1998 Warmwater Fisheries Survey of Powerline Lake (Franklin County)

by

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Abstract

Powerline Lake (Franklin County) was surveyed by Washington Department of Fish and Wildlife Warmwater Enhancement Program personnel August 24-25, 1998. Survey methods included boat electrofishing, gill netting, and fyke netting. Largemouth bass (*Micropterus salmoides*) and yellow perch (*Perca flavescens*) accounted for the highest proportion of the catch by weight and number. Black crappie (*Pomoxis nigromaculatus*) and brown bullhead catfish (*Ameiurus nebulosus*) densities were lower. Population indices for largemouth bass indicated a crowded population composed of many fish less than quality length (≥ 300 mm and ≤ 380 mm) with below average condition. No largemouth bass greater than quality length were sampled. Yellow perch showed a higher proportion of quality length fish (≥ 200 mm and ≤ 250 mm) and above average growth. The relatively few black crappie and brown bullhead sampled allowed only limited interpretation of population indices for these species. However, the black crappie sampled had above average condition and growth. Management options include taking advantage of the current state of the fish community and managing the lake to promote panfish angling opportunities for quality yellow perch and black crappie, as well as abundant stock length largemouth bass (≥ 200 mm) *or* adopting a 12-17 inch slot-limit for largemouth bass if a quality catch and release bass fishery is desired.

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Introduction

Powerline Lake is a small body of water located in Franklin County, northwest of Mesa (surface area = 22 acres; mean depth = 7 m [22 ft]; max depth = 17 m [55 ft]). The lake is spring fed and has no inlets. Water intermittently flows out of the lake into wetland habitat. Development around the lake is low and limited to agriculture. A Washington Department of Fish and Wildlife (WDFW) park and walk-in site (≈1 mile) provides good shoreline and float tube access to the lake.

Historically, Powerline Lake was privately owned and had limited public fishing access. In 1968 the lake was rehabilitated with toxophene to eliminate a stunted pumpkinseed sunfish (*Lepomis gibbosus*) population. Following the rehabilitation, the lake was stocked with rainbow trout (*Oncorhynchus mykiss*) and provided some angling opportunity through a verbal angler access agreement between the landowner and the Washington Department of Game. In 1992, public access to the lake was acquired with the WDFW purchase of the Windmill Ranch. This land purchase resulted in a 2000 acre parcel of contiguous federal (Bureau of Reclamation) and state land (WDFW and Washington Department of Natural Resources) now managed as the Windmill Ranch Wildlife Area.

No stocking of Powerline Lake has occurred recently. Today, angling opportunities are the result of naturally reproducing warmwater fish populations and statewide general regulations apply. WDFW Warmwater Enhancement Program personnel conducted this survey of Powerline Lake in August 1998 to assess the state of the fish community.

Methods

Sampling

Powerline Lake was surveyed by a three person assessment team August 24-25, 1998. Fish were captured using boat electrofishing, gill netting and fyke netting. The electrofishing unit consisted of a 5.5 m Smith-Root 5.0 GPP "shock boat" using a DC current of 120 cycles / sec $^{-1}$ at 5 to 6 amps power. Experimental gill nets (45.7 m long x 2.4 m deep) were constructed of four sinking panels (two each at 7.6 m and 15.2 m long) of variable mesh size (1.3, 1.9, 2.5, and 5.1 cm stretched mesh) monofilament. Fyke nets were constructed of a main trap net (4.7 m long and 1.2 m diameter), a lead net (30.5 m long x 1.2 m deep) and two wings (7.6 m long x 1.2 m deep).

Sampling locations were selected by dividing the shoreline into nine consecutively numbered sections of approximately 400 meters. Three sections were randomly selected for sampling by boat electrofishing, two were selected for gill netting, and two were selected for fyke netting using a random number generator (Casio fx-991D scientific calculator). While electrofishing, the boat was maneuvered slowly through the shallows following the shoreline. Gill nets were set perpendicular to the shoreline with the small mesh end attached onshore and the large mesh end anchored offshore. Fyke nets were set perpendicular to the shore with the lead net anchored onshore and the wing nets set at a 45 degree angle to the trap. Length of the lead from shore and depths the fyke nets were set varied with the slope of the shoreline. Sampling was conducted during evening hours to maximize the number of species and fish captured. Samples were weighted so as to achieve a standardized 1:1:1 ratio of electrofishing to gill netting to fyke netting (1:1:1 - 1800 seconds boat electrofishing:24 gillnet hours:24 fyke net hours). This methodology is employed to reduce bias between gear types (Fletcher et al. 1993). Total electrofishing time was 1800 seconds ("pedal-down" time), or one standard unit. Total gill net and fyke net time equaled one standard unit of two nets of each type fished for one night.

