2000 Warmwater Fish Survey of Ohop Lake, Pierce County

by

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Abstract

Ohop Lake was surveyed by a three-person crew from May 9-10, 2000. Multiple gear types (electrofishing, gill nets, and trap nets) were utilized to reduce any sampling bias associated with each sampling method. A total of 565 fish, representing ten species and the family Cottidae were sampled at Spanaway Lake. Of those, largescale sucker (*Catostomus macrocheilus*) and yellow perch (*Perca flavescens*) were the two most abundant by number, respectively. Largescale sucker and and largemouth bass (*Micropterus salmoides*) were the two most abundant by biomass, respectively. Other species sampled included: rainbow trout (*Onchorynchus mykiss*), black crappie (*Pomoxis nigromaculatus*), coho (*Oncorhynchus kisutch*), brown bullhead (*Ameiurus nebulosus*), pumpkinseed (*Lepomis gibbosus*), cutthroat trout (*O. clarki*), sculpin (family Cottidae), lake whitefish (*Coregonus clupeaformis*), and bluegill (*Lepomis macrochirus*). Sample sizes for most species were too low to draw firm conclusions about the balance of the fish community as a whole. Largemouth bass and black crappie are two of the more important warmwater species in Ohop Lake, though neither were abundant in our sample. Growth of largemouth bass was high, and many age classes were present. This species probably provides most of the warmwater angling opportunity. Recommendations for Ohop Lake include: 1.) an angler creel survey to estimate angler preference, effort, and harvest; 2.) continued fish community surveys during both spring and fall season; and 3.) an assessment of secondary productivity.

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Introduction and Background

Ohop Lake is a small lake, approximately 230 acres in surface area. The mean depth of the lake is 5.1 meters (17 ft), and the maximum depth is 7.6 m (25 ft). Water flows into Ohop Lake through Ohop Creek, as well as four open springs from the surrounding, steep sided slopes. Water flows out of the lake through Ohop Creek, and into the Nisqually River.

Ohop Lake has been managed as a mixed species lake for some time. But, the majority of the emphasis has been placed on the stocking of rainbow trout to provide a put-and-take fishery. Yearly, Ohop Lake annually receives 16-20,000 hatchery produced rainbow trout. As of spring 2000, Ohop Lake was moved onto an opening day schedule. The state access area is closed, and the lake is closed to fishing between October 31, and the last Saturday in April. Little emphasis has been placed on promoting or managing warmwater fish in Ohop Lake.

Although Ohop Lake is known as one of western Washington's better bass lakes, we currently have little to no information on the status of the fish community in the lake. This survey was completed as an initial data point in a long term data gathering effort to better understand, and more effectively manage our warmwater fish populations.

Materials and Methods

Data Collection

Ohop Lake was surveyed by a three-person team during May 9 - 10, 2000. Fish were captured using three sampling techniques: electrofishing, gill netting, and fyke netting. The electrofishing unit consisted of a Smith-Root SR-16s electrofishing boat, with a 5.0GPP pulsator unit. The boat was fished using a pulsed DC current of 60 Hz at 4-6 amps power. Experimental gill nets, 45.7 meters (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-size (1.3, 1.9, 2.5, and 5.1 cm stretch) monofilament mesh. Fyke (modified hoop) nets were constructed of five 1.2 m diameter hoops with two funnels, and a 2.4 m cod end (6 mm nylon delta mesh). Attached to the mouth of the net were two 7.6 m wings, and a 30.5 m lead.

In order to reduce the gear induced bias in the data, the sampling time for each gear was standardized so that the ratio of electrofishing to gill netting to fyke netting was 1:1:1. The standardized sample is 1800 sec of electrofishing (3 sections), 2 gill net nights, and 2 fyke net nights. Sampling occurred during the evening hours to maximize the type and number of fish captured. Sampling locations were selected from a map by dividing the entire shoreline into 400 m sections, and numbering them consecutively. Nightly sampling locations were randomly chosen without replication. While electrofishing, the boat was maneuvered through the shallows at a slow rate of speed for a total of 600 seconds of "pedal-down" time or until the end of the section was reached, whichever came first. Nighttime electrofishing occurred along approximately 75% of the available shoreline. Gill nets were fished perpendicular to the shoreline; the small-mesh end was tied off to shore, and the large- mesh end was anchored off shore. Fyke nets were fished perpendicular to the shoreline as well with the lead tied off to shore, the cod-end anchored away from shore, and the wings anchored at approximately a 45E angle from the net lead. We tried to set fyke nets so that the hoops were 0.3 - 0.5 m below the water surface, this sometimes would require shortening the lead. Gill nets and fyke nets were set overnight (roughly 12 hours per set) at two locations around the lake. Due to the presence of out-migrating coho smolts, gill net sets were kept to an absolute minimum.

