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2002 Warmwater Fisheries Survey of Fish Lake, Chelan County, Washington

Warmwater Fish Enhancement

by Michael R. Schmuck and Marc R. Petersen

Washington Department of
FISH AND WILDLIFE
Fish Program
Fish Management Division

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Abstract

Fish Lake, Chelan County, Washington was sampled between September 23-27, 2002, using a boat electofisher, gill nets, and fyke nets. Eight fish species were observed during sampling efforts. Largemouth bass *Micropterus salmoides*, yellow perch *Perca flavescens*, rainbow trout *Oncorhyncus mykiss*, brown trout *Salmo trutta*, largescale sucker *Catostomus macrocheilus*, northern pikeminnow *Ptychocheilus oregonensis*, prickly sculpin *Cottus asper*, and redside shiner *Richardsonius balteatus* were collected during this survey. Rainbow trout comprised the majority of the fish captured at Fish Lake, while warmwater gamefish, primarily yellow perch comprised 29.8 percent of the fish collected. Largescale sucker comprised 48.5 percent of the total biomass of fish collected, while rainbow trout comprised 21.6 percent of the biomass of fish collected.

Yellow perch ranged in age from one to eight years; however, Ages five and seven yellow perch were absent from our sampling. The PSD for yellow perch was 20, and relative weights were near the national average (W_r = 100). Growth of yellow perch was above the state average for all but age one fish.

Fish Lake is primarily managed as a trout fishery. Yellow perch are also sought after by anglers year-round. Historically, this lake provided excellent perch fishing; however, recently anglers have expressed concern over declines in harvest during the summer. No creel surveys have been conducted on this lake; therefore, no data exist on perch exploitation. This survey was conducted, in part, to determine the size structure and abundance of yellow perch in the lake. We found YOY and age one fish to be smaller than average for this time of year. It is possible that rainbow trout are competing with yellow perch for forage as well as preying on yellow perch YOY and juveniles. However, without any analysis of trout diets this remains unknown

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Introduction and Background

Fish Lake is approximately 27 km (16 miles) northwest of Leavenworth, Washington (Chelan County). It has a perimeter of 7,724 m, and an area of approximately 200 ha (Figure 1). Water drains from Fish Lake into Fish Lake Run, which empties into the Wenatchee River approximately 1.6 km east of the lake.

Fish Lake is a senescent kettle lake located in the foothills of the Cascade mountain range at an elevation of 587 m. The west end of the lake is covered by a floating mat of sedge and cattail, which is indicative of a mid to late successional kettle lake (Cole 1994). Dominant vegetation surrounding Fish Lake includes Douglas fir *Pseudotsuga menziesii*, grand fir *Abies grandis*, and ponderosa pine *Pinus ponderosa*. Emergent vegetation found along the perimeter includes cattail *Typhus latifolia*, bulrush *Scirpus spp.*, and sedge *Carex spp.* Aquatic vegetation found in the lake includes water milfoil *Myriophyllum spp.*, pondweed *Potamogeton spp.*, and filamentous algae.

Fish Lake is managed by the WDFW primarily for trout and perch fishing. There is a private boat launch and a large fishing dock on the southwest end of the lake at Cove Resort. The launch and dock are open to the public for a fee. There is also a boat launch and resort on the northwest side of the lake which is also open to the public.

The WDFW has stocked Fish Lake since 1936. Initially, WDFW stocked largemouth bass *Micropterus salmoides*, channel catfish *Ictalurus punctatus*, as well as rainbow *Oncorhyncus mykiss*, brook *Salvelinus fontinalis* and cutthroat trout *O clarki*. Black bass have not been stocked in Fish Lake since 1937, and brook trout have not been stocked since 1990. Any bass now found in Fish Lake are likely the result of illegal stocking. Currently, WDFW stocks Fish Lake with rainbow, cutthroat, and brown trout *Salmo trutta* (Table 1).

Warmwater gamefish are managed using statewide general freshwater species rules. There is no minimum size limit for bass, or panfish; however, only bass less than 12 inches or greater than 17 inches may be kept. Anglers may retain up to five bass, of which only one may be over 17 inches, and there is no limit on the number of panfish that may be kept. There is no size limit on rainbow and brown trout, and the daily limit is five trout, of which no more than two fish over 15 inches may be retained per day.

Anglers have expressed concern over the decline in quality perch fishing available at Fish Lake. Historically anglers enjoyed excellent perch fishing throughout the year; however, it appears as though the quality of fishing has declined. This survey was conducted, in part to determine the abundance of yellow perch in Fish Lake, and to determine which factors are negatively impacting yellow perch.

