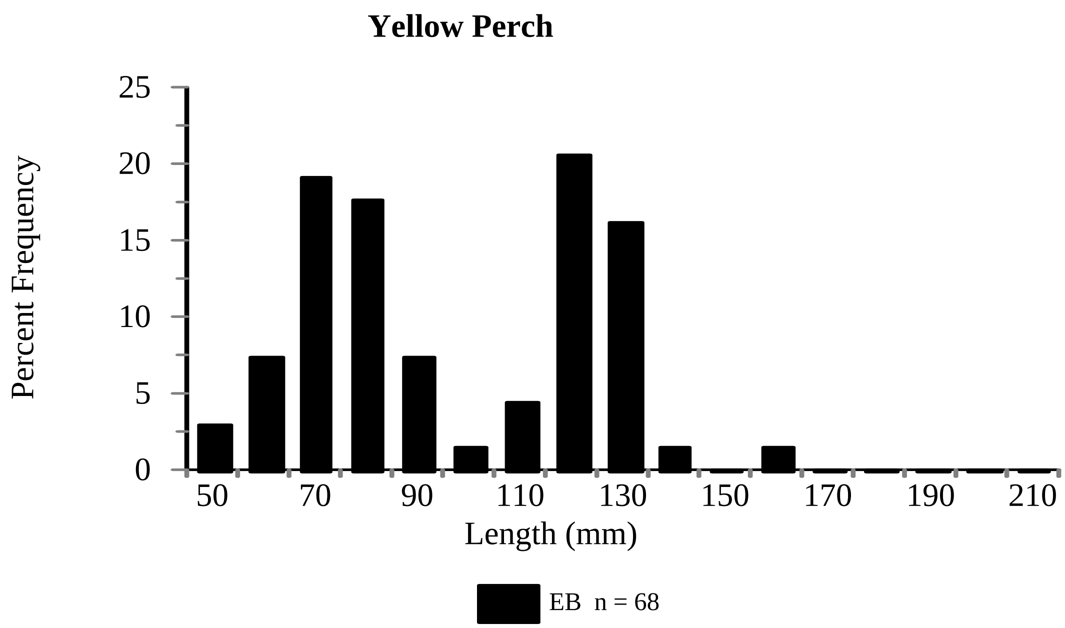

Figure 17. Length frequency of yellow perch captured by electrofisher (EB) in Evergreen Reservoir during November 1997.

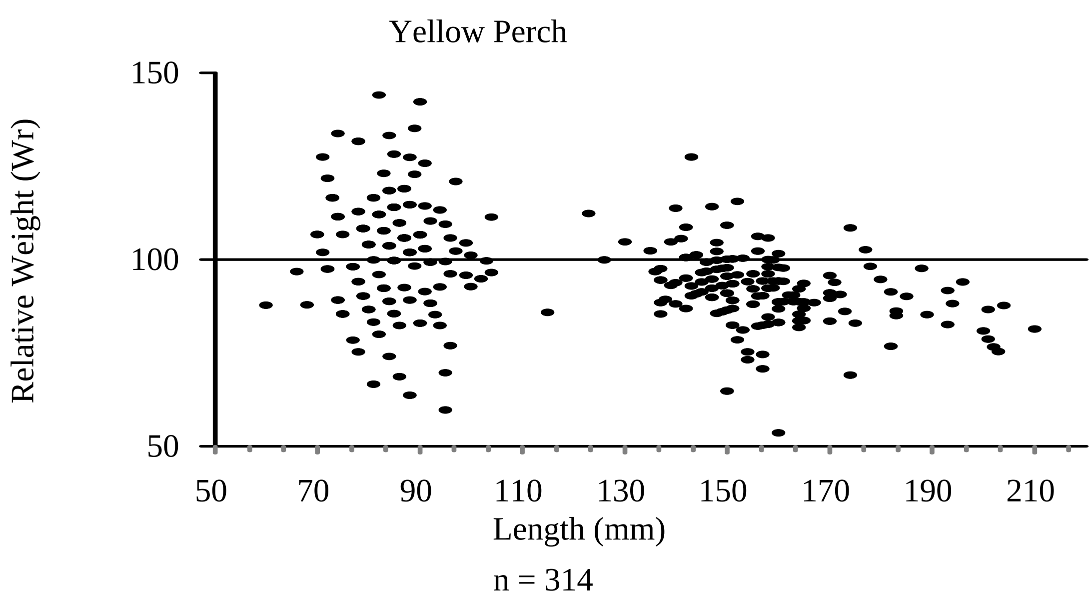

Figure 18. Relative weights of yellow perch captured by electrofisher (EB), gill nets (GN), and fyke nets (FN) in Evergreen Reservoir during June 2000, as compared to the national average, W_r = 100 (Anderson and Neumann 1996).