Each fish captured was identified to species, measured for total length (TL; mm) and weighed (g). Scales were collected from largemouth bass (*Micropterus salmoides*), black crappie (*Pomoxis nigromaculatus*), and yellow perch (*Perca flavescens*) to analyze age and growth. Scale samples (up to five per 10 mm length class) were mounted, pressed, and aged according to Jearld (1983) and Fletcher et al. (1993). Brown bullhead catfish (*Ameiurus nebulosus*) were not aged.

Water quality data was collected on the evening (7:30 PM) of August 24, 1998 from the deepest location in the lake. Data was collected on dissolved oxygen, temperature, specific conductance, total dissolved solids, pH, and salinity using a Hydrolab® probe and digital recorder.

Data Analysis

Percentages of the total biomass and number of fish collected for each species provides useful information regarding the balance and productivity of the community (Swingle 1950; Bennet 1962; Fletcher et al. 1993). Species composition by weight (kg) and number was calculated from data collected using boat electrofishing, gill netting, and fyke netting.

Catch per unit effort (CPUE) by sampling method was determined for each fish species collected (number of fish/hour electrofishing and number of fish/net night). The CPUE for each fish species was calculated using only stock length fish and larger. Stock length, which varies by species, is the size of a particular fish species that offers threshold recreational value to an angler (Anderson 1976). Randomly chosen sample sections can contribute to high variability among samples, therefore 80% confidence intervals (CI) were calculated for each mean CPUE by species and by sampling method. Each CI was calculated as the mean $\pm t(\propto,N-1)\times SE$, where t=Student's t for $\propto$ confidence level with N-1 degrees of freedom (two tailed) and SE=standard error of the mean. When standardized sampling is used, CPUE is a useful index that can be used to compare lakes within the State of Washington and monitor changes in relative abundance over time.

Length frequency histograms (percent frequency captured by different sampling methods) were used to evaluate the size structure of all warmwater fish species collected.

Proportional stock density (PSD), calculated as the number of fish≥quality length/number of fish≥stock length ×100, was determined for each warmwater fish species collected (Anderson and Neuman 1996). PSD can provide information about the proportion of various size fish in a population and can be a useful tool when sample size is adequate (Willis et al. 1993; Divens et al. 1998). Stock and quality lengths used in the calculation of PSD are based on a percentage of world record catch size and vary depending on fish species (Table 1). Stock lengths (20-26% of the world record) refer to the minimum length fish of recreational value, and quality lengths (36-41% of the world record) refer to the minimum length fish anglers prefer catching. In addition to stock and quality length, Gabelhouse (1984b) introduced preferred, memorable, and trophy length categories. Preferred length (45-55% of world record length) refers to the length of fish anglers would prefer to catch when given a choice. Memorable length (59-64% of the world-record length) refers to the minimum length fish most anglers remember catching, whereas trophy length (74-80% of world record length) refer to the length of fish worthy of acknowledgment. Bister et al. (2000) developed and proposed additional length categories for 83 additional species including brown bullhead catfish.

Table 1. Length categories for warmwater fish captured at Powerline Lake (Franklin County) August 1998. Measurements are minimum total lengths (mm) for each PSD, and RSD category.

Species	Size				
	Stock	Quality	Preferred	Memorable	Trophy
Largemouth Bass	200	300	380	510	630
Yellow Perch	130	200	250	300	380
Black Crappie	130	200	250	300	380
Brown Bullhead	130	200	280	360	430

Relative Stock Density (RSD), calculated as the number of fish≥specific length/number of fish≥stock length×100, was also calculated for each game fish species. Like PSD, it can also provide useful information regarding population dynamics and is more sensitive to changes in year-class strength. For example, RSD-P was the percentage of stock length fish greater than or equal to preferred length, RSD-M, the percentage of stock length fish that are greater than or equal to memorable length, and so on. Eighty-percent confidence intervals for PSDs and RSDs are provided as an estimate of statistical precision and were calculated using normal approximation (Conover 1980; Gustafson 1988).