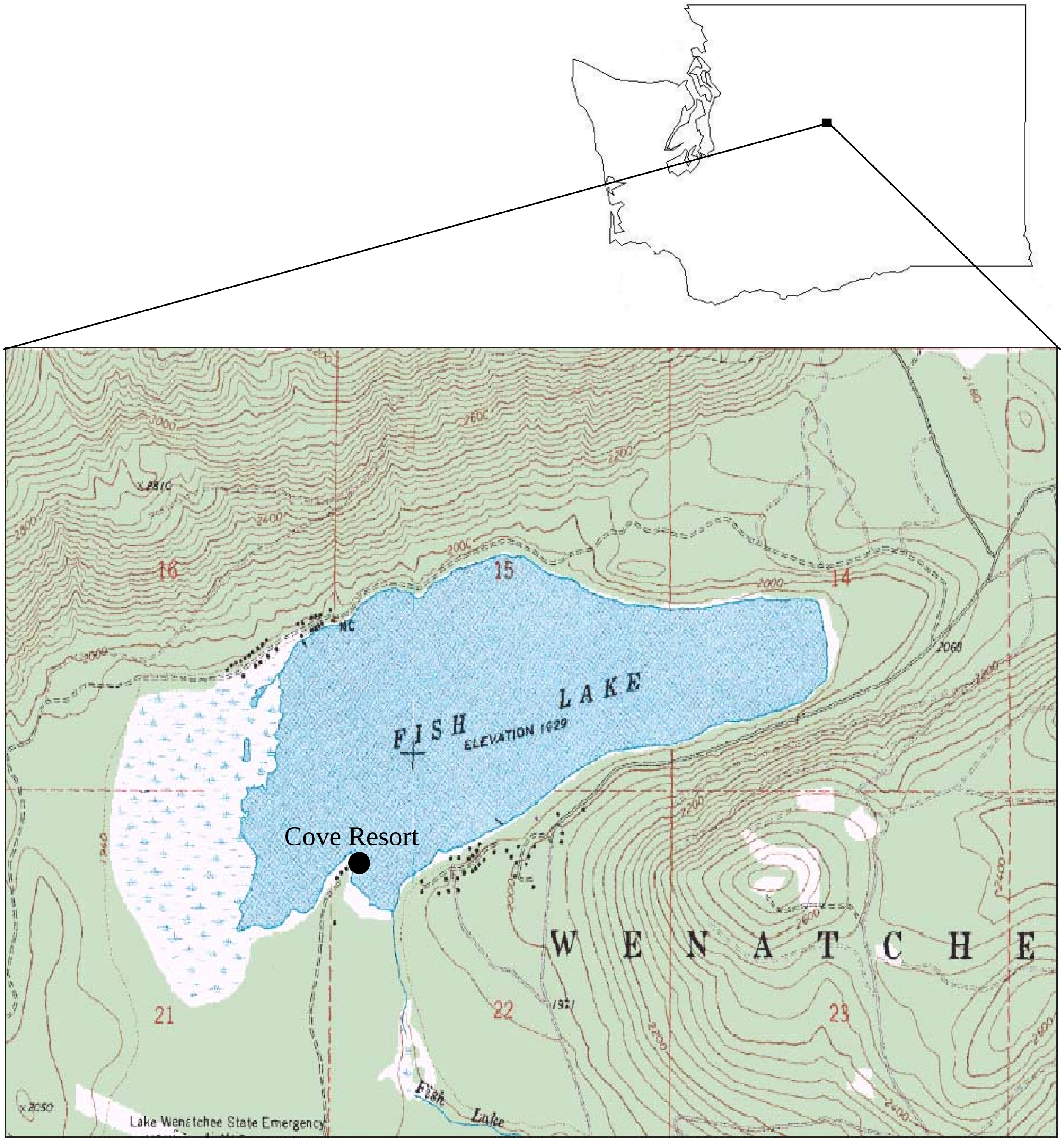

Figure 1. Map of Fish Lake, Chelan County, Washington.

Table 1. Summary of fish stocked in Fish Lake from 2000–2002.

Year	Species	Size	Number
2000	Rainbow trout	Catchables	40,110
		Advanced Fingerlings	46,000
		Fingerlings	145,380
	Brown trout	Advanced Fingerlings	28,118
		Fingerlings	10,957
2001	Rainbow trout	Catchables	47,629
		Advanced Fingerlings	77,530
		Fingerlings	80,144
		Fry	105,694
	Brown trout	Unknown	25,372
	Cutthroat trout	Fry	8,736
2002	Rainbow trout	Catchables	41,935
		Advanced Fingerlings	48,860

Materials and Methods

The Region Two Warmwater Team surveyed Fish Lake during September 23-27, 2002. 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 electrofisher boat with a DC current of 30 cycles/sec at 2 to 4 amps power (Bonar et al. 2000). Experimental gill nets (45.7 m x 2.4 m) were constructed of variable size (13, 19, 25, and 51 mm stretched) monofilament mesh. 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. Fyke net 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 are 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 18.3 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.