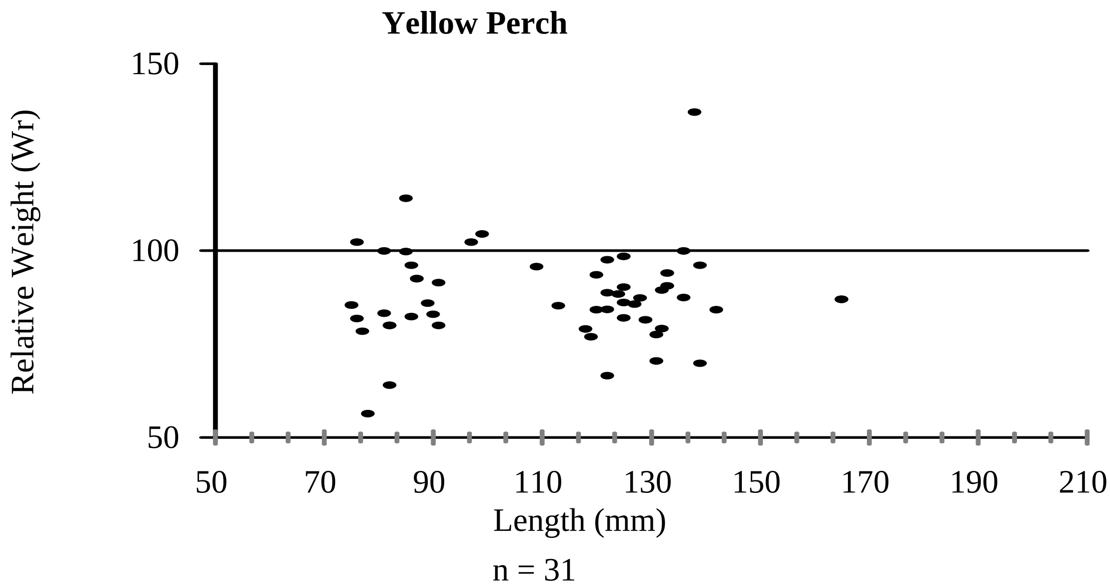

Figure 19. Relative weights of bluegill captured by electrofisher (EB) in Evergreen Reservoir during November 1997, as compared to the national average, W_r = 100 (Anderson and Neumann 1996).

Walleye

A total of 97 walleye were observed during this survey (Table 2). Low numbers were observed in 1997 (n = 3) and 1987 (n = 25) (WDFW, Evergreen Reservoir file data, 1997, Walton and Wirt 1989). Ages of walleye observed during 2000 ranged from 1 to 8 with age 3 being the most abundant age evaluated (Table 11). Growth of walleye collected in 2000 was above average for all ages when compared to the Minnesota state average (Wydoski and Whitney 1979). While age and growth data were not analyzed in 1997, growth of walleye ages 1 to 8 were above average in 1987, with the exception of Age 8, when compared to the Minnesota state average. Total lengths of walleye ranged from 185 mm to 710 mm during 2000 (Figure 20), 227 mm to 712 mm in 1997, and 400 mm to 707 mm in 1987. Relative weights of walleye were below average for most fish in 2000 and 1997 (Figure 21, WDFW, Evergreen Reservoir file data, 1997).

Of the 97 walleye observed in our samples, 95 were of stock length or larger (Table 4). Approximately 33 percent of the stock length walleye were 18 inches (457 mm) or larger and fell above the legal limit for angler harvest. Given the relatively small size of Evergreen Reservoir (247 acres) and the abundance of stock length or larger walleye, this reservoir should provide an above average walleye fishery.

Table 11. Age and growth of walleye captured at Evergreen Reservoir during June 2000. Shaded values are mean back-calculated lengths using the direct proportion method (Fletcher et al. 1993), and unshaded values are mean back-calculated lengths using Lee's modification of the direct proportion method (Carlander 1982).