Age and growth of warmwater fishes sampled were evaluated using the direct proportion method (Fletcher et al. 1993) and Lee's modification of the direct proportional method (Carlander 1982). Although Lee's modification corrects for species-specific threshold length at the time of scale formation, direct proportion allows for comparison of growth with in-state survey averages previously calculated using direct proportion. We have chosen to present the results for calculations from both methods until survey averages can be developed using Lee's modification. Using the direct proportional method, total length at annulus formation, L_n, was back-calculated as $L_n=(A\times TL)/S$, were A is the radius of the fish scale at age n, TL is the total length of the fish captured, and S is the total radius of the scale at capture. Using Lee's modification, L_n was back-calculated as $L_n=a+A\times(TL-a)/S$, where a is the species-specific standard positive y-axis intercept from a scale radius-fish length regression. Mean back-calculated lengths at age n for each species were presented in tabular form for easy comparison of growth between year classes, as well as between the lake average and what has been found in other surveys in Washington for the same species using the direct proportion method (Fletcher et al. 1993).

The relative weight (Wr) index was used to evaluate the condition of fish in the lake. Relative weight is useful for comparing the condition of different size groups within a single population to determine if all sizes are finding adequate nutrition (ODFW 1997). A Wr value of 100 generally indicates average condition compared to the national average for a species. This index is calculated as $Wr=W/Ws\times100$, where W is the weight (g) of an individual fish and Ws is the standard weight of a fish of the same length (mm) (Murphy and Willis 1991). Ws is calculated from the standard log10 weight-log10 length relationship defined for the species of interest. Anderson and Neumann (1996) list the parameters for the Wr equations of many warmwater fish species, including minimum length recommendations for their application. Wr values calculated from this survey were compared to the national average (Wr=100) for each species.

Results

Water Quality

Water quality data, collected at 7:30 PM on August 24, 1998, revealed thermal stratification at six meters (Table 2). Water temperature decreased from 23ºC at 6 meters to 18ºC at 7 meters. Dissolved oxygen levels decreased from 9 mg/l in the epilimnion to less than .70 mg/l below 7 meters. Although the dissolved oxygen levels above 7 meters were within the acceptable range for all warmwater fish species, levels below 7 meters were undesirable for fish production (Boyd 1990). The pH levels were within the desirable range of 6.5 to 9 at all depths (Swingle 1969).

Table 2. Water quality data from Powerline Lake (Franklin County) collected 7:30 p.m. August 24, 1998.

Depth (m)	Temp (°C)	Ph	DO	Total Dissolved Solids	Conductivity	Salinity
0	24.57	8.81	9.42	0.33	515.40	0.26
1	24.53	8.81	9.72	0.33	516.10	0.26
2	23.94	8.82	10.00	0.33	513.90	0.26
3	23.70	8.82	10.08	0.33	514.20	0.26
4	23.58	8.82	9.99	0.33	513.90	0.26
5	23.52	8.82	9.89	0.33	512.70	0.26
6	23.13	8.73	9.59	0.33	514.70	0.26
7	18.80	7.71	0.70	0.37	572.10	0.29
8	14.37	7.72	0.59	0.69	576.20	0.29
9	12.19	7.65	0.29	0.68	575.70	0.29
10	12.62	7.64	0.29	0.37	574.20	0.29
11	9.45	7.53	0.20	0.38	585.20	0.30
12	8.20	7.51	0.09	0.37	578.90	0.30
13	7.59	7.49	0.07	0.37	580.20	0.30
14	7.29	7.48	0.05	0.37	580.70	0.30
15	7.11	4.47	0.04	0.72	582.50	0.30
16	6.84	7.52	0.27	0.37	586.20	0.30
17	6.84	7.49	0.16	0.37	586.60	0.30
Bottom	6.87	7.47	0.11	0.38	587.50	0.30

Low dissolved oxygen and high water temperatures limit the amount of habitat available to fish in Powerline Lake at times. At the time of this survey, fish species were restricted to the upper 6 meters of the lake. The lack of adequate dissolved oxygen in the hypolimnion, despite favorable water temperatures, greatly limits management possibilities for Powerline Lake to warmwater fish species. Water quality limitations curtail the possibility of a quality trout fishery and limit the potential for trout to a spring and fall put-and-take trout fishery. Additional water quality data collected at other times of the year are needed to fully assess water quality limitations on Powerline Lake fish populations.