All fish were identified to species, measured in millimeters (mm) to total length (TL), 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 gamefish species in the lake. Fish 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 1m increments from the area of greatest depth. A Hydrolab® was used to collect information on dissolved oxygen (milligrams per liter)(mg/l), temperature (°C), pH, and conductivity (micro siemens per centimeter)(μS/cm).

Species composition, by weight (kg) and number, was determined from fish captured. Fish less than one year old, i.e., young-of-the-year (YOY), were excluded from all analyses. Eliminating YOY fish prevents distortions in analyses that may occur due to sampling location, 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. Electrofisher CPUE was determined by dividing the number of fish captured by the total amount of time electrofished. Gill net and fyke net CPUE's were standardized, and were determined by dividing the total number of fish captured by the total number of nights each gear was deployed. Since CPUE is standardized, it is 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. As presented by Anderson and Neumann (1996), a W_r of 100 indicates that a 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). Standard weight was derived from a standard weight-length ($\log_{10}$) relationship, which was defined for each species of interest in Anderson and Neumann (1996). Minimum lengths were used for each species as the variability can be significant for small fish (YOY). Relative weights less than 50 were also excluded from our analyses as we suspected unreliable weight measurements.

Age and growth of warmwater fish 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).

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 information about the proportion of various size fish in a population. Stock length is defined as the minimum size of a fish, which provides recreational value, or approximate length when fish reach maturity (Table 2). Quality length is the minimum size of a fish that most anglers like to catch or begin keeping (Table 2). PSD is calculated using the number of quality sized fish, divided by the number of stock sized fish, multiplied by 100. Stock and quality lengths, which vary by species, are based on percentages of world-record lengths (Anderson and Weithman 1978). 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 (Table 2). 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 (Anderson and Weithman 1978). 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).

Table 2. 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

Eight fish species were collected during sampling efforts on Fish Lake (Table 3). Rainbow trout comprised 40.1 percent of the total fish captured and 21.6 percent of the total biomass of fishes collected. Yellow perch *Perca flavescens* comprised 29.3 percent of the total fish captured and 7.3 percent of the total biomass. Largescale sucker *Catostomus macrocheilus* comprised the majority of the total biomass (48.9 %) of fish captured; however, only 16.7 percent of the total number of fish collected. Brown trout comprised 10.3 percent of the total biomass captured on Fish Lake yet only 3.4 percent of the total number of fish collected.

Table 3. Species composition by weight, number, and size range of fish captured at Fish Lake during a warmwater fish survey, September. 23-27, 2002.

	Species Composition					
	Weight		Number		Size Range (mm TL)	
Species	**Kg**	**%**	**No.**	**%**	**Min.**	**Max**
Rainbow trout	91.46	21.59	561	40.10	124	407
Yellow perch	31.08	7.34	410	29.31	101	281
Brown trout	43.60	10.29	48	3.43	164	800
Largemouth bass	4.90	1.16	7	0.50	168	430
Largescale sucker	20.02	48.86	233	16.65	72	537
Northern pikeminnow	43.56	10.28	95	6.79	147	594
Redside shiner	0.01	0.00	1	0.07	113	113
Sculpin	2.04	0.48	44	3.15	27	237

Young of the Year Fish (YOY)

We exclude YOY fish from our analysis due to distortions in analysis that may occur due to sampling location, method, and specific timing of hatches (Fletcher et al. 1993). Abundance of YOY fish gives us an indication of the amount of reproduction that is occurring in a system. Relatively few YOY fish were collected during this survey. We collected 29 YOY yellow perch, 17 YOY largemouth bass, and 3 YOY largescale sucker in Fish Lake.

Catch Per Unit Effort (CPUE)

Whether using active (electrofishing) or passive (gill netting or fyke netting) techniques to sample a lake or reservoir, CPUE can be a useful index to monitor size structure and relative abundance (Hubert 1996). Electrofishing catch rates were highest for rainbow trout and yellow perch; however, these rates were highly variable which indicates that these species were not equally distributed throughout our electrofishing sections. Gill net catch rates were highest for rainbow trout and yellow perch, while fyke nets captured yellow perch most effectively (Table 4). Brown trout were only captured using the boat electrofisher.

Table 4. Mean catch per unit effort by sampling method, including 80 percent confidence intervals (CI), for fish collected from Fish Lake, September 23-27, 2002.

	Gear Type								
	Electrofisher			Gill Nets			Fyke Nets		
Species	**No./ Hour**	**CI (+/-)**	**No. Sites**	**No./ Net Night**	**CI (+/-)**	**Net Nights**	**No./ Net Night**	**CI (+/-)**	**Net Nights**
Yellow perch	93.6	41.9	15	18.5	7.4	8	3.6	2.7	8
Rainbow trout	144.4	51.7	15	6.4	2.5	8	0	0	8
Brown trout	14.8	0	15	0	0	8	0	0	8
Largemouth bass	0.4	0.5	15	0.7	0.3	8	0.3	0.3	8

Stock Density Indices

A minimum of 55 stock length fish is necessary for precise estimates of PSD (Gustafson 1988). Yellow perch was the only species collected in adequate numbers that could be evaluated using PSD. Percid (perch, walleye) PSD's generated from gill net data provide us a more accurate reflection of the entire population; therefore we report gill net PSDs for percids in our reports. The PSD for yellow perch was 20.5, and the RSD-P for was 2.1. These numbers indicate that a majority of yellow perch collected during this survey were less than 200 mm.