Year Class	# Fish	Mean length (mm) at age 1	2	3	4	5	6	7	8
1999	1	165.9							
		173.4							
1998	17	167.6	289.6						
		192.3	292.2						
1997	51	163.2	339.3	447.0					
		195.8	347.4	440.0					
1996	10	135.0	312.0	426.5	488.0				
		174.5	331.8	433.5	488.0				
1995	9	149.8	318.7	447.3	506.2	544.4			
		189.6	341.5	457.1	510.1	544.5			
1994	3	158.8	291.7	371.6	433.6	459.4	480.7		
		196.7	315.4	385.9	440.2	462.4	480.7		
1993	2	186.6	369.4	515.9	600.3	641.0	665.7	687.5	
		226.8	394.9	529.7	607.4	644.8	667.4	687.5	
1992	1	202.7	370.6	481.4	573.3	624.0	652.5	677.8	700.0
		241.8	396.5	498.6	583.3	630.0	656.2	679.6	700.0
Direct P. means		166.2	327.3	448.3	520.3	567.2	599.6	682.7	700.0
Lee's means		193.2	335.6	442.2	503.6	547.1	572.2	684.9	700.0
Minnesota Ave.		117	216	305	381	460	521	582	638

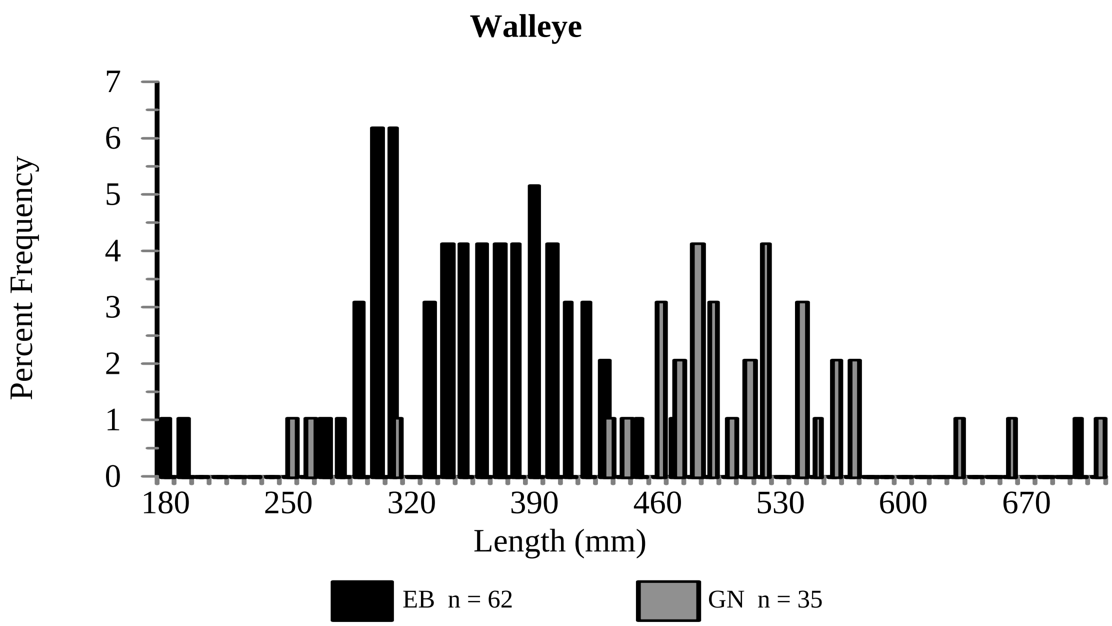

Figure 20. Length frequency of walleye captured by electrofisher (EB) and gill nets (GN) in Evergreen Reservoir during June 2000.