With the exception of the family Cottidae (sculpin), all fish captured were identified to the species level. Each fish was measured to the nearest millimeter (mm) and assigned to a 10 mm size class based on total length (TL). For example, a fish measuring 156 mm TL was assigned to the 150 mm size class for that species, and a fish measuring 113 mm TL was assigned to the 110 mm size class, and so on. However, if a sample included several hundred young-of-year (YOY) or small juveniles (<100 mm TL) of a given species, then a sub-sample (N ~100 fish) were measured, and the remainder were just counted. The frequency distribution of the sub-sample was then applied to the total number collected. Scales were taken from five individuals per size class, mounted, pressed, and aged using the Fraser-Lee method. Very few scale or spine samples are taken from non-game fish for aging purposes.

Water quality data was collected during midday from two locations on May 15, 2000. Using a Hydrolab® probe and digital recorder, dissolved oxygen (mg/l), temperature (CE), pH, turbidity (NTU), and conductivity (F siemens/cm^2) data was gathered in the deepest section of the lake at 1 m intervals through the water column.. Secchi disk readings, used to measure transparency, were taken by the methods outlined by Wetzel (1983).

Data Analysis

Species Composition

The species composition by number of fish captured, was determined using procedures outlined by Fletcher et al.(1993). Species composition by weight (kg) of fish captured, was determined using procedures adapted from Swingle (1950). Only fish estimated to be at least one year old were used to determine species composition. These were inferred from the length-frequency distributions described below, in conjunction with the results of the aging process. Young of year or small juveniles were not considered in biomass and species composition estimates because large fluctuations in their numbers may cause distorted results (Fletcher et al. 1993). Also, most of these fish would be subject to natural attrition during their first winter, resulting in a different size distribution by the following year.

Catch Per Unit of Effort

The catch per unit of effort (CPUE) of electrofishing for each species was determined by dividing the total number in all size classes equal or greater than stock size (defined in Appendix A), by the total electrofishing time (sec). The CPUE for gill nets and fyke nets was determined similarly, except the number equal or greater than stock size was divided by the number of net-nights for each net (usually one). An average CPUE (across sample sections) with 80% confidence interval was calculated for each species and gear type.

For fishes in which there is no published stock size (i.e., sculpins, suckers, etc.), CPUE is calculated using all individuals captured. Furthermore, since it is standardized, the CPUE is useful for comparing stocks between lakes.

Length-Frequency

A length-frequency histogram was calculated for each species and gear type in the sample. Length-frequency histograms are constructed using individuals that are age one and older (determined by the aging process), and calculated as the number of individuals of a species in a given size class, divided by the total individuals of that species sampled. Plotting the histogram this way tends to flatten out large peaks created by an abundant size class, and makes the graph a little easier to read.

Stock Density Indices

Stock density indices, used to assess the size structure of fish populations. Proportional stock density (PSD) and relative stock density (RSD) are calculated as proportions of various size-classes of fish in a sample. The size classes are referred to as minimum stock (S), quality (Q), preferred (P), memorable (M), and trophy (T). Lengths have been published to represent these size classes for each species, and were developed to represent a percentage of world-record lengths as listed by the International Game Fish Association (Gablehouse 1984). These lengths are presented in Appendix A.

The indices calculated here are described by Gablehouse (1984) as the traditional approach. The indices are accompanied by a 80% confidence interval (Gustafson 1988) to provide an estimate of statistical precision.

Relative Weight

A relative weight index (W_r) was used to evaluate the condition (plumpness or robustness) of fish in the lake. A W_r value of 1.0 generally indicates a fish in good condition when compared to the national average for that species and size. Furthermore, relative weights are useful for comparing the condition of different size groups within a single population to determine if all sizes are finding adequate forage or food (ODFW 1997). Following Murphy and Willis (1991), the index was calculated as $W_r = W/W_s \times 100$, where W is the weight (g) for an individual fish from the sample and W_s is the standard weight of a fish of the same total length (mm). W_s is calculated from a standard log weight - log length relationship defined for the species of interest. The parameters for the W_s equations of many fish species, including the minimum length recommendations for their application, are listed in Anderson and Neumann (1996).

Age and Growth

Age and growth of warmwater fishes were evaluated according to Fletcher et al. (1993). Total length at annulus formation, L_n, was back-calculated using the Fraser-Lee method. Intercepts for the y axis for each species were taken from Carlander (1982). Mean back-calculated lengths at each age for each species were presented in tabular form for easy comparison between year classes. Mean back-calculated lengths at each age for each species were compared to averages calculated from scale samples gathered at lakes sampled by the warmwater enhancement teams.

