Methods and Summary Data for Limnology and Food Web Structure in Lake Wenatchee, Washington (2010-2022)

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by

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We would also like to acknowledge Nick Brown and Patrick Thompson for reviewing this manuscript; they made several clarifying additions.

ABSTRACT

McQueen, D.J., Judson, B., Pham, S., Ogden, A.D., Mathieu, C., Wiens, L. 2026. Methods and Summary Data for Limnology and Food Web Structure in Lake Wenatchee, Washington (2010-2022). Can. Data Rep. of Fish. Aquat. Sci. 1497: ix + 45 p.

The 2010-2022 food web data consistently suggest that Lake Wenatchee provides excellent habitat for juvenile Sockeye Salmon. Although the lake is oligotrophic, a unique mix of physical and biological conditions permits unusually high rates of Sockeye growth and production. These factors include (i) a well oxygenated, cold water hypolimnion, (ii) a ratio of edible to total phytoplankton which is exceptionally high, suggesting that most of the algal species found in Lake Wenatchee have sizes, shapes and digestibility that make them excellent food sources for freshwater zooplankton, and (iii) a zooplankton community that includes two large-bodied species (*Daphnia schodleri* and *Hesperodiaptomus kenai*), which provide excellent food sources for Sockeye fry. Through the period 2010-2022, the fall population density for Lake Wenatchee Sockeye fry averaged 2121 ha^{-1}. Age-0 Sockeye fry growth rates were variable, but in all years were higher than expected when compared to similar data from Osoyoos Lake. Years 2017-2019 and 2021-2022 bioenergetics-based production and consumption analysis showed that the percentage of prey production that was consumed per day by Sockeye fry was always much lower than the carrying capacity (i.e. 2017 = average 6.0% of prey production consumed per day, 2018 = 14.1%, 2019 = 14.0%, 2021 = 25.5%, 2022 = 5.1%). In no case was there any indication that consumption by age-0 and age-1 Sockeye Salmon fry was capable of limiting prey availability. We conclude that for the summer-early fall period, Lake Wenatchee has unused zooplankton production capacity that could be consumed by Sockeye fry. We suggest that the lake would be able to support September Sockeye fry population densities of 4000 ha^{-1}, and that the lake could be managed for that density.

RÉSUMÉ

McQueen, D.J., Judson, B., Pham, S., Ogden, A.D., Mathieu, C., Wiens, L. 2026. Methods and Summary Data for Limnology and Food Web Structure in Lake Wenatchee, Washington (2010-2022). Can. Data Rep. of Fish. Aquat. Sci. 1497: ix + 45 p.

Les données sur le réseau trophique de 2010-2022 indiquent systématiquement que le lac Wenatchee offre un excellent habitat pour le saumon rouge juvénile. Bien que le lac soit oligotrophe, un mélange unique de conditions physiques et biologiques permet des taux de croissance et de production de saumon rouge inhabituellement élevés. Ces facteurs comprennent i) un hypolimnion d'eau froide bien oxygéné, ii) un rapport exceptionnellement élevé entre le phytoplancton comestible et le phytoplancton total, ce qui donne à penser que la plupart des espèces d'algues présentes dans le lac Wenatchee ont des tailles, des formes et une digestibilité qui en font d'excellentes sources alimentaires pour le zooplancton d'eau douce, et iii) une communauté de zooplancton qui comprend deux espèces de grande taille (*Daphnia schodleri* et *Hesperodiaptomus kenai*), qui constituent d'excellentes sources alimentaires pour les alevins de saumon rouge. Au cours de la période de 2010-2022, la densité de la population automnale des alevins de saumon rouge du lac Wenatchee a atteint 2121 ha^{-1}. Les taux de croissance des alevins de saumon rouge âgés de 0 an étaient variables, mais ils étaient plus élevés que prévu par rapport aux données similaires du lac Osoyoos, et ce à toutes les années. L'analyse de la production et de la consommation fondées sur la bioénergie des années 2017-2019 et 2021-2022 a démontré que le pourcentage de la production de proies consommée par jour par les alevins de saumon rouge était toujours de beaucoup inférieur à la capacité de charge (c.-à-d. 2017 = moyenne 6,0 % de la production de proies consommée par jour, 2018 = 14,1 %, 2019 = 14,0 %, 2021 = 25,5 %, 2022 = 5,1 %). Il n'y a eu aucune indication que la consommation de saumon rouge à l'âge de 0 et de 1 an pouvait limiter la disponibilité des proies. Nous concluons que, pour la période de l'été et du début de l'automne, le lac Wenatchee a une capacité de production de zooplancton inutilisée qui pourrait être consommée par les alevins de saumon rouge. Il est de notre avis que le lac est en mesure de soutenir une densité de population d'alevins de saumon rouge de 4 000 ha^{-1} et que le lac pourrait être géré en fonction de cette densité.

INTRODUCTION

This report focuses on the population of Sockeye Salmon (*Oncorhynchus nerka*) from Lake Wenatchee, Washington (Figure 1). This population and the larger population from Osoyoos Lake (British Columbia, Canada) represent the last two self-sustaining populations of Sockeye Salmon in the Columbia River watershed. To reach Lake Wenatchee, migrating adult Sockeye must pass eight hydroelectric dams and over 600km of the Columbia and Wenatchee rivers (Figure 1). Adults typically pass through Tumwater Dam in the late summer, with some individuals migrating through into September (Table 4.20a in Hillman et al., 2022). Adults migrate through Lake Wenatchee and spawn in the Little Wenatchee River (~9% average), White River (-90% average) and the Napeequa River (~1% average). After hatching, the majority of juveniles rear in Lake Wenatchee for one year, and a smaller proportion stay for a second year in the lake prior to smolting. Smolt emigration rates typically peak around mid-April, with small numbers of individuals emigrating later in May (Hillman et al., 2022).