Species Composition

Four fish species were collected at Powerline Lake in August 1998. Yellow perch and largemouth bass were the most abundant species by weight and by number (Table 3). Largemouth bass and yellow perch together totaled 95 % of the catch by weight. Brown bullhead catfish and black crappie were sampled at lower densities.

Table 3. Species composition by weight (kg) and number of fish captured at Powerline Lake (Franklin County) during August 1998.

Species	Species Composition					
	by Weight		by Number		Size Range (mm TL)	
	(kg)	(%)	(#)	(%)	Min	Max
Yellow Perch	16.06	52.77	294	55.47	79	249
Largemouth Bass	13.01	42.75	220	41.51	60	276
Brown Bullhead	0.59	1.95	3	0.57	101	335
Black Crappie	0.77	2.53	13	2.45	132	204

CPUE

Stock length yellow perch were captured at the highest rate by electrofishing at 206 fish per hour. Stock length largemouth bass were captured by electrofishing at 74 fish per hour. No black crappie or brown bullhead were captured by electrofishing, however they were captured by gill netting. No fish were captured using fyke nets (Table 4).

Table 4. Mean catch per unit effort by sampling method, including 80% confidence intervals, for stock length fish collected from Powerline Lake (Franklin County) during August 1998.

Species	Gear Type					
	Electrofishing		Gill Netting		Fyke Netting	
	(#/hour)	Sites	#/Net Night	Net Nights	#/Net Night	Net Nights
Yellow Perch	206.00 ± 91.45	3	79.50 ± 55.75	2	0	2
Largemouth Bass	74.00 ± 20.50	3	1.50 ± 1.92	2	0	2
Black Crappie	0.00	3	6.50 ± 4.49	2	0	2
Brown Bullhead Catfish	0.00	3	1.00 ± 1.30	2	0	2

Stock Density Indices

Considering the limited amount of sampling conducted for this survey, the catch of stock length largemouth bass was high compared to other lakes surveyed (Table 5). However, no largemouth

bass of quality length (≥300 mm) or greater were sampled resulting in a PSD value of 0. This is an indication of a community which is "predator-crowded".

Table 5. Traditional stock density indices, including 80% confidence intervals, for fish collected from Powerline Lake (Franklin County) August 1998 by sampling method.

Species	Electrofishing				
	#≥Stock Length	PSD	RSD-P	RSD-M	RSD-T
Largemouth Bass	37	0	0	0	0
Yellow Perch	103	0	0	0	0
	Gill Netting				
Largemouth Bass	3	0	0	0	0
Yellow Perch	159	34 ± 5	0	0	0
Black Crappie	13	8 ± 9	0	0	0
Brown Bullhead	2	50 ± 45	0	0	0

A more adequate sample size (159) of stock length yellow perch (≥130 mm) was collected. A relatively high yellow perch PSD value of 34±5 was calculated. Crowding of panfish populations are often the result of extensive competition for limited food resources and/or low predation rates due to a low abundance of predators. Extensive crowding of this population may be prevented by an adequate abundance of less than quality length (> 300 mm) largemouth bass and /or sufficient angling pressure.

Too few stock length black crappie and brown bullhead were sampled to interpret stock density indices for these species. The relatively few stock length black crappie and brown bullhead captured may simply be an indication of their relatively low abundance in Powerline Lake at the time of this survey. Additional sampling would likely provide more conclusive information.

Largemouth Bass

Powerline Lake largemouth bass sampled ranged in size from 60 to 276 mm TL (Table 3; Figure 1). The age of largemouth bass sampled ranged from one to three years (Table 6). Largemouth bass growth rates were generally lower than the known Washington state average. Largemouth bass condition was relatively low compared to the national 75th percentile and appeared to decline as length and age increased possibly indicating interspecific competition (Figure 2). Low condition and slow growth typically indicates inter- and /or intra-specific competition for available resources. The absence of larger fish in this sample may also be an indication of angler harvest of quality length bass and larger. However, additional sampling effort would allow for more conclusive interpretation.

Table 6. Age and growth of largemouth bass sampled from Powerline Lake (Franklin County) August 1998. Unshaded values are mean back-calculated length at annulus using the direct proportion method (Fletcher et al. 1993). Shaded values are mean back-calculated lengths using the Lee's modification (Carlander 1982).