Results and Discussion

Water Quality and Habitat

Water quality parameters were collected in the deepest section of Ohop Lake on May 15, 2000 (Table 1). Dissolved oxygen levels are high throughout the water column. Temperature declines steadily with increasing depth, and was weakly stratified at about 2 meters.

Table 1. Water quality measurements taken from Ohop Lake, spring 2000. Measurements taken at midday.

Depth m	Temp CE	pH	D.O. mg/l	Turbidity NTU	Conductance Fs/cm
0	17.2	7.1	10.1	25.0	52.6
1	16.5	7.1	10.2	16.0	52.8
2	13.3	6.7	8.6	16.2	52.4
3	12.9	6.6	8.1	15.7	51.5
4	12.2	6.5	7.1	18.1	51.9

Species Composition and Relative Abundance

Our sample at Ohop Lake was dominated numerically by largescale sucker. Yellow perch were second most abundant numerically. Largescale sucker accounted for most of the biomass (Table 2), followed by largemouth bass.

Table 2. Species composition by weight and number for fish sampled (Age 1 and older) from Ohop Lake, spring 2000.

	Species Composition					
	by Weight		by Number		Size Range (mm TL)	
Species	**(kg)**	**(%w)**	**(#)**	**(%n)**	**Min**	**Max**
Largescale sucker	120.99	78.26	169	29.91	115	560
Largemouth bass	19.48	12.60	59	10.44	69	519
Rainbow trout	4.64	3.00	40	7.08	130	267
Yellow perch	3.38	2.19	157	27.79	59	230
Black crappie	2.15	1.39	43	7.61	68	250
Coho	1.06	0.68	49	8.67	108	147
Brown bullhead	0.89	0.57	3	0.53	197	320
Pumpkinseed	0.88	0.57	16	2.83	92	167
Cutthroat trout	0.55	0.36	5	0.88	186	255
Sculpin	0.23	0.15	19	3.36	6	145
Large whitefish	0.18	0.12	1	0.18	275	275
Bluegill	0.17	0.11	4	0.71	44	159

Catch per unit of effort (CPUE) can be used as an index of abundance. Viewed together with a confidence interval, it can be used to represent the homogeneity of the distribution of fish around the lake. Table 3 shows the CPUE for stock sized and larger fish from our spring 2000 sample of

Ohop Lake, by gear type. Largescale sucker had the highest catch per hour for all species. For stock sized and larger gamefish, yellow perch had the highest catch per hour, while largemouth bass ranked fifth. Electrofishing was the primary gear type used, and was completed in one night. Gill net sets were kept to an absolute minimum due to the presence of out-migrating juvenile coho.

Table 3. Average catch per unit effort for fish sampled from Ohop Lake, spring 2000.

	Electrofishing			Gill Netting			Fyke Netting		
Species	**(#/hour)**	**80% CI**	**Sample sites**	**#/net night**	**80% CI**	**# net nights**	**#/net night**	**80% CI**	**# net nights**
Largescale sucker	65.35	16.91	9	2.34	0.56	2	0.03	0.04	2
Coho	32.45	17.98	9	—	—	2	—	—	2
Yellow perch	15.00	6.80	9	0.39	0.27	2	—	—	2
Sculpin	11.92	5.12	9	—	—	2	0.03	0.04	2
Largemouth bass	11.09	3.36	9	—	—	2	—	—	2
Pumpkinseed	10.26	6.35	9	—	—	2	—	—	2
Black crappie	8.54	3.35	9	0.14	0.10	2	0.03	0.04	2
Cutthroat	2.67	2.26	9	—	—	2	—	—	2
Bluegill	1.33	1.71	9	—	—	2	—	—	2
Rainbow trout	1.33	1.71	9	0.23	0.29	2	—	—	2
Brown bullhead	1.33	1.71	9	—	—	2	0.03	0.04	2
Lake whitefish	—	—	9	0.04	0.05	2	—	—	2

Sample sizes were too low to calculate meaningful PSDs (Table 4). With that being said, Table 4 is shown only to provide the reader with the number of stock length and larger fish in the sample.

Table 4. Stock density indices, by gear type, for fish sampled from Ohop Lake, spring 2000.