Lake Wenatchee has a long history of hatchery supplementation. Beginning in 1939, Sockeye were collected at Rock Island Dam and used as hatchery broodstock to produce approximately 58.9 million juveniles that were released into Lake Wenatchee between 1941 and 1969 as part of the Grand Coulee Fish-Maintenance Project. After a hiatus of hatchery production, Chelan County Public Utility District (PUD) began releasing approximately 200,000 juveniles annually into Lake Wenatchee starting in 1990 (brood year 1989) from broodstock that were caught on the Wenatchee River at Tumwater Dam until 2010, but at Dryden Dam in 2011. In 2004, the United States Fish and Wildlife Service (USFWS), Washington Department of Fish and Game (WDFW), the National Oceanic and Atmospheric Administration (NOAA) Fisheries, the Colville Confederated Tribes and the Yakama Nation collaboratively implemented the Habitat Conservation Plan (HCP) for Chelan PUD. The primary objective of this plan was to implement an adaptive management approach to achieving No Net Impact (NNI) for the operation of the Rock Island Dam. To achieve this objective, funds were allocated to habitat restoration, population enhancement via hatchery-origin Sockeye, and establishing a survival standard for fish passing through hydroelectric facilities. As hatchery supplementation did not have a net positive effect on the trajectory of wild Sockeye Salmon recruitment, hatchery efforts were terminated in 2011 (although small numbers of hatchery-origin Sockeye returned until the fall of 2017).

The limnological and juvenile Sockeye Salmon data that are summarized here result from a collaborative effort between the Okanagan Nation, the Yakima Nation and Fisheries and Oceans Canada. The research goals were to quantify life history parameters for the Lake Wenatchee age-0[1] and age-1 Sockeye Salmon population, to investigate the physical, chemical and biological factors that may be regulating population growth in freshwater, and to estimate lake carrying capacity for this species. The in-lake program began in 2010 with a single acoustic and trawl survey (ATS). This was expanded to two ATS in 2011, and in 2012 the program was expanded to include a full limnological assessment, including estimates of lake turnover, oxygen-temperature profiles, water chemistry, phytoplankton, zooplankton and Sockeye fry

[1] Age-0 juveniles become age-1 when they smolt and leave the lake. Age-1 in-lake juveniles remain in freshwater for an additional year, and become age-2 when they smolt and leave the lake.

abundance. Between 2012 and 2019, survey frequency was increased, was suspended for much of 2020, and fully resumed in 2021-2022.