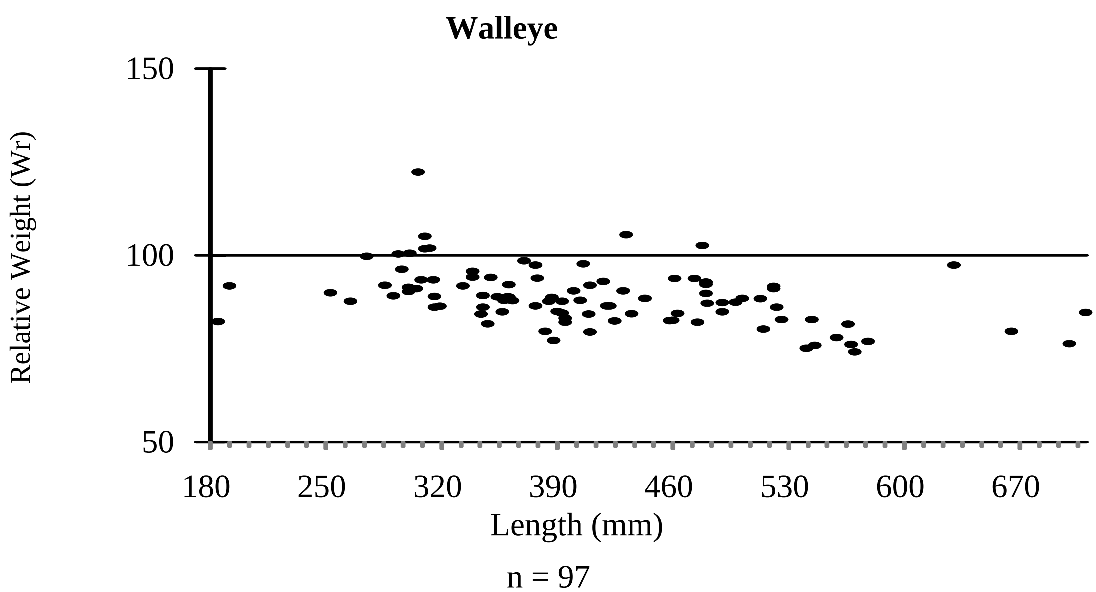

Figure 21. Relative weights of walleye captured by electrofisher (EB) and gill nets (GN) in Evergreen Reservoir during June 2000, as compared to the national average, W_r = 100 (Anderson and Neumann 1996).

Tiger Muskie

A total of 8 tiger muskie were observed during 2000 (Table 2) and 10 were observed in 1997 (WDFW, Evergreen Reservoir file data, 1997). Stocking of tiger muskie began in Evergreen Reservoir began in 1997, and continued each year thereafter to enhance the current warmwater fishery and provide anglers with new angling opportunities. Tiger muskie stocking rates were as follows: 1,660 (1997), 1,500 (1998), 400 (1999), and 300 (2000) at 10-15 inches in length. Ages 4 and 5 tiger muskie were observed in 2000, with Age 4 being the most abundant age evaluated (Table 12). Statewide growth averages for tiger muskie had not been developed at the time of this report. When age and growth of Evergreen Reservoir tiger muskie were compared to average lengths at age of tiger muskie in Merwin Reservoir and Mayfield Lake, growth of Evergreen Reservoir tiger muskie were below average (Jack Tipping, WDFW, personal communication). Lengths of Evergreen Reservoir tiger muskie ranged from 615 mm to 820 mm in 2000 (Figure 22) and from 296 mm to 537 mm in 1997 (Figure 23). Length frequency and available growth data suggest tiger muskie should obtain harvestable length (914.4 mm) in 2001. Relative weights of tiger muskie were found slightly below average in 2000 (Figure 24) and in 1997 (Figure 25). Due to the limited data on tiger muskie growth rates and condition in Evergreen Reservoir, it is unknown whether these data truly indicate below average growth and condition of tiger muskie for this waterbody.

Table 12. Age and growth of tiger muskie captured at Evergreen Reservoir during June 2000. Mean back-calculated lengths were calculated using the direct proportion method (Fletcher et al. 1993).

		Mean length (mm) at age				
Year Class	**# Fish**	**1**	**2**	**3**	**4**	**5**
1999	0					
1998	0					
1997	0					
1996*	5	191.2	366.7	545.4	726.3	
1995*	3	182.3	305.6	518.1	673.5	728.3
Direct P. means		187.9	343.8	535.1	706.5	728.3

* Evergreen Reservoir tiger muskies were stocked beginning in 1997. Since tiger muskies were aged at 4 and 5, questions regarding aging were raised, future tiger muskie scales will be sent to the Olympia scale lab for analysis.