Year Class	# Fish	Mean length (mm) at age		
		1	2	3
1997	35	70		
		80		
1996	24	61	144	
		75	150	
1995	10	60	138	194
		75	147	198
Direct Proportion Overall Mean		64	141	194
Lee's Weighted Mean		78	149	198
Direct Proportion State Average		60	146	222

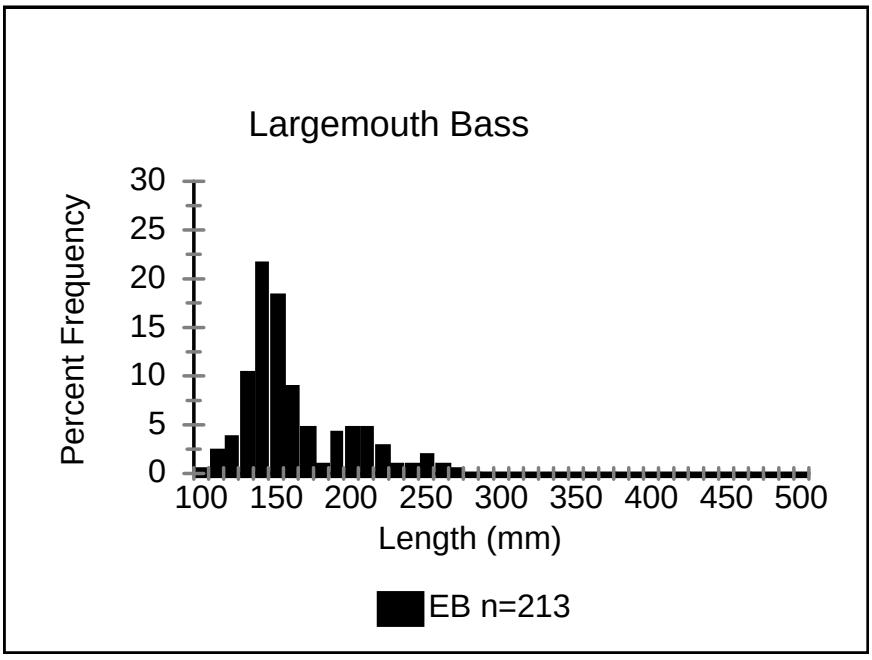

Figure 1. Length frequency distribution of largemouth bass sampled at Powerline Lake (Franklin County) August 1998 by boat electrofishing (EB).

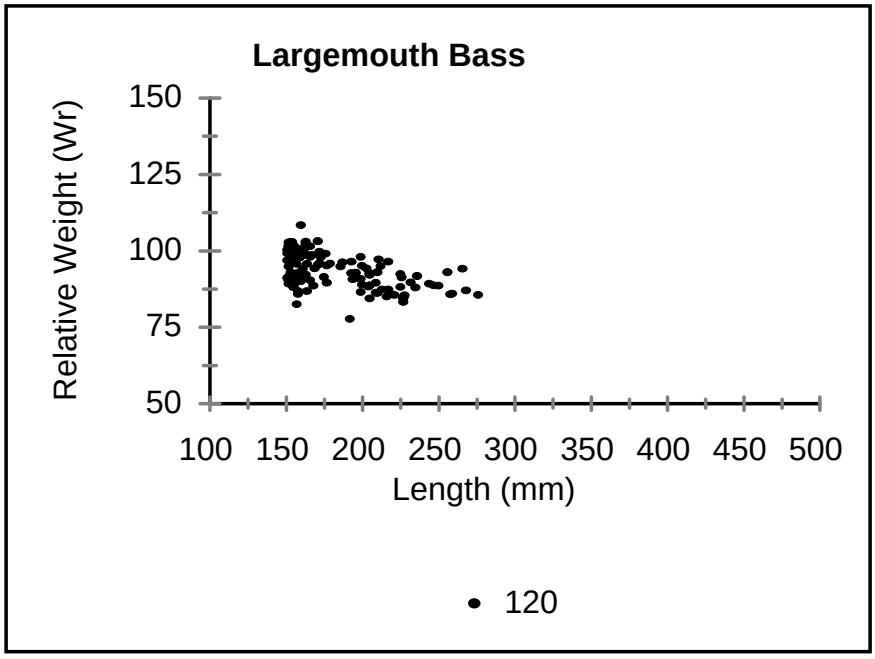

Figure 2. Relative weight (Wr) of largemouth bass sampled at Powerline Lake (Franklin County) August 1998 compared to the national 75th percentile.