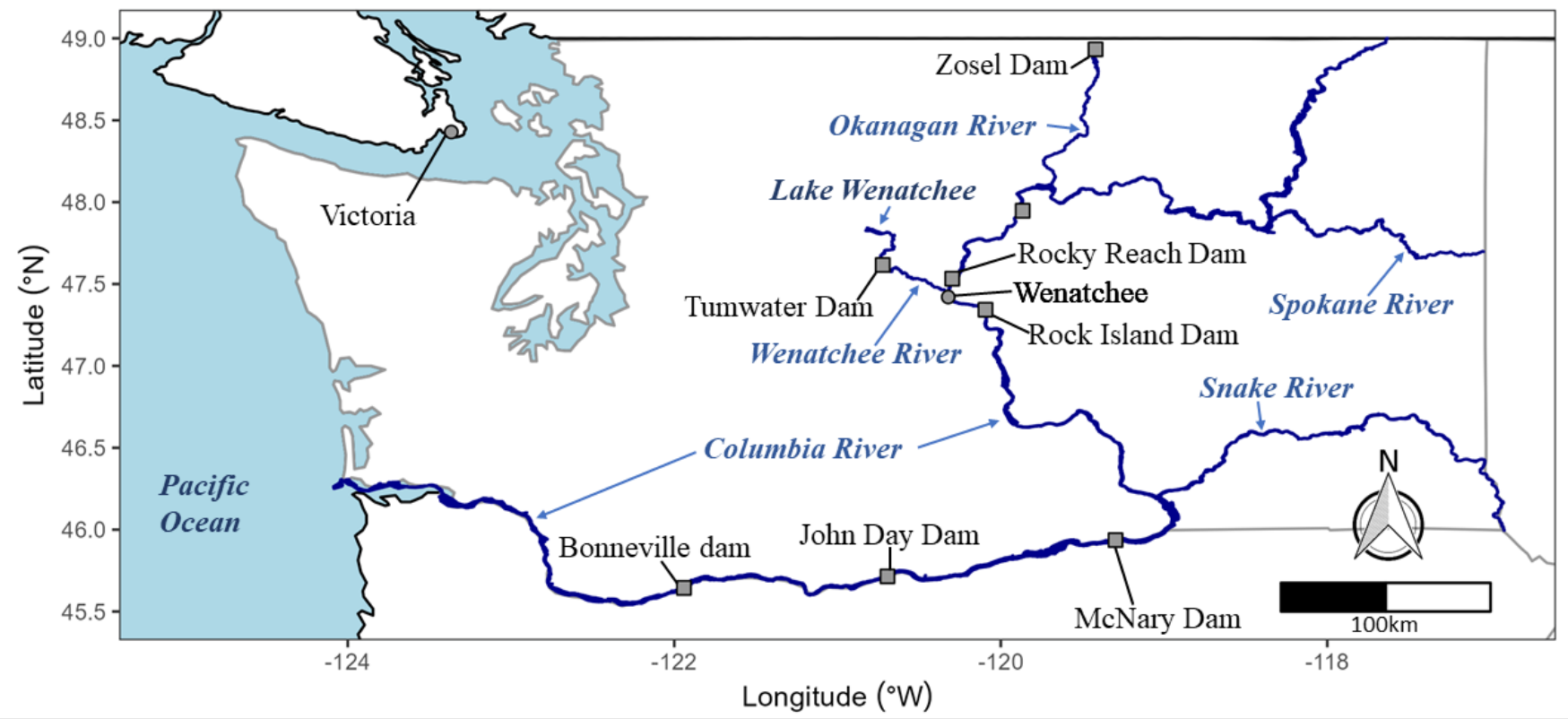


Figure 1. Map of Washington State, USA, showing features relevant to this study. Water bodies are indicated by dark blue lines and corresponding blue text labels. Also labelled are cities (black and gray circles), hydroelectric dams (black and gray squares), state borders (pale gray lines), and the Canada-USA border (black line). Note that only hydroelectric dams directly mentioned in this study are shown. Shape files used to make this figure were obtained from the Washington Geospatial Open Data Portal (https://geo.wa.gov/) on January 12th, 2023. The R packages ggsn v0.5.0 (Baquero, 2019), mapdata v2.3.1 (Deckmyn, 2022), maptools v1.1-6 (Bivand et al., 2022) and ggspatial v1.1.7 (Dunnington et al., 2022) were used to construct this figure.

METHODS AND SITE DESCRIPTION

Site Description

Lake Wenatchee, WA, is a deep, moderately large, Sockeye Salmon nursery lake that flows into the Wenatchee River and ultimately into the Columbia River. Physical characteristics are summarized in Figure 2 and Table 1.

Table 1. Lake Wenatchee physical characteristics. The data source for this table is Dion et al. (1976).

	Units USA		Units metric	
Location 47.823^{O}N, 120.778^{O}W				
Elevation	1,872	feet	570	m
Area	2,500	acre	1,011	ha
Volume	360,000	acre feet	444,052,800	cubic m
Average depth	150	feet	45	m
Maximum depth	244	feet	74	m

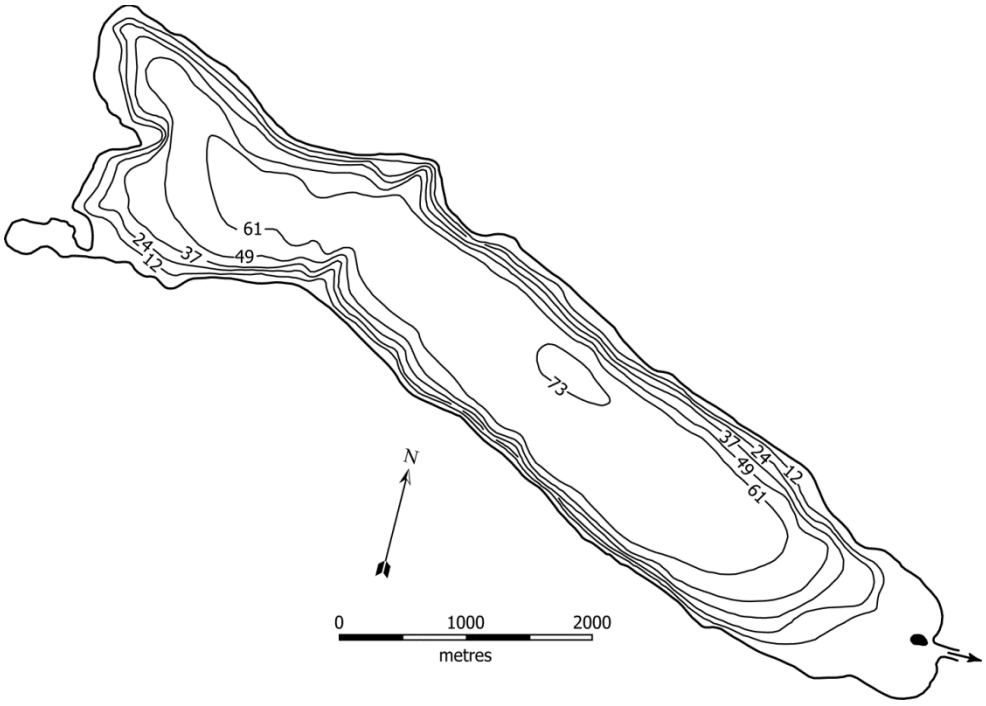


Figure 2. Bathymetric map of Lake Wenatchee, WA. Depths are in metres (original map in feet). Adapted from Dion, et al. (1976).

Chemistry and Plankton Sampling and Data Processing

Two sampling sites (Limno 1: N 47^{O}49.394 W 120^{O}47.170) (Limno 2: N 47^{O}48.590 W 120^{O} 45.190) were used for water chemistry, phytoplankton and zooplankton, and seven transects were used for acoustic and trawl surveys of juvenile Sockeye Salmon (Figure 3).