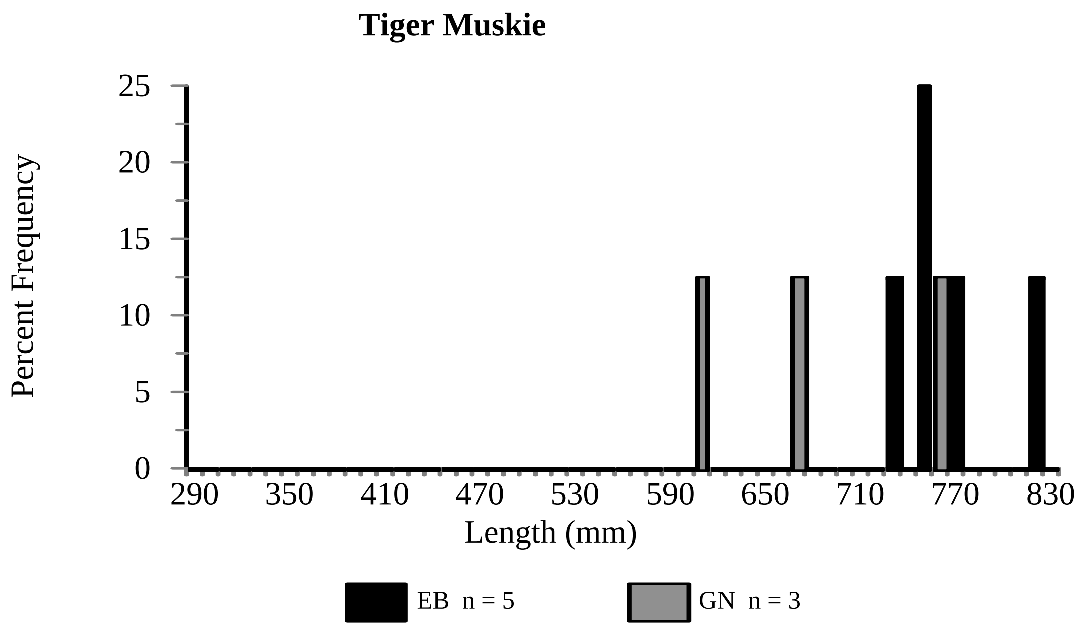

Figure 22. Length frequency of tiger muskie captured by electrofisher (EB) and gill nets (GN) in Evergreen Reservoir during June 2000.

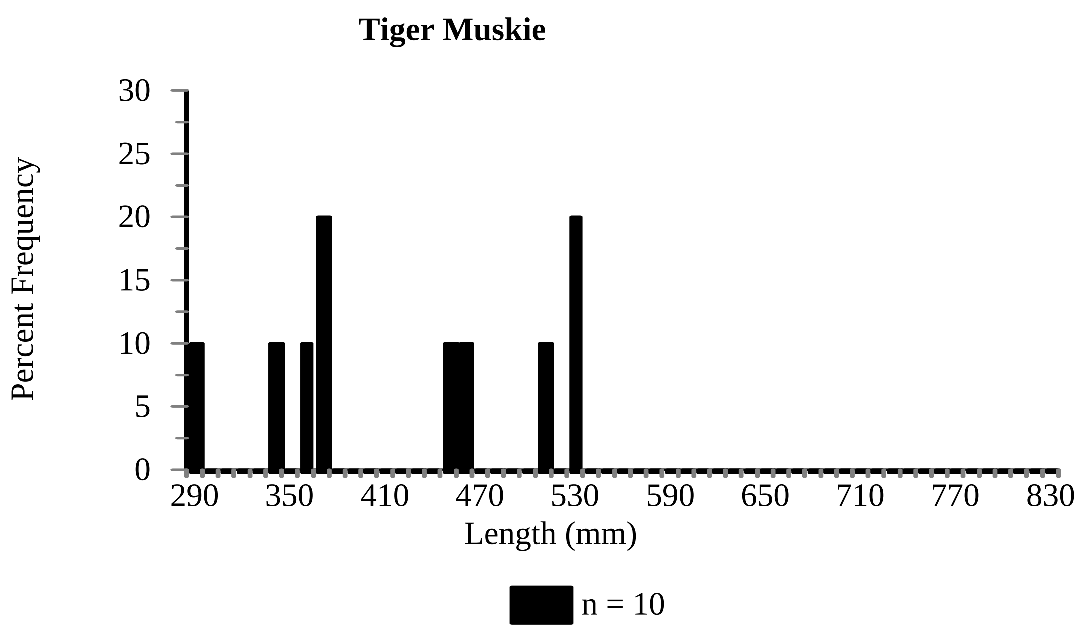

Figure 23. Length frequency of tiger muskie captured by electrofisher (EB) in Evergreen Reservoir during November 1997.