Yellow Perch

Powerline Lake yellow perch sampled ranged in size from 70 to 249 mm TL(Table 3) and showed stable year-class strength (Figure 3). Yellow perch size at age two was greater than the known state average for Washington (Table 7). Condition was lower than the national 75th percentile at all lengths and decreased as fish length increased (Figure 4). A decrease in condition of yellow perch greater than quality length (200 mm) is likely an indication of inter- and intra-specific competition. Additional harvest of quality length yellow perch may increase the condition of older age classes by decreasing the amount of competition for available resources.

Table 7. Age and growth of yellow perch sampled from Powerline Lake (Franklin County) August 1998. Unshaded values are mean back-calculated length at annulus using the direct proportion method (Fletcher et al. 1993). Shaded values are mean back-calculated lengths using the Lee's modification (Carlander 1982).

Year Class	# Fish	Mean length (mm) at age	
		1	2
1997	46	57	
		75	
1996	28	47	144
		70	154
Direct Proportion Overall Mean		52	144
Lee's Weighted Mean		73	154
Direct Proportion State Average		60	120

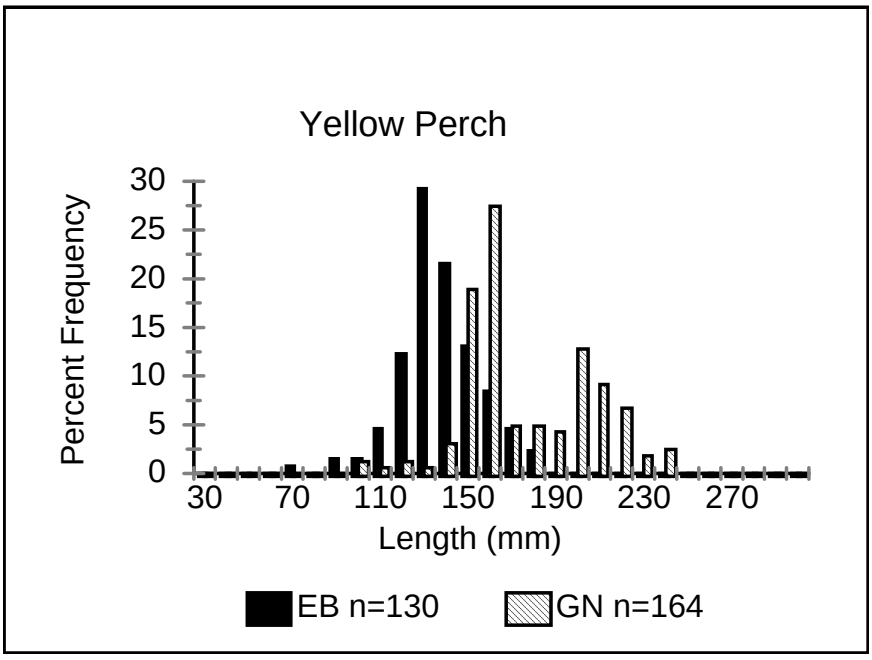

Figure 3. Length frequency distribution of yellow perch sampled at Powerline Lake (Franklin County) August 1998 by boat electrofishing (EB) and gill net (GN).