		Quality		Preferred		Memorable		Trophy	
Species	**# stock length**	**PSD**	**80% CI**	**RSD-P**	**80% CI**	**RSD-M**	**80% CI**	**RSD-T**	**80% CI**
Electrofishing									
Yellow perch	23	17	10	—	—	—	—	—	—
Largemouth bass	17	88	10	71	14	6	7	—	—
Pumpkinseed	16	19	13	—	—	—	—	—	—
Black crappie	13	38	17	8	9	—	—	—	—
Cutthroat	4	0	0	—	—	—	—	—	—
Brown bullhead	2	50	45	50	45	—	—	—	—
Rainbow trout	2	0	0	—	—	—	—	—	—
Bluegill	2	50	45	—	—	—	—	—	—
Gill Net									
Yellow perch	11	64	19	—	—	—	—	—	—
Rainbow trout	6	0	0	—	—	—	—	—	—
Black crappie	4	0	0	—	—	—	—	—	—

Summary by Species

A total of twelve fish species were sampled at Ohop Lake, including: largescale sucker (*Catostomus macrocheilus*), largemouth bass (*Micropterus salmoides*), rainbow trout (*Onchorynchus mykiss*), yellow perch (*Perca flavescens*), black crappie (*Pomoxis nigromaculatus*), coho (*Oncorhynchus kisutch*), brown bullhead (*Ameiurus nebulosus*), pumpkinseed (*Lepomis gibbosus*), cutthroat trout (*O. clarki*), sculpin (family Cottidae), lake whitefish (*Coregonus clupeaformis*), and bluegill (*Lepomis macrochirus*). These species are listed in order by decreasing total biomass from the spring 2000 survey.

Catostomus macrocheilus, largescale sucker

Largescale suckers ranged in size from 115 - 560mm total length, and were the most abundant species by number and biomass in our sample. These are not an important sport or food-fish in Washington. These fish were not aged. All size classes were well represented in our electrofishing sample (Figure 1).

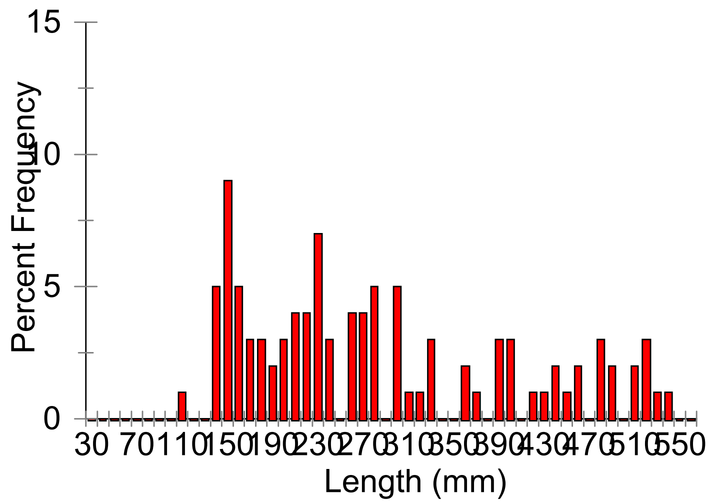

Figure 1. Length-frequency distribution of Largescale sucker from the spring 2000 survey of Ohop Lake, Pierce County. Represents individuals one year old or older.

Micropterus salmoides, largemouth bass

Largemouth bass were had the second highest total biomass in our sample, but the fifth highest catch per hour. Largemouth bass size ranged from 69-519mm total length, but the sample size of stock sized and larger bass was too low to calculate meaningful stock density indices or a length-frequency histogram.

Back calculated length at age for largemouth bass (Table 5) shows that initial growth is faster than what is average, but slows down considerably after age 5. The abrupt slowing of growth after age 5 could be due to a biological bottleneck, naturally limiting growth of this population.

Largemouth bass relative weights were, in general, higher than the national standard of 100 (Figure 2). High relative weights indicate a population that is easily finding food items.

Table 5. Mean back calculated length at age for largemouth bass from the spring 2000 survey of Ohop Lake, Pierce County.

		Mean Length at Age (mm)											
Year class	**n**	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
1999	16	**89**											
1998	7	70	**181**										
1997	3	102	212	**308**									
1996	0	—	—	—	—								
1995	3	86	171	312	387	**411**							
1994	3	97	231	338	386	415	**436**						
1993	2	106	163	229	333	394	415	**431**					
1992	0	—	—	—	—	—	—	—	—				
1991	1	63	219	301	373	417	439	454	474	**486**			
1990	0	—	—	—	—	—	—	—	—	—	—		
1989	1	67	161	269	337	402	424	454	475	494	510	**519**	
1988	2	76	209	277	336	371	389	413	426	441	454	470	**480**
Fraser-Lee	38	86	192	297	364	402	420	433	450	465	473	486	480
State avg		60	146	222	261	289	319	368	396	440	485	472	496
Direct prop		77	185	292	360	400	418	431	448	464	472	486	480