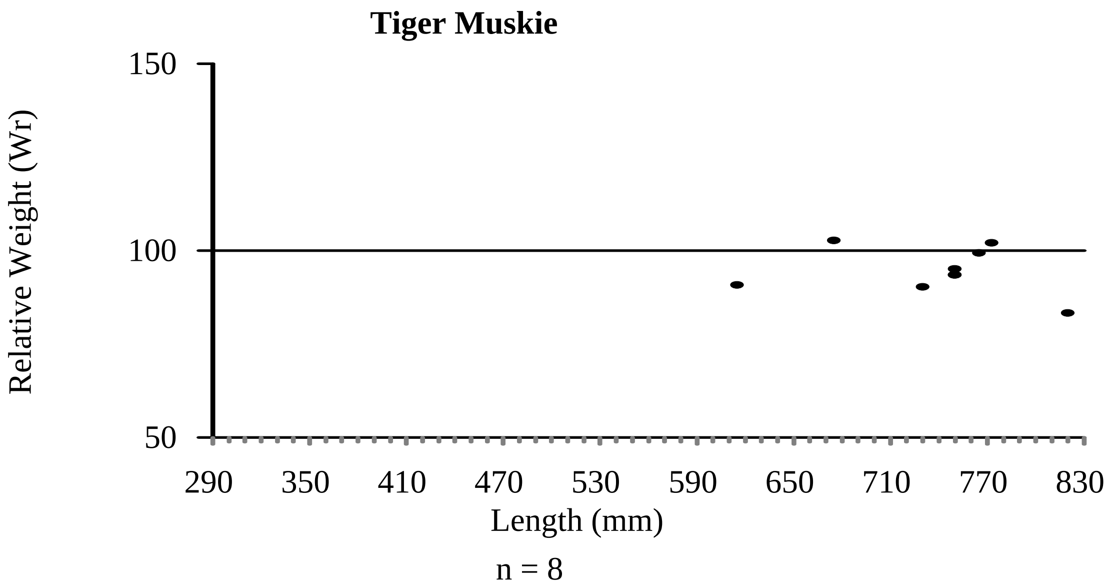

Figure 24. Relative weights of tiger muskie captured by electrofisher (EB) and gill nets (GN) in Evergreen Reservoir during June 2000, as compared to the national average, W_r = 100 (Anderson and Neumann 1996).