Table 5. Stock density indices, including 80 percent confidence interval, for warmwater fishes collected using boat electrofisher, gill nets, and fyke nets in Fish Lake, September 23-27, 2002. 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
Boat Electrofisher					
Largemouth bass	1	100 (± 0)	100 (± 0)	0	0
Yellow perch	158	12 (± 3.3)	4.4 (± 2.1)	0	0
Gill Nets					
Largemouth bass	5	100 (± 0)	20 (± 23)	0	0
Yellow perch	146	20.5 (± 4.3)	2.1 (± 1.5)	0	0
Fyke Nets					
Yellow perch	7	0	0	0	0

Water Chemistry

Fish Lake was relatively homogenous in terms of temperature, pH, dissolved oxygen, and conductivity, with the exception of the deepest measurement (Table 6). Dissolved oxygen decreased significantly between 11 and 11.7 feet; however, throughout most of the water column dissolved oxygen was well above the five mg/L threshold at which warmwater fish thrive (Willis et al. 1990). Water temperature varied slightly, ranging from 15.4 to 16.4°C, and pH ranged between nine and 10.4. The pH of Fish Lake is basic, but fish appeared to be in good health. It should be noted that our Hydrolab was calibrated after this survey and found to be giving pH readings that were too high. The true pH of Fish Lake was probably closer to eight.

Table 6. Water chemistry data from Fish Lake collected during a warmwater fish survey in September 2002.

Location	Depth (m)	Temp (C)	pH	Dissolved O_2	Conductivity
Center lake	Surface	16.4	10.4	9.45	93
	1	15.7	10.4	9.15	93
	2	15.6	10.4	9.05	93
	3	15.6	10.2	8.54	93
	4	15.6	10.2	8.41	93
	5	15.6	10.2	8.91	93
	6	15.5	10.2	8.45	92
	7	15.5	10.1	8.46	93
	8	15.5	10.1	8.47	93
	9	15.5	9.9	8.05	93
	10	15.4	9.9	8.08	93
	11	15.4	9.8	7.65	93
	11.7	15.5	9.0	1.54	110

Largemouth Bass

Seven largemouth bass, comprising three age classes (excluding YOY) were collected during this survey. Growth was above average for Ages four and five fish yet slightly below average for age one fish (Table 7). The majority of largemouth bass collected were captured in gill nets (Figure 2), and relative weights were well above the national average (Figure 3). Multiple age classes of bass were not collected and it is doubtful that this population will offer much to anglers in the near future.

Table 7. Age and growth of largemouth bass captured at Fish Lake during September 2002. Shaded values are mean back-calculated lengths using the direct proportion method (Fletcher et al. 1993). 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**
2001	1	59.5				
		72.4				
2000	0					
1999	0					
1998	1	101.2	239.8	307.7	346.3	
		115.6	246.3	310.5	346.9	
1997	4	93.5	223.3	293.2	329.7	355.5
		108.5	231.4	297.6	332.2	356.6
Direct proportion mean		84.7	231.5	300.5	338.0	355.5
Fraser Lee mean		103.7	234.4	300.2	335.1	356.6
E. Washington Average		85.17	154.5	161.14	265.4	320.7