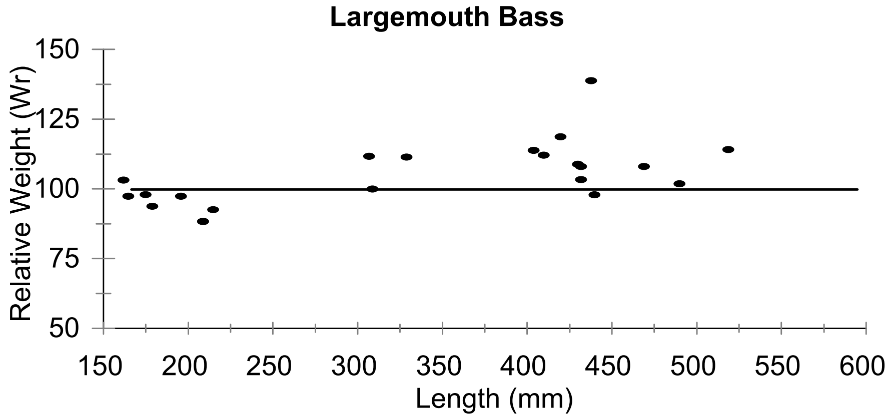

Figure 2. Relative weights of largemouth bass from the spring 2000 survey of Ohop Lake, Pierce County. Horizontal line at 100 represents the national 75th percentile.

Oncorhynchus mykiss, rainbow trout

Rainbow trout were the third most abundant species by biomass in Ohop Lake. Ohop Lake is planted yearly with approximately 20,000, legal sized rainbow trout to support a sport fishery. These fish were 130 - 267mm in length (5-10 inches). During the 2001 angling season, Ohop Lake also received a plant of nearly 1,000 triploid rainbow trout. None of these fish were aged.

Relative weights of these trout were all below the national standard of 100 (Figure 3). Low relative weights can be due to lack of prey items in the lake, or inefficient foraging. In general, we find low relative weights for our stocked rainbow trout. These fish are planted at high densities, and must learn to forage in a natural environment.

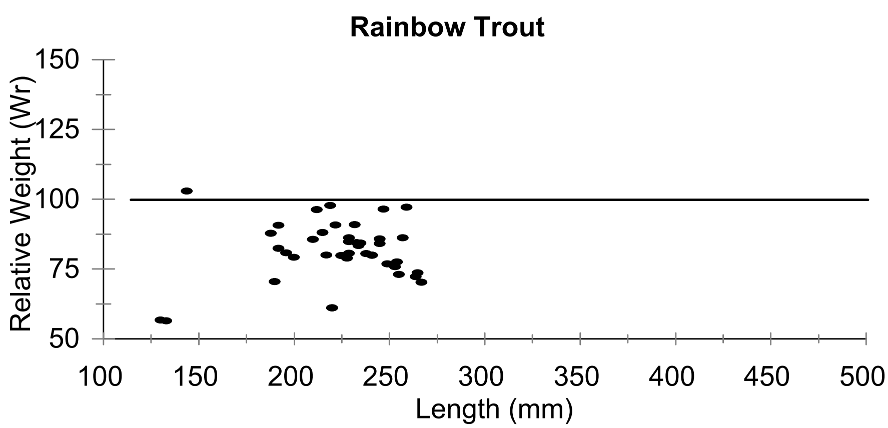

Figure 3. Relative weights of rainbow trout from the spring 2000 survey of Ohop Lake, Pierce County. Horizontal line at 100 represents the national 75th percentile.

Perca flavescens, yellow perch

Yellow perch were the fourth most abundant species by total biomass sampled, and had the third highest CPUE. Yellow perch in our sample ranged in size from 59 - 230mm total length (2.5 - 9 inches). Table 6 shows the mean back calculated length at age for each year class. Yellow perch growth rates are faster than what is average for lakes in western Washington. The length-frequency histogram is dominated by age one fish, two and three year old fish are about equally represented (Figure 4). Gill netting captured only larger fish.

Table 6. Mean back calculated length at age for yellow perch from the spring 2000 survey of Ohop Lake, Pierce County.