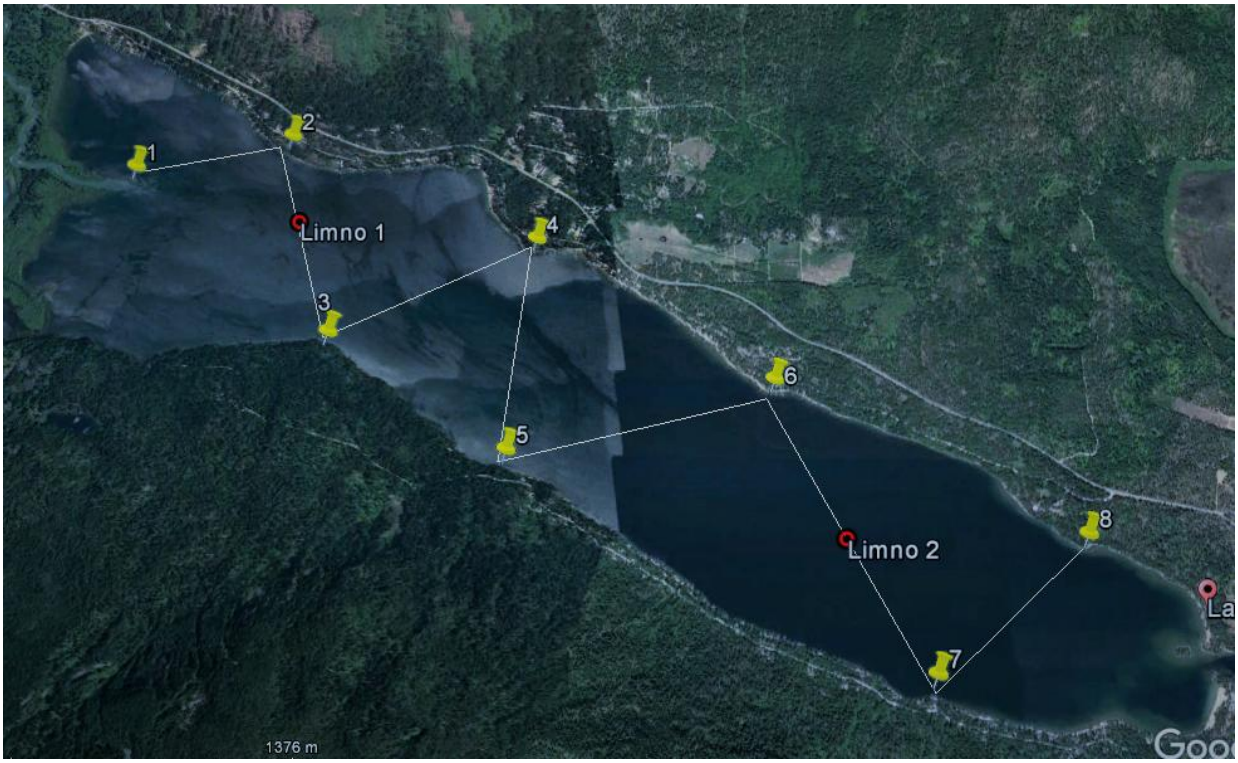


Figure 3. Location of acoustic and trawl transects and two sampling stations (Limno 1 and Limno 2) in Lake Wenatchee. Figure source: McQueen and Pham (2021).

Oxygen and temperature were recorded at both Limno 1 and Limno 2. Sampling depths were at 1 m intervals (1-20 m) and at 4 m intervals (24-52 m) thereafter.

Water chemistry samples were collected at both Limno 1 and Limno 2. During 2012-2013, total phosphorus (TP) samples were stored in screw-cap test-tubes in the dark until analysis. NO_{3+} NO_2 samples were passed through an acrodisk filter, placed in screw-cap plastic bottles, and frozen until analysis. Chlorophyll-a samples were filtered (47-mm Millipore) and frozen until analysis. Samples were analyzed at the Cultus Lake laboratory of Fisheries and Oceans Canada. Additional samples were sent to Vancouver Island University where they were analyzed for Na, Mg, and Ca (ppm) and for $CaCO_3$ alkalinity (ppm).

During 2017, two water chemistry stations (Limno 1 and 2) were sampled as described above. During daylight hours, Secchi depth was recorded at each limnological station. During periods of night sampling, Secchi depth was not recorded. In the epilimnion, water chemistry samples were collected using a Van Dorn bottle at 1, 5, 10 m depths. Water from the three depths was integrated and then sub-sampled to yield: 1 nutrient (nitrogen) sample stored in a clear 250 mL bottle, 1 TP sample stored in a clear 250 mL bottle, 1 alkalinity and calcium sample stored in a clear 250 mL bottle, and 1 phytoplankton sample stored in a 500 mL clear plastic bottle and treated with Lugol's solution. During collection, all water samples were held in coolers in the dark. Hypolimnetic samples were averaged from samples collected at 20, and 34 or 45 m (depending on lake depth). Details are in Lawrence et al. (2007). All samples were couriered to the provincial water chemistry laboratories in Burnaby, B.C. (PSC Analytical Services laboratory, Burnaby, British Columbia). The analytical protocol followed the methods of Bran

and Luebbe Inc. (1987) and Eaton et al. (1995, 1998). Water chemistry samples were not collected during 2014-2016, 2018-2019, and 2021-2022.

During 2012-2019 and 2021-2022, phytoplankton biomasses were sampled at two stations (Limno 1 and 2). At each station, water was combined from depths of 1, 5, and 10 m, and samples were drawn from the mixture. In the laboratory, the samples were settled, and densities, cell sizes, cell shapes, and biovolumes were recorded. One of the objectives of the phytoplankton counting procedure was to assess the relative availabilities of edible (grazable) and non-edible (non-grazable) algae. We quantified "edibility" based on size, toxicity, and digestibility. Single cells or colonies ≤ 30 µm width or length were considered edible (Cyr 1998; Cottingham 1999) unless they were classified as being either "toxic" or "digestion-resistant". *Microcystis* was always classified as being "toxic". Other genera were assumed to be non-toxic. Algae with thick gelatinous sheaths can pass through *Daphnia* guts undigested (Stutzman 1995) and were considered to be digestion-resistant, independent of size. Additional detail with respect to methods is available in Hyatt et al. (2005) and McQueen et al. (2007). During 2012-2017, samples were analyzed by Elaine Carney. During 2018-2019, 2021-2022, samples were analyzed by Biologica Environmental Services, Ltd. using the protocol developed by Ms. Carney.