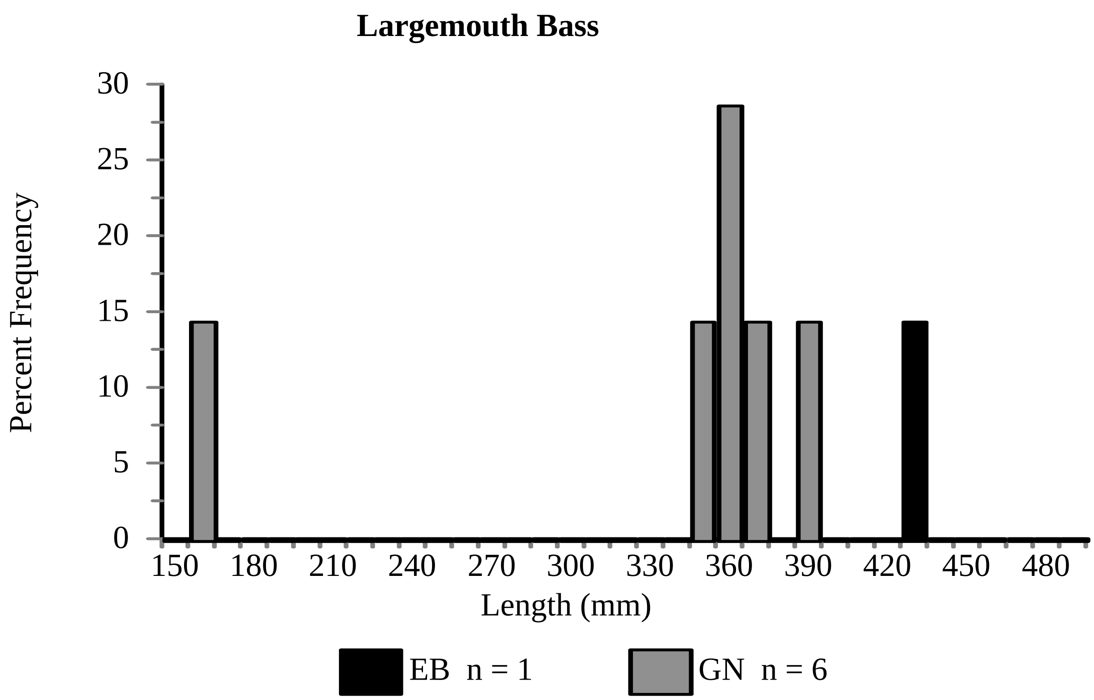

Figure 2. Length frequencies of largemouth bass collected using a boat electrofisher (EB), and gill nets (GN) on Fish Lake, September 2002.

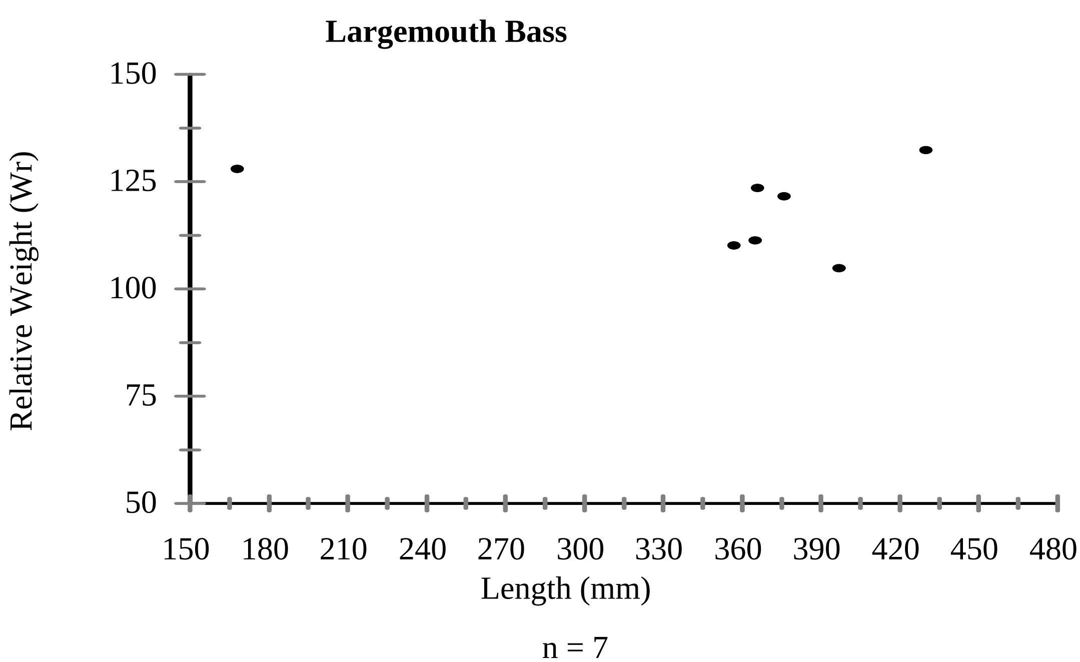

Figure 3. Relative weights for largemouth bass collected at Fish Lake, September 2002, compared to the national average W_r = 100 (Anderson and Neumann 1996).

Yellow Perch

A total of 411 yellow perch were collected during this survey and ranged from one to eight years of age, with ages five and seven being absent from our sampling (Table 8). Growth of yellow perch older than age one was above the state average. Slow growth of age one perch may be due to a late spawn time, which results in a shorter growing season, or the availability of adequate size prey (invertebrates). Approximately 57 percent of yellow perch were collected in gill nets and most fish were less than eight inches (Figure 4). Relative weights for the majority of fish < 190 mm were above the national average (W_r = 100). Beyond 190 mm, relative weights declined as yellow perch length increased. Yellow perch greater than 235 mm had relative weights that were below the national average (Figure 5). This may be an indication that food resources are limiting for larger sized yellow perch.