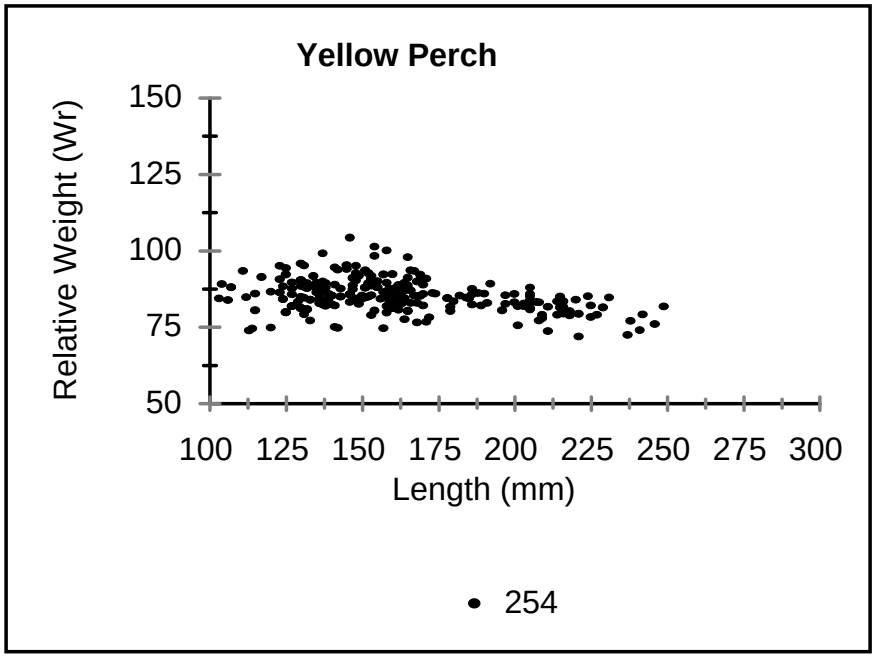

Figure 4. Relative weight (Wr) of yellow perch sampled at Powerline Lake (Franklin County) August 1998 compared to the national 75th percentile.

Black Crappie

Powerline Lake black crappie sampled ranged in total length from 130 to 204 mm TL (Table 3; Figure 5). The growth of the few black crappie collected was higher than the known state average (Table 8) and relative weights were higher than the national 75th percentile indicating low intraspecific competition (Figure 6). However, the low sample size of black crappie collected in this survey limits interpretation. Additional sampling of Powerline Lake would allow for more conclusive interpretation of black crappie population indices.

Table 8. Age and growth of black crappie sampled from Powerline Lake (Franklin County) August 1998. Unshaded values are mean back-calculated length at annulus using the direct proportion method (Fletcher et al. 1993). Shaded values are mean back-calculated lengths using the Lee's modification (Carlander 1982).

Year Class	# Fish	Mean length (mm) at age	
		1	2
1997	12	53	
		75	
1996	1	54	128
		80	141
Direct Proportion Overall Mean		54	128
Lee's Weighted Mean		76	141
Direct Proportion State Average		46	111

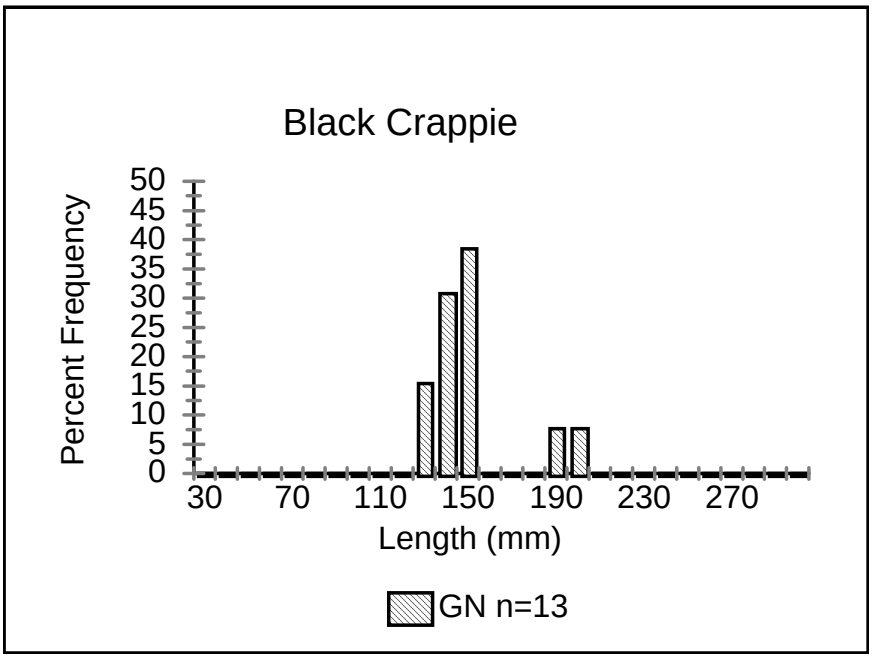

Figure 5. Length frequency distribution of black crappie sampled at Powerline Lake (Franklin County) August 1998 by gill net (GN).