During 2012-2019 and 2021-2022, zooplankton were sampled at night at the two limnological stations (Limno 1 and 2) (Figure 2) via metered vertical net hauls (Rigosha meter, 100 µm mesh, 0.5 m net diameter, net length 3 m). Samples were collected approximately every 4-6 weeks. Each sample was washed out of the plankton net using water saturated with carbon dioxide and was then preserved in 5.5% buffered and sugared formalin and shipped to the laboratory. In the laboratory, individual samples from each of 2 stations were combined to produce one volume-weighted, combined sample for each sampling date (McQueen et al. 2007). Because each of the samples had different sampling efficiencies (measured with a Rigosha flow meter), each station sample was suspended in water so that each one mL of sample contained water from 10 L of lake water. For each station, 10 mL (containing plankton from 100 L of lake water) from each sample jar was then added to a combined sample jar. Because there were 2 stations, the combined sample jar contained 20 mL of sample representing the zooplankton found in 200 L of lake water. The original samples were then re-filtered to remove excess water, re-suspended in 5.5 % formalin and re-labelled to record the loss of a certain percentage of the sample. During counting, Cladocerans and copepods (both adults and copepodids) were identified to species. Nauplii were identified as either *Diacyclops thomasi* or *Hesperodiaptomus kenai.* Edmondson (1959) was the principal taxonomic reference, but also Dussart and Fernando (1990) for Cyclopoids, and Lieder (1983) for Bosminids. Eggs per female were counted for all species. To calculate biomass, body lengths of all animals were measured using an image-based, semi-automated counting and measuring system. Animal weights were estimated using length-weight regressions summarized in Girard and Reid (1990). When preserved animals were used to develop these regressions, a 39% correction for weight loss in formalin was applied (Giguère et al. 1989).

Fish Sampling and Data Processing

The acoustic and trawl surveys (ATS) included both echosounding and trawl biosampling conducted along the same transects (Figure 3). Here we summarize the methods used, but greater detail is available in MacLellan and Simmonds (1992) and Hyatt et al. (2017); the latter

details the methods used in Osoyoos Lake, but the same methods, and often the same field crews, were used in Lake Wenatchee.

Hatchery Sockeye were stocked into Lake Wenatchee beginning in 1990. After brood year 2011, the hatchery program was terminated. It was assumed that some of the stocked fish (a small proportion) would be found in the lake during 2012-2013 and would be mixed in with wild stocks. In addition, trawl bio-sampling prior to September 2015 did not include retention of scales, so bio-sampled lengths and ages could not be determined and therefore could not be used as the basis for age-proportion. Therefore, until September 21st, 2015 (inclusive), fish densities, lengths and weights recorded in the data that follow represent mixtures of age-0 and age-1 fry, and during 2010-13, mixtures of wild and hatchery fry. Kokanee have not been observed in Lake Wenatchee (Catherine Willard, Senior Fisheries Biologist at Chelan County Public Utility District**,** *pers. comm*.).

Surveys were conducted 1-5 times per year during 2010-2022. Samples of pelagic fish were collected using a 3 m x 7 m mid-water trawl designed by Enzenhofer and Hume (1989). When the fish samples were collected by Fisheries and Oceans Canada, juvenile Sockeye were preserved in 95% ethanol. They were then transported to the laboratory, where the preservative was changed twice over six weeks. Next they were removed from the preservative, blotted dry, measured (total length), and weighed. Weights (but not lengths) were corrected for the effects of ethanol using the expression (fresh weight = preserved weight/0.868429; P. Rankin, Pacific Biological Station, unpublished data). When samples were collected by the Okanagan Nation Alliance, they were kept on ice and transported back to the laboratory where fresh lengths and weights were recorded.

Juvenile Sockeye Salmon densities were assessed using a Biosonics DT-X echosounder (200 kHz sounder, pulse width at 0.4 ms and a 6.6° transducer). Sonar5-Pro software was used to convert fish-like targets (FLTs) from the echosounding traces to estimated lengths and to generate a distribution of those fish by size. We acoustically sampled 7 transects (Figure 3) per nightly sample period, calculated the weighted average fish density per transect, and summed the weighted averages (numbers per ha), thus accounting for the effects of depth and transect length (Hyatt and Stockner 1985, Gjernes et al. 1986, MacLennan and Simmonds 1992, Hyatt et al. 2017). This method allowed us to calculate both the total number of limnetic fish in the lake and an estimate of sampling variance based on among-transect variability, which was typically 10-30% of the mean. However, this estimate of uncertainty assumes independence between transects, which may not be the case if there is spatial autocorrelation in densities within the lake.

Once the estimate of total limnetic fish numbers was calculated, the relative proportions of age-0 and age-1 nerkid juveniles, and other fish (>15cm), in the lake were calculated as follows.

After the September 2015 sample, fry in the trawl samples were aged based on their scale annuli, and their bio-sampled lengths were used to assign the age-0 and age-1 nerkids into corresponding length bins for the acoustic FLTs. For example (Table 2), the catch from trawl bio-sampling showed that all juvenile nerkids 0-6 cm in length are age-0 fish, so 100% of the 0-3 and 3-6 cm bins were considered age-0 Sockeye; if the bio-sampled nerkids included 50% 6 cm and 7.5 cm age-0 fish, as well as 50% 8 cm and 9 cm age-1 fish, then the 6-9 cm length frequency bin was assumed to be 50% age-0 and 50% age-1. Once all of the echosounding size bins were thus assigned proportions, the total estimated proportions of age-0, and age-1

Sockeye juveniles, and other fish, were summed individually and applied to the total limnetic fish estimate. Final estimated fish densities, by category, were generated by dividing these total limnetic estimates by the usable area of the lake, 1004 hectares.