Table 8. Age and growth of yellow perch captured at Fish Lake during September 2002. Shaded values are mean back-calculated lengths using the direct proportion method (Fletcher et al. 1993). 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**
2001	21	51.8							
		69.4							
2000	30	47.2	121.5						
		69.3	131.2						
1999	14	46.1	126.2	196.8					
		70.1	139.7	201.1					
1998	10	52.9	135.0	199.9	236.8				
		76.7	153.0	212.8	247.2				
1997	0								
1996	3	45.4	114.1	168.9	210.1	229.7	240.5		
		69.9	130.3	178.4	214.7	231.9	241.4		
1995	0								
1994	1	46.1	115.1	173.4	211.3	228.9	245.2	262.8	269.6
		71.0	132.6	184.5	218.3	234.0	248.4	264.1	270.2
Direct Proportion mean		48.2	122.4	184.7	219.4	229.3	242.8	262.8	269.6
Fraser Lee mean		70.5	137.0	202.3	238.2	232.4	243.2	264.1	270.2
State Average (DP)		59.7	119.9	152.1	192.5	206			

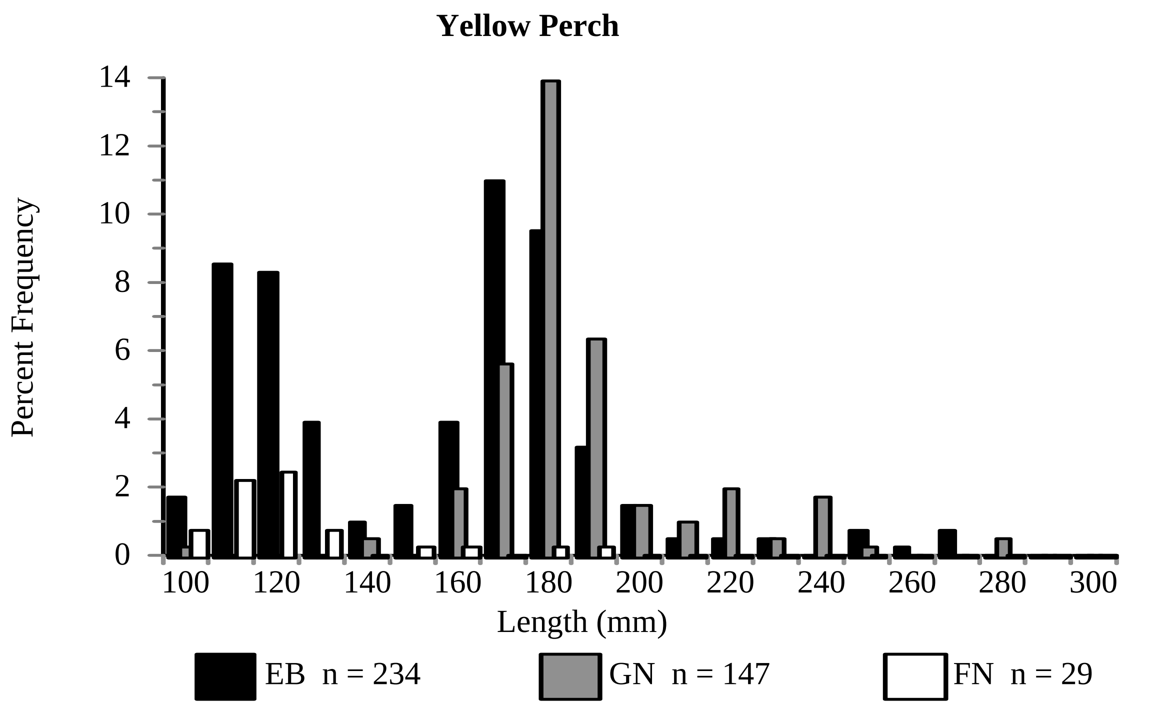

Figure 4. Length frequencies of yellow perch collected using a boat electrofisher (EB), gill nets (GN), and fyke nets (FN) on Fish Lake, September 2002.