		Mean Length at Age (mm)		
Year Class	**n**	**I**	**II**	**III**
1999	17	**81**		
1998	9	83	**166**	
1997	18	77	155	**196**
Fraser-Lee	44	80	159	196
State avg.		60	120	152
Direct prop.		66	154	196

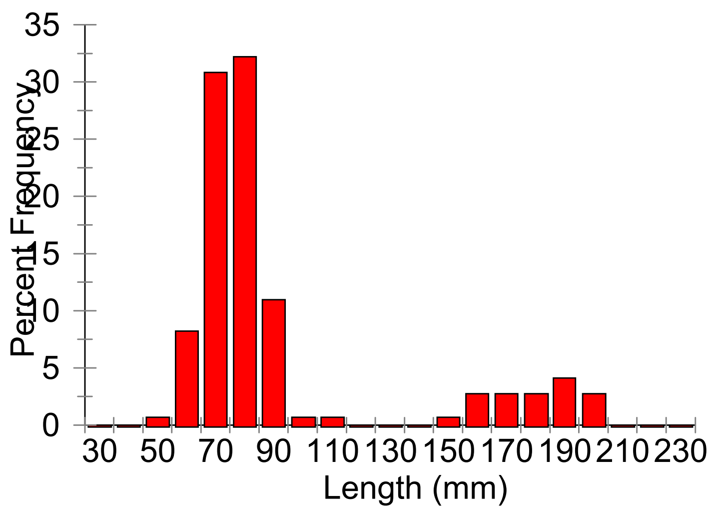

Figure 4. Length-frequency distribution of yellow perch from the spring 2000 survey of Ohop Lake, Pierce County. Represents individuals one year old or older.

Relative weights of yellow perch (Figure 5) represent the norm for western Washington, they are below the national 75th percentile, and decrease with increasing length. Low relative weights may be caused by competition, or poor foraging efficiency.

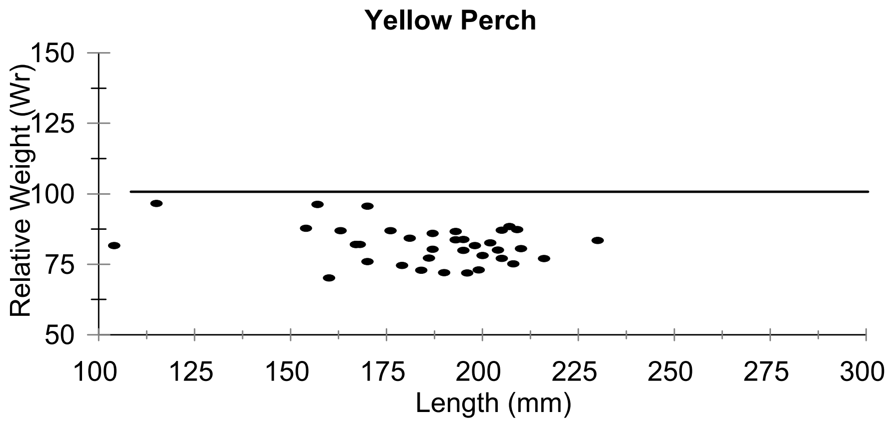

Figure 5. Relative weights of yellow perch from the spring 2000 survey of Ohop Lake, Pierce County. Horizontal line at 100 represents the national 75th percentile.

Pomoxis nigromaculatus, black crappie

Black crappie in our sample ranged in size from 68 - 250mm (2.5 - 10 inches) in length. Black crappie were not very abundant in our sample. With only 13 fish being stock sized or larger, few meaningful indices could be calculated.

Relative weights of black crappie were all above the national standard of 100, but decreased with increasing length (Figure 6). The mean back-calculated length at age for black crappie shows that they are growing at a faster rate than what is average for western Washington (Table 7). High relative weights and fast growth rates show that there is a sufficient food source for this population.

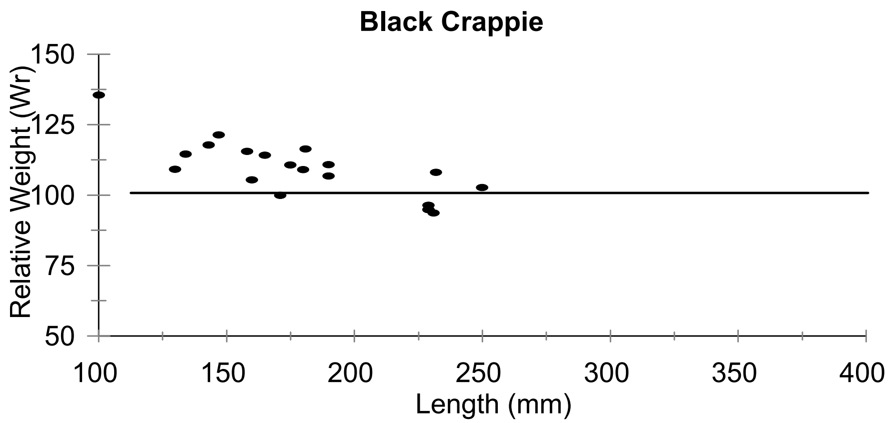

Figure 6. Relative weights of black crappie from the spring 2000 survey of Ohop Lake, Pierce County. Horizontal line at 100 represents the national 75th percentile.