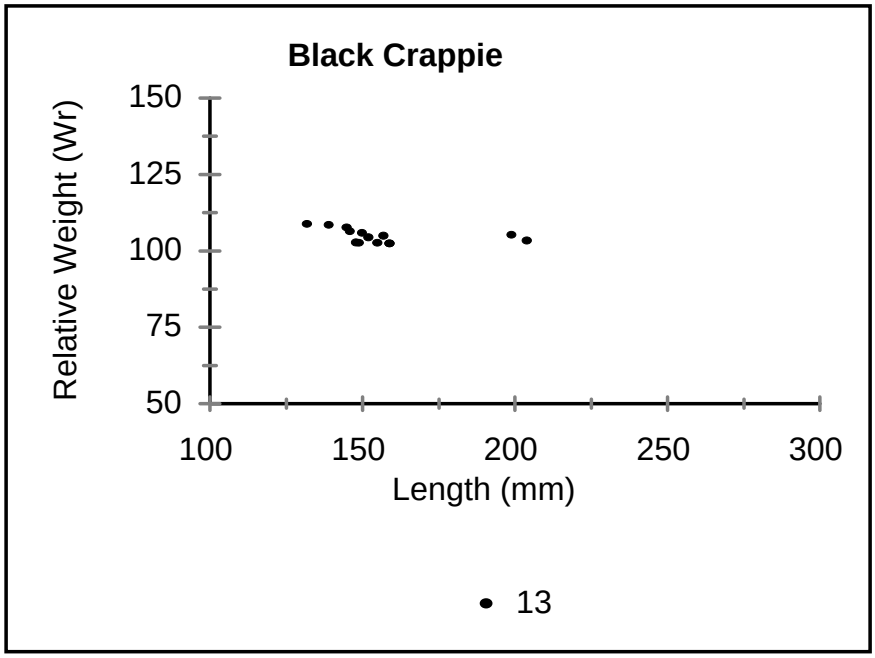

Figure 6. Relative weight (Wr) of black crappie sampled at Powerline Lake (Franklin County) August 1998 compared to the national 75th percentile.

Discussion

Warmwater fisheries managers typically consider the "balance" between predator and prey fish populations when assessing warmwater fish communities. The term "balance" is used loosely to describe a system in which omnivorous prey panfish maximize food resources to produce harvestable-size fish stocks for anglers and an adequate forage base for piscivorus predator fish (Bennett 1962). Fish communities may otherwise typically be described as being prey-crowded or predator-crowded. To provide quality warmwater fishing opportunities, predatory gamefish species such as largemouth bass must be able to reproduce and grow to control overpopulation of both prey and predator species.

Due to the limited duration and number of fish sampled in this survey, the results are less than conclusive and their interpretation limited. However, some inferences can be made from analysis of the data collected. In August 1998, Powerline Lake showed indications of having a predator-crowded, fish community dominated by largemouth bass and yellow perch. The high abundance and low condition of stock length largemouth bass (200 - 300 mm) and quality length yellow perch ($\geq$ 200 mm) may be the result of interspecific competition for limited forage. However, the relatively high PSD of yellow perch suggests that predation rates on yellow perch by largemouth bass are sufficient to control stunting. Increased harvest of yellow perch may result in an increase in the condition of remaining quality length yellow perch.

Management Options to Enhance Warmwater Fishing Opportunities

Panfish Option

At the time of this survey, the fish community most resembled that of one managed for panfish. Such communities are typically characterized by panfish populations exhibiting good growth and condition, as well as a predator population capable of reducing the chances of stunting. Such fisheries typically provide anglers an opportunity to catch and keep quality panfish and abundant small largemouth bass. Fishery managers could take advantage of the Powerline Lake fish community's current condition by working to maximize opportunities for panfish angling. Additional sampling effort is needed to better describe and fully understand the fishery potential of black crappie.

Largemouth Bass Slot-Limit Regulation

If an improved largemouth bass fishery were the goal of fishery managers, Powerline Lake would be a likely candidate for inclusion under the states 12 - 17 inch slot-limit for largemouth bass. This regulation consists of a five fish limit, fish 12"-17" are to be released, and only one fish over 17" may be retained. The intent of this regulation would be to increase the number of quality

size (≥300mm, 12") largemouth bass in the lake, which would then be available for catch and release angling opportunities. Slot-limits have been used successfully in other states and some lakes in Washington to provide both quality bass and panfish angling (Rasmussen and Michaelson 1972; Eder 1984; Wilde 1997). However, enforcement of such a regulation at this isolated lake may prove difficult.

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