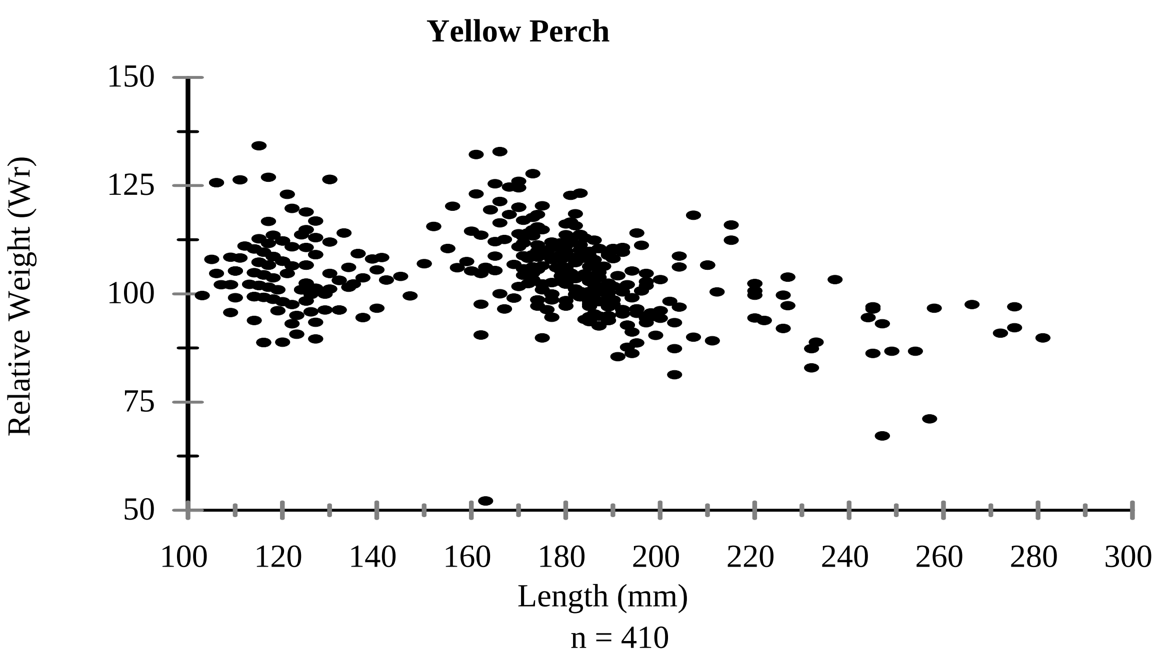

Figure 5. Relative weights for yellow perch collected at Fish Lake, September 2002, compared to the national average W_r = 100 (Anderson and Neumann 1996).

Rainbow Trout

A total of 561 rainbow trout were sampled in Fish Lake, in Sept. 2002. Fish Lake is managed as a trout fishery by the WDFW, which stocks thousands of trout in Fish Lake annually. Length frequency data suggests that three age classes of rainbow trout are present in Fish Lake (Figure 6). Relative weights were below the national average (W_r = 100) for most fish and declined in relation to fish length (Figure 7). Yellow perch exhibit a similar trend in relative weight and this is likely due to competition for food resources.

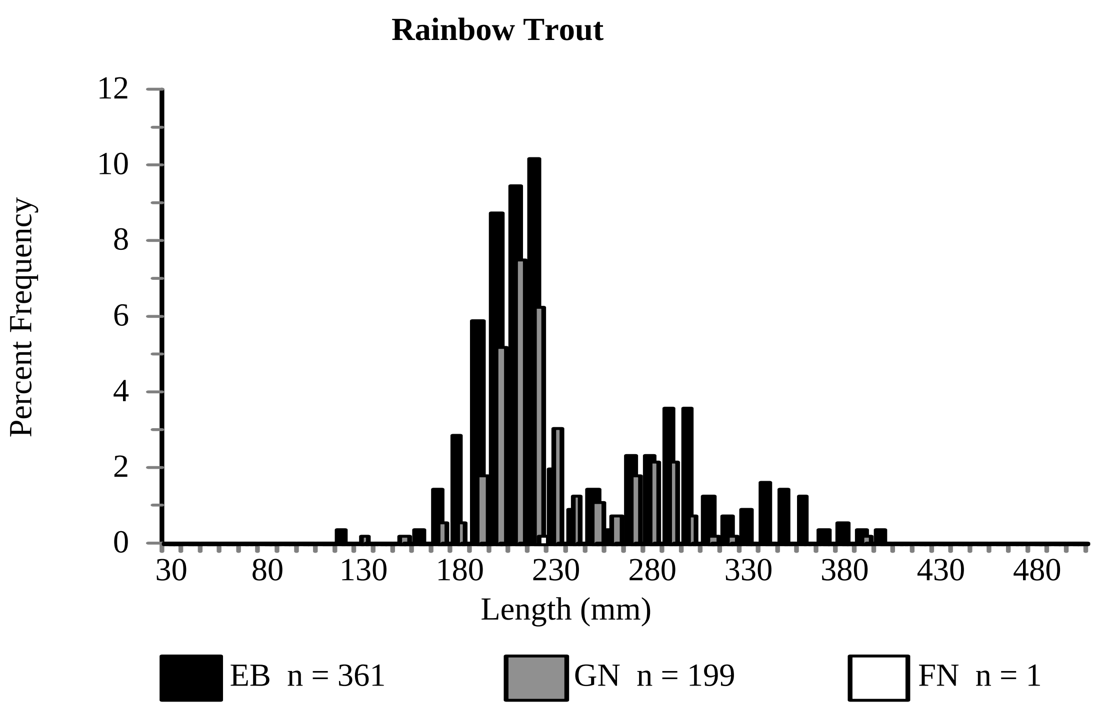

Figure 6. Length frequencies of rainbow trout collected using a boat electrofisher (EB), gill nets (GN), and fyke nets (FN) on Fish Lake, September 2002.