Table 7. Mean back calculated length at age for black crappie from the spring 2000 survey of Ohop Lake, Pierce County.

		Mean Length at Age (mm)		
Year Class	**n**	**I**	**II**	**III**
1999	12	**82**		
1998	11	67	**154**	
1997	5	83	170	**231**
Fraser-Lee	28	76	159	231
State avg.		46	111	157
Direct prop.		60	154	231

Oncorhynchus kisutch, coho

Juvenile coho salmon were sampled in Ohop Lake, and ranged in size from 108-147mm (about 4.25-6 inches) in length. Coho salmon spawn above Ohop Lake in Ohop and Twenty-Five Mile Creeks. Juveniles migrate back through the lake and into the Puyallup River system.

No scales were collected from coho for aging purposes, and no indices were calculated for coho other than catch per hour.

Ameiurus nebulosus, brown bullhead

Brown bullhead were present in our sample, but not very abundant. Three fish were captured in our sample, their total lengths were 292, 197, and 320mm. Relative weights were 102, 78, and 81, respectively. The relative abundance of these fish in the lake is most likely higher than our sampling indicates. No spines were collected for aging.

Lepomis gibbosus, pumpkinseed

Pumpkinseed were present in our sample, but were not an abundant species in the lake. The fish in our sample ranged in size from 92-167mm (3.5-6.5 inches) total length. Mean back-calculated length at age (Table 8) shows that growth of pumpkinseed is faster than average for western Washington. The relative weights for pumpkinseed are also higher than the national standard of 100 (Figure 7).

Table 8. Mean back calculated length at age for pumpkinseed from the spring 2000 survey of Ohop Lake, Pierce County.

		Mean Length at Age (mm)		
Year Class	**n**	**I**	**II**	**III**
1999	0	—		
1998	13	50	**116**	
1997	3	43	113	**156**
Fraser-Lee	16	49	115	156
State avg.		24	72	102
Direct prop.		30	112	156

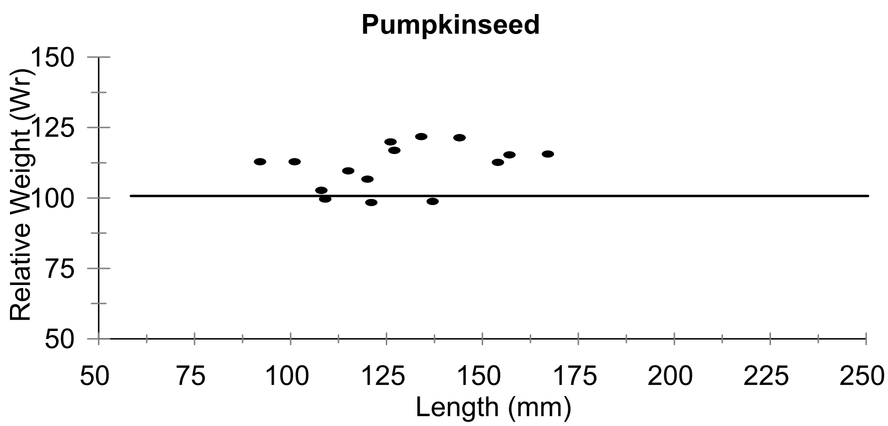

Figure 7. Relative weights of pumpkinseed from the spring 2000 survey of Ohop Lake, Pierce County. Horizontal line at 100 represents the national 75th percentile.

Oncorhynchus clarki, Cutthroat trout

Cutthroat trout were present in our sample, but were not abundant. Fish sampled ranged in size from 186-255mm (7-10 inches). Relative weights for these fish varied from 77 to 113, showing a wide range of condition.

Cottidae, sculpin

Sculpin had the fourth highest electrofishing catch rate, but were one of the least abundant by weight. These are not an important recreational species. Due to their minute morphological variations, these species are only identified to the family level. No age and growth analysis was performed on these species. Sculpin ranged in size from 6-145mm (¼-5.5 inches) in total length.

Coregonus clupeaformis, lake whitefish

A single lake whitefish, with a length of 275mm, was sampled in a gill net. More gill netting would probably show that these fish are much more abundant than indicated here, and probably account for a large proportion of the total biomass in the lake. Lake whitefish are capable of growing to a very large size, and often become quite abundant in lakes in which they reside. Though lake whitefish are a good food fish, they are not regularly sought after by anglers.