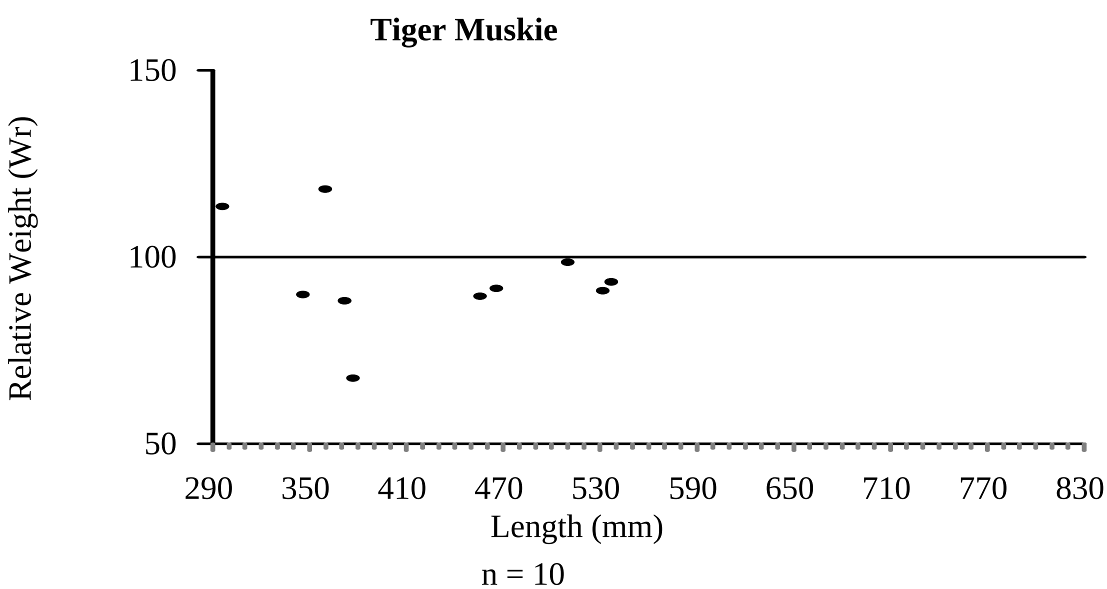

Figure 25. Relative weights of tiger muskie captured by electrofisher (EB) in Evergreen Reservoir during November 1997, as compared to the national average, W_r = 100 (Anderson and Neumann 1996).

Summary and Management Options

A total of 13 fish species were observed in Evergreen Reservoir, and bluegill was the most abundant warmwater fish species collected during the 2000 warmwater fish survey (Table 2). Growth and relative weights of bluegill were above average for most fish indicating this population was not limited by available food at the time of our survey (Table 9, Figure 10). The number of stock-length bluegill observed in Evergreen Reservoir in 2000 was high (n = 325) while the PSD was low, 13 ($\pm$ 2)(Table 5). Bluegill were not observed by Walton and Wirt (1989) during the 1987 warmwater survey, and were found in low numbers (n = 11) in 1997 (WDFW, Evergreen Reservoir file data, 1997). Data indicate the bluegill population in Evergreen Reservoir had expanded, and were beginning to recruit to quality size at the time of the 2000 survey.

Yellow perch (n = 314) was the second most abundant warmwater fish species observed in 2000 (Table 2), and most abundant species observed in 1997 (n = 68), and 1987 (n = 375) (WDFW, Evergreen Reservoir file data, 1997, Walton and Wirt 1989). Yellow perch in 2000 ranged in length from 60 mm to 210 mm (Figure 16). The PSD of yellow perch captured by gill nets in 2000 was low, 8 ($\pm$ 4), and was expected higher given the number fish that had reached stock length (n = 161)(Table 5). These data were consistent with what was observed in 1997 and 1987, and suggests few yellow perch reach quality size or larger in Evergreen Reservoir. It is unknown why more yellow perch aren't reaching larger sizes; however, angler harvest and/or predation may be involved in suppressing this population.

Largemouth bass abundance (n = 156) in Evergreen Reservoir appeared to increase from what was observed by Walton and Wirt (1989) and during the 1997 warmwater fish survey (WDFW, Evergreen Reservoir file data, 1997). Variation in sampling gears and sampling effort among surveys may be responsible, in part, for this increase. Relative weights were above average (Figure 4) with low numbers of stock-size fish observed and high PSD and RSD values (Table 5). These data suggest largemouth bass in Evergreen Reservoir were in relatively low abundance and food competition was not evident at the time of our survey. A lower abundance of largemouth bass in Evergreen Reservoir is not a concern; however, available habitat, reservoir drawdown, angler harvest, and predation may all be affecting their density.

Walleye was the fifth most abundant species observed during 2000, and accounted for the second highest (25.6%) total fish biomass collected (Table 2). Approximately 33 percent of the stock length walleye (n = 95) were 18 inches (457 mm) or larger, above the minimum size for angler harvest. Given the relatively small size of Evergreen Reservoir (247 acres) and the abundance of stock length or larger walleye, this reservoir should provide an above average walleye fishery.

The abundance of walleye collected during 2000 (n = 97) increased from 1997 (n = 3) and 1987 (n = 25) surveys, likely indicating this population has expanded, though variations in sampling gears and effort among surveys make it difficult to determine the extent.

Most warmwater fish species were found in average or above average condition. Walleye, yellow perch (> 140 mm), and tiger muskie were the only fish species observed with below average relative weights. Relative weights of walleye and yellow perch in other Columbia Basin lakes are frequently found slightly below average, and may not be an indication of poor health or lack of prey. Additionally, little data were available on growth and condition of tiger muskie stocked in Washington waters, and below average relative weights of tiger muskie observed in Evergreen Reservoir may not be unexpected. With the exception of age 1 yellow perch, age 1 warmwater fish species were observed in very low numbers in our samples. We suspect environmental factors, such as fluctuating water levels within Evergreen Reservoir, may have contributed to poor spawning success or survival during 1999. Additionally, predation by walleye, largemouth bass, and tiger muskie may be suppressing their survival, or we were ineffective at sampling this age class. Most Evergreen Reservoir warmwater fish species exhibited above average growth, which was consistent with the findings in 1997 and 1987. Above average growth and condition of these warmwater fish species may suggest these populations were in good health, and were not limited by the available food supply within Evergreen Reservoir at the time of these surveys.