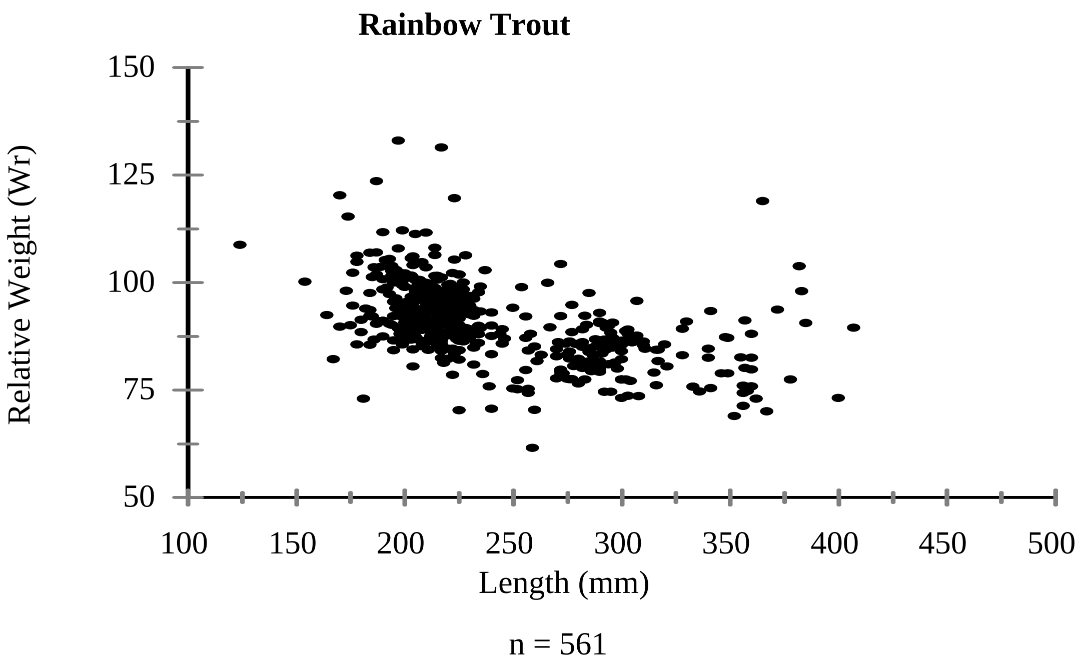

Figure 7. Relative weights for rainbow trout collected at Fish Lake, September 2002, compared to the national average W_r = 100 (Anderson and Neumann 1996).

Brown Trout

A total of 48 brown trout were collected during this survey. Brown trout were spawning during the time of this survey, and we were able to catch many large fish at night in shallow water. The majority (71%) of the brown trout collected were $\geq$ 400 mm (~ 15 inches). Brown trout comprised only 3.4 percent of the fish collected; however, they comprised 10.3 percent of the total biomass collected.

Largescale Sucker and Northern Pikeminnow

A total of 233 largescale sucker, and 95 northern pikeminnow *Ptychocheilus oregonensis* were sampled in Fish Lake, in September 2002. Largescale sucker represented 48.8 percent of the total biomass, and 16.7 percent of the total number of fish captured during this survey. Northern pikeminnow represented 10.3 percent of the total biomass and 6.8 percent of the total number of fish sampled during this survey.

Conclusions and Management Recommendations

Exploitation

The majority (85%) of perch sampled during this survey were less than 200 mm (~ 8 inches). This could be the result of over exploitation on large fish; however, without a complete creel survey we are unable to determine to what degree angling is impacting this population. Fish Lake is popular for both summer and winter perch angling. A creel survey would help us determine what effect angling is having on this population.

Predation

It may be reasonable to conclude that rainbow trout are preying on YOY yellow perch. Yellow perch were the most abundant panfish collected during this survey and are known to produce large numbers of YOY every spring. The WDFW stocks tens of thousands of rainbow trout in Fish Lake each year during spring and fall. Yellow perch YOY are optimal size (< 70 mm) to serve as forage for rainbow trout and other predatory fish. An examination of rainbow trout diets would help us determine if these fish are preying on yellow perch.

Management Recommendations

Creel Census

We recommend that a complete creel survey be conducted in order to answer questions concerning perch harvest. This creel survey would need to be conducted over an entire year in order to determine both summer and winter exploitation. In addition, an investigation examining rainbow and brown trout diets would allow us to determine to what extent trout are consuming yellow perch. As a precautionary measure we recommend imposing a 25 perch per day limit on Fish Lake until exploitation can be evaluated.

Warmwater Surveys

Warmwater fisheries surveys should be conducted at regular intervals in order to monitor the fish community and to evaluate harvest regulations.

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Glossary

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

Confidence Interval (CI): Is defined as an estimated range of values, which 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 (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: Is defined as the minimum size fish worthy of acknowledgment. Is also identified as 74-80 percent of world record length. Trophy length varies by species.

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