Table 2. Length frequency of fish-like targets (FLTs), and frequencies of FLTs per acoustic transect in an example from sampling on March 15, 2018. Note that the FLTs have not been weighted and therefore do not represent estimates of total limnetic fish numbers. All age-0 and age-1 fish are Sockeye.

	Fish-Like Targets per Acoustic Transect									
Length freq (cm)	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**Mean freq**	**% freq**	**Assignment**
0 .. 3	108	112	143	118	138	178	54	122	15.11	Age - 0 Sockeye
3 .. 6	188	256	311	357	380	463	39	285	35.41	Age - 0 Sockeye
6 .. 9	119	202	240	289	275	422	28	225	27.97	Age - 0 Sockeye
9 .. 12	61	106	108	141	175	224	13	118	14.70	50% Age-0, 50% Age-1
12 .. 15	20	27	42	32	56	80	8	38	4.71	50% Age-0, 50% Age-1
15 .. 18	3	11	10	12	19	24	0	11	1.40	Other Fish
15 .. 18	3	11	10	12	19	24	0	11	0.44	Other Fish
18 .. 21	1	1	2	3	8	10	0	4	0.11	Other Fish
21 .. 24	0	0	0	1	0	5	0	1	0.04	Other Fish
24 .. 27	0	0	1	0	1	0	0	0	0.07	Other Fish
27 .. 30	0	0	2	0	1	1	0	1	0	Other Fish
30 .. 33	0	0	0	0	0	0	0	0	0.02	Other Fish
33 .. 36	0	0	0	0	0	1	0	0	0	Other Fish
36 .. 39	0	0	0	0	0	0	0	0	0.02	Other Fish
39 .. 42	0	1	0	0	0	0	0	0	0	Other Fish
42 .. 45	0	0	0	0	0	0	0	0	0	Other Fish
45 .. 48	0	0	0	0	0	0	0	0	0	Other Fish
48 .. 51	0	0	0	0	0	0	0	0	0	Other Fish
51 .. 54	0	0	0	0	0	0	0	0	0	Other Fish
Tot. no. tracks	**500**	**716**	**859**	**953**	**1053**	**1408**	**142**	**804**	**100**	

Bioenergetics

During 2012-2019 and 2021-2022, fish stomachs were processed on one date in 2013 (13 July, number of stomachs =30), three dates in 2017 (29 June, age-0 n=40, age-1 n=1; 31 August, age-0 n=30, age-1 n=1; and 15 September age-0 n=30, age-1 n=1), two dates in 2018 (14 August, age-0 n=30; age-1, n=30 and 07 November age-0, n=30), three dates in 2019 (28 July, 30 Sept, and 24 Oct), two dates during 2021 (28 Sept, 11 Nov) and three dates during 2022 (27 June, 26 Sept, 03 Nov). Prey identified included *Diacyclops*, *Hesperodiaptomu*s, *Daphnia, Bosmina* and adult dipterans. The stomach data were used as inputs for bioenergetics modeling.

Bioenergetics-based production and consumption analysis was used to estimate daily rates of consumption by both age-0 and age-1 Sockeye fry consuming each of the main species of zooplankton, chironomids and adult dipterans. Consumption rates of prey by Sockeye fry were compared with rates of production by each of the major zooplankton species. If production exceeds consumption, we would conclude that density-dependent growth suppression of fish was occurring. In contrast, if production exceeds consumption, we would conclude that the fish were not controlling zooplankton biomass and that density-dependent growth suppression due to prey removal was not occurring.

Samples appropriate for bioenergetics analysis were collected during 2012, 2013, 2017, 2018, 2019, 2021, 2022, and bioenergetics-based consumption rates were estimated for each of these years. The 2012 and 2013 estimates are detailed in McQueen (2014), but because sample sizes were limited in those years, these estimates have not been included in this report. The remaining five bioenergetics-based production-consumption analyses are included here. The data required for each analysis included: (1) weights and densities of age-0 and age-1 Sockeye fry with respect to date, (2) diets for Sockeye fry, (3) Sockeye fry vertical distribution in the water column with respect to date, (4) water temperatures with respect to date and depth, (5) zooplankton species-specific biomass and energy content, and (6) estimates of zooplankton species-specific rates of production. All of these data are summarized in the following pages of this report. (7) Energy densities (J/g wet weight) were set at 5233 J/g for Sockeye, and for prey, they were set at: copepods 3000 J/g, cladocerans 2500 J/g, adult dipterans 1500 J/g (Hanson et al. 1997). Production and consumption were calculated using the bioenergetics model of Rudstam (1989), adapted by Hanson et al. (1997), with a functionally equivalent R version developed by Deslauriers et al. (2017). Fish Bioenergetics 3.0 of Hanson et al. (1997) was used to make the bioenergetics estimates.

Fish Acoustics Re-estimation

The abundance of total limnetic fish, whole-lake estimates of age-0 Sockeye, age-1 Sockeye, and other, larger fish, as well as the densities of these three classes of fish (Tables 21-22), were re-estimated by reading the acoustic estimates into R, which bypassed calculation errors that were present in some of the earlier acoustics .xls workbook estimates and appear in reports published internally by the ONA.