Lepomis macrochirus, bluegill

Only four (4) bluegill were sampled at Ohop Lake, ranging in size from 44-159mm. Back calculated length at age (Table 9) shows that these few individuals are growing faster than average for western Washington lakes. Relative weights for the two fish above stock size were 105 (147mm fish) and 113 (159 mm fish). High growth rates, coupled with high relative weights are indicative of an abundant forage base.

Table 9. Mean back calculated length at age for bluegill from the spring 2000 survey of Ohop Lake, Pierce County.

		Mean Length at Age (mm)	
Year Class	**n**	**I**	**II**
1999	0	—	
1998	2	49	144
Fraser-Lee	2	49	144
State avg.		37	97
Direct prop.		34	143

Discussion and Management Options

Population Health

Its hard to judge the overall health of a fish population from a single sample, especially when the sample size of many of the key species is below 100 fish. High growth rates of most species, coupled with the high relative weights suggest that many of the species are successfully finding plenty of forage. Catch rates for all warmwater species were lower than other lakes in the area, especially for the sunfish species. The low catch rates may be a seasonally related phenomenon, or there might be high natural or fishing mortality rates. More work needs to be done to get a better feel for the condition of the fish community.

Important Species

Black crappie and largemouth bass are probably the two most important warmwater fish species in Ohop Lake. These are usually two of the most sought after warmwater fish species, though neither were present in large numbers in our sample.

Lake whitefish are not an important sport fish in Washington, and there are only a few areas that have defined food fisheries for this species. Lake whitefish are a large fish; in many lakes, they will account for the vast majority of the total biomass. More can be done by this agency to promote the use of this fish as a food fish. Promoting the harvest of whitefish with an informational pamphlet on fishing techniques, cleaning, and cooking techniques may help us control their abundance in some of our smaller lakes.

Short Term Management and Sampling Goals

More detailed information is needed to produce a management plan for warmwater species in Ohop Lake. First, continued standardized sampling on a fall and following spring basis will help us gather the needed information quickly and efficiently. Sampling this way will allow us to see if there is a seasonal bias in our sampling, and will also help us determine if there are problems with initial recruitment. Increasing the number of net nights while sampling will help us gain more of an understanding of the lake whitefish population.

Ohop Lake has a high flushing rate. Monthly water quality and secondary productivity sampling will help us determine if the lake is productive enough to support a fairly dense, healthy population of warmwater fish.

Lastly, an angler creel survey should be completed to determine angler effort, harvest, and preferences. If feasible, the survey could include an exploitation study on some of the more important species in the lake, like largemouth bass and black crappie. Exploitation rates are a piece of information that is missing from our current data collection methods. This information is essential when modeling changes in the fish populations based on harvest regulations.

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Appendix A

Table A1. Length categories that have been proposed for various fish species. Measurements are total lengths (updated from Neumann and Anderson 1996).

	Category									
	Stock		Quality		Preferred		Memorable		Trophy	
	(in)	(cm)	(in)	(cm)	(in)	(cm)	(in)	(cm)	(in)	(cm)
Black bullhead	6	15	9	23	12	30	15	38	18	46
Black crappie	5	13	8	20	10	25	12	30	15	38
Bluegill	3	8	6	15	8	20	10	25	12	30
Brook trout	5	13	8	20						
Brown bullhead	5	13	8	20	11	28	14	36	17	43
Brown trout	6	15	9	23	12	30	15	38	18	46
Burbot	8	20	15	38	21	53	26	67	32	82
Channel catfish	11	28	16	41	24	61	28	71	36	91
Common carp	11	28	16	41	21	53	26	66	33	84
Cutthroat trout	8	20	14	35	18	45	24	60	30	75
Flathead catfish	11	28	16	41	24	61	28	71	36	91
Green sunfish	3	8	6	15	8	20	10	25	12	30
Largemouth bass	8	20	12	30	15	38	20	51	25	63
Pumpkinseed	3	8	6	15	8	20	10	25	12	30
Rainbow trout	10	25	16	40	20	50	26	65	31	80
Rock bass	4	10	7	18	9	23	11	28	13	33
Smallmouth bass	7	18	11	28	14	35	17	43	20	51
Walleye	10	25	15	38	20	51	25	63	30	76
Warmouth	3	8	6	15	8	20	10	25	12	30
White catfish	8	20	13	33	17	43	21	53	26	66
White crappie	5	13	8	20	10	25	12	30	15	38
Yellow bullhead	4	10	7	18	9	23	11	28	14	36
Yellow perch	5	13	8	20	10	23	12	30	15	38