Option 1: Warmwater Fishing Regulation

Warmwater fish populations within Evergreen Reservoir appear in good health and did not appear limited by available prey at the time of our survey. Quality length largemouth bass and walleye were found available for angler harvest, and the bluegill population appeared to be expanding and approaching quality length. We recommend maintaining the current statewide fishing regulations on Evergreen Reservoir warmwater fish species.

Option 2: Tiger Muskie Stocking

Tiger muskies have been observed in low densities in Evergreen Reservoir. Sampling methods may not be as effective at collecting tiger muskie as other warmwater gamefish; however, little is known about their survival in Evergreen Reservoir following stocking. A comparison of species composition data from the 1997 and 2000 warmwater surveys indicate tiger muskie stocking has likely had little effect on the composition of Evergreen Reservoir warmwater fish species, though some species increased in number. Tiger muskies were expected to reach harvestable size during 2001. We recommend continued stocking of tiger muskie at approximately 1 fish per acre each year, and 12 to 14 inches in length, for the purpose of providing warmwater anglers with additional angling opportunities.

Option 3: Creel Survey

Evergreen Reservoir data suggest harvestable length largemouth bass and walleye exist within the reservoir. Additionally, bluegill and tiger muskie, among other species, were expected to be available for angler creels during 2001. Little information is known on angler harvest of warmwater fish species in Evergreen Reservoir. We recommend a periodic creel survey to monitor angler harvest of warmwater fish species in Evergreen Reservoir as time and budget permits, and to aid in future fishery management of Evergreen Reservoir.

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Glossary

Catch Per Unit Effort (CPUE): Is defined as the number of fish captured by a sampling method (ie., electrofisher, gill nets, or fyke nets) divided by the amount of time sampled.

Confidence Interval (CI): Is defined as an estimated range of values that is likely to include an unknown population parameter with a percentage or degree of confidence.

Memorable Size: Is defined as fish anglers remember catching, and also identified as 59-64 percent of the world record length. Memorable length varies by species.

Preferred Size: Is defined as the size fish anglers preferred to catch when given a choice, and also identified as 45-55 percent of world record length. Preferred length varies by species.

Proportional Stock Density (PSD): Is defined as the number of quality length fish and larger, divided by the number of stock sized fish and larger, multiplied by 100.

Quality Length: Is defined as the length at which anglers begin keeping fish. Also identified as 36-41 percent of world record length. Quality length varies by species.

Relative Stock Density (RSD): Is defined as the number of fish of a specified length category (quality, preferred, memorable, or trophy) and larger, divided by the number of stock length fish and larger, multiplied by 100.

Relative Stock Density of Preferred Fish (RSD-P): Is defined as the number of fish in the preferred size category and larger, divided by the number of stock length fish and larger, multiplied by 100.

Relative Stock Density of Memorable Fish (RSD-M): Is defined as the number of fish in the memorable size category and larger, divided by the number of stock length fish and larger, multiplied by 100.

Relative Stock Density of Trophy Fish (RSD-T): Is defined as the number of fish in the trophy size category and larger, divided by the number of stock length fish and larger, multiplied by 100.

Relative Weight (W_r): The comparison of the weight of a fish at a given size to the national average weight (W_r = 100) of fish of the same species and size.

Standard Weight (W_s): Is defined as a standard or average weight of a fish species at a given length determined by a national length-weight regression.

Stock Length: Is defined by the following: 1) approximate length of fish species at maturity; 2) the minimum length effectively sampled by traditional sampling gears; 3) minimum length of fish that provide recreational value; and 4) 20-26 percent of world record length. Stock length varies by species.

Total Length (TL): Is defined as the length measurement from the anterior most part of the fish to the tip of the longest caudal (tail) fin ray (compressed).

Trophy Size: The minimum size fish worthy of acknowledgment, and also identified as 74-80 percent of world record length. Trophy length varies by species.

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