RESULTS

Lake Wenatchee Water Temperatures

Table 3. Water temperature (ºC) profiles. Profiles are averaged from data collected from two sampling locations (Figure 3). Shaded area cells indicate water temperatures known to be avoided by juvenile sockeye due to temperature preferences > 17 ºC (Brett 1952, 1964, Levy 1990, 1991). No data available for blank cells.

Water depth (m)	04-Jun-12	25-Jun-12	05-Jul-12	09-Aug-12	18-Sep-12	06-Oct-12	25-Jun-13	30-Jul-13	26-Aug-13	23-Sep-13	05-Jun-14	23-Jun-14	14-Jul-14	11-Aug-14	04-Sep-14	08-Oct-14	01-Jun-15	25-Jun-15	14-Jul-15	05-Aug-15	28-Aug-15	16-Sep-15
1	8.1	8.2	10.6	14.2	16.4	13.8	11.2	18.0	18.6	16.1	9.4	11.6	15.3	19.0	17.7	15.5	13.3	16.6	19.2	18.5	17.8	16.5
2	7.7	8.2	10.2	14.2	16.1	13.8	10.5	17.5	18.4	16.2	9.3	11.6	15.0	18.6	17.6	15.4	13.2	16.6	19.1	18.5	17.9	16.4
3	7.6		10.0	14.2		13.7	10.5	17.2	18.1	16.2	9.3	11.1	15.0	18.1	17.4	15.4	13.1	16.6	18.9	18.5	18.0	16.2
4	7.5	8.0	9.5	14.2	15.6	13.7	10.4	17.0	18.0	16.2	9.1	10.9	14.8	17.8	17.3	15.4	12.8	16.5	18.8	18.5	18.0	16.1
5	7.3		9.3	14.2		13.7	10.3	16.9	18.0	16.2	9.1	10.9	14.7	17.6	17.2	15.4	12.3	16.3	18.8	18.5	18.0	16.1
6	7.3	8.1	9.2	14.2	15.5	13.7	10.3	16.7	17.8	16.3	9.0	10.8	14.5	17.3	17.2	15.4	11.8	16.1	18.7	18.5	18.0	16.0
7	7.2		9.1	14.0		13.7	10.2	16.6	17.8	16.3	9.0	10.7	14.4	17.1	17.1	15.4	11.5	15.5	18.6	18.4	18.0	16.0
8	7.2	8.1	9.0	13.9	15.3	13.6	10.2	16.5	17.7	16.3	8.9	10.6	14.2	16.9	17.1	15.4	11.2	15.1	18.6	18.4	18.0	16.0
9	7.2		8.8	13.7		13.6	10.1	16.2	17.7	16.3	8.8	10.6	14.2	16.4	17.0	15.4	11.0	14.9	18.5	18.4	18.0	15.9
10	7.1	8.0	8.6	13.6	15.1	13.6	10.0	16.1	17.7	16.3	8.7	10.4	14.0	16.0	17.0	15.3	10.7	14.7	18.3	18.4	18.0	15.9
11	7.1		8.6	13.5		13.6	9.9	16.1	17.6	16.3	8.7	10.2	13.5	15.8	16.9	15.3	10.4	14.5	17.9	18.4	18.0	15.9
12	7.1	7.7	8.5	13.5	14.8	13.6	10.0	15.9	17.5	16.3	8.6	10.1	13.0	15.7	16.4	15.3	10.4	14.2	17.0	18.4	18.0	15.9
13	7.0		8.4	13.4		13.6	9.4	15.7	17.3	16.3	8.6	10.0	12.7	15.5	16.3	15.2	10.3	14.0	15.8	18.2	18.0	15.9
14	6.9	7.4	8.4	13.4	14.5	13.6	9.2	15.4	17.0	16.3	8.5	10.0	12.4	15.3	16.2	15.1	10.1	13.8	15.2	18.1	18.0	15.9
15	6.9		8.3	13.3		13.6	9.1	14.9	17.3	15.8	8.5	9.6	12.1	15.1	16.0	15.0	10.0	13.4	14.4	17.8	18.0	15.8
16	6.8	7.4	8.2	12.9	14.2	13.6	8.9	13.3	16.5	15.5	8.4	9.4	11.8	15.0	15.4	14.9	9.8	13.0	13.5	17.8	18.0	15.8
17	6.8		8.0	12.8		13.6	8.8	12.7	15.5	14.9	8.4	9.3	11.6	13.9	14.5	14.7	9.8	12.9	12.7	17.7	18.0	15.8
18	6.7	7.4	7.9	12.8	14.0	13.6	8.7	11.4	14.9	14.6	8.3	9.2	11.4	13.0	14.1	14.6	9.7	12.5	12.3	17.7	17.6	15.8
19	6.7		7.8	12.7		13.5	8.6	11.1	14.0	13.6	8.3	9.1	11.2	12.5	13.5	14.5	9.5	12.3	12.2	16.5	17.5	15.7
20	6.7	7.4	7.8	12.3	13.8	13.4	8.5	11.0	13.3	12.6	8.3	9.0	10.8	11.9	12.8	14.4	9.4	12.1	11.9	15.2	17.2	15.7
24	6.5	7.2	7.5	10.5	12.3	13.2	8.4	10.5	10.7	10.6	8.2	8.9	10.3	10.6	11.6	13.2	8.9	10.8	10.4	11.3	13.3	14.9
28	6.4	7.1	7.4	9.5	11.6	11.1	8.2	9.7	9.9	9.5	8.1	8.7	9.9	9.7	10.6	11.4	8.6	9.8	9.6	10.1	10.2	10.2
32	6.3		7.2	8.9		8.6	8.1	8.9	9.0	8.8	7.9	8.5	9.4	9.0	9.7	9.6	8.0	8.8	8.7	9.2	9.2	9.0
36	6.3		7.1	8.5		7.9	7.9	8.4	8.6	8.4	7.6	8.2	8.9	8.6	9.0	9.1	7.5	8.1	8.1	8.4	8.5	8.4
40	6.2		7.0	7.9		7.5	7.6	8.0	8.2	8.0	7.3	8.0	8.6	8.2	8.6	8.9	7.1	7.7	7.7	8.0	7.9	7.9
44	6.1		6.9	7.6		7.4	7.4	7.6	7.8	7.7	7.0	7.8	8.2	7.9	8.2	8.2	6.8	7.2	7.2	7.6	7.5	7.4
48	6.1		6.8	7.3		7.2	7.2	7.4	7.5	7.5	6.8	7.6	7.9	7.7	7.9	8.0	6.6	7.0	7.0	7.4	7.2	7.2
52	6.0		6.7	7.1		7.1	7.0	7.2	7.3	7.3	6.7	7.4	7.7	7.5	7.7	7.8	6.5	6.8	6.8	7.2	7.0	7.0

Table 4. Water temperature (ºC) profiles, continued.

Water depth (m)	08-Jun-16	29-Jun-16	20-Jul-16	10-Aug-16	31-Aug-16	29-Sep-16	12-Apr-17	28-Jun-17	21-Aug-17	15-Sep-17	15-Mar-18	13-Jun-18	15-Jun-18	11-Jul-18	04-Aug-18	13-Aug-18	22-Aug-18	10-Sep-18	03-Oct-18	09-Oct-18	06-Nov-18
1	11.8	13.4	16.4	16.6	18.8	15.5	4.1	8.7	18.3	17.1	4.1	9.8	10.5	14.7	17.6	18.9	18.7	16.2	14.2	13.4	10.7
2	11.8	13.3	16.2	16.5	18.6	15.5	4.1	8.7	18.1	17.2	4.1	9.8	10.4	14.6	17.6	18.6	18.7	16.2	14.2	13.5	10.7
3	11.6	13.2	16.1	16.5	18.4	15.4	4.0	8.7	17.7	17.1	4.0	9.8	10.3	14.5	17.6	18.5	18.7	16.2	14.3	13.6	10.7
4	11.4	13.0	15.9	16.5	18.3	15.4	4.0	8.6	17.6	17.1	4.0	9.8	10.3	14.3	17.5	18.4	18.7	16.2	14.4	13.6	10.8
5	11.1	12.8	15.7	16.5	18.2	15.4	4.0	8.6	17.5	17.1	3.9	9.8	10.2	14.0	17.5	18.2	18.7	16.2	14.4	13.6	10.8
6	10.8	12.8	15.4	16.5	18.1	15.4	3.9	8.5	17.4	17.0	3.8	9.8	10.2	13.5	17.3	17.9	18.5	16.2	14.4	13.6	10.8
7	10.7	12.8	15.2	16.5	18.1	15.3	3.9	8.5	17.2	17.0	3.5	9.7	10.1	13.1	17.2	17.5	18.1	16.2	14.4	13.7	10.8
8	10.6	12.7	15.1	16.5	18.1	15.3	3.9	8.5	17.0	16.9	3.4	9.7	10.0	12.8	17.1	17.1	17.7	16.3	14.4	13.7	10.8
9	10.5	12.7	14.9	16.5	18.0	15.3	3.9	8.5	16.9	16.8	3.4	9.6	9.8	12.7	17.0	17.0	17.3	16.3	14.4	13.7	10.8
10	10.3	12.6	14.8	16.5	18.0	15.3	3.9	8.5	16.7	16.7	3.3	9.5	9.5	12.6	16.8	16.7	17.2	16.3	14.4	13.7	10.8
11	10.2	12.6	14.6	16.5	17.8	15.3	3.9	8.5	16.6	16.7	3.3	9.5	9.4	12.5	16.8	16.5	16.9	16.3	14.4	13.7	10.8
12	10.0	12.5	14.4	16.5	17.7	15.3	3.9	8.5	16.5	16.6	3.3	9.4	9.3	12.4	16.5	16.3	16.4	16.3	14.4	13.7	10.8
13	9.8	12.4	14.2	16.5	17.6	15.3	3.9	8.5	16.2	16.5	3.3	9.3	9.3	12.3	15.9	16.2	16.7	16.3	14.4	13.7	10.8
14	9.6	12.3	14.0	16.5	17.5	15.3	3.9	8.5	15.9	16.3	3.3	9.3	9.3	12.2	14.6	16.1	16.6	16.2	14.4	13.7	10.8
15	9.3	12.2	13.7	16.5	17.5	15.2	3.9	8.5	15.4	16.3	3.3	9.3	9.2	11.9	14.3	15.6	16.4	16.2	14.4	13.7	10.8
16	9.2	12.2	13.5	16.5	17.3	15.2	3.9	8.5	15.1	16.2	3.2	9.3	9.1	11.8	14.1	14.8	16.1	16.2	14.4	13.7	10.8
17	9.1	12.1	13.3	16.4	16.7	15.1	3.9	8.5	14.4	16.0	3.2	9.3	9.1	11.7	13.6	14.3	15.5	16.1	14.4	13.7	10.8
18	9.0	12.1	13.2	15.9	16.4	15.1	3.9	8.5	13.8	15.0	3.2	9.3	9.0	11.5	13.3	13.5	14.4	16.0	14.4	13.7	10.7
19	8.9	12.0	13.1	15.8	15.5	15.0	3.9	8.5	12.9	13.5	3.2	9.2	9.0	11.4	12.7	12.8	14.0	15.5	14.3	13.6	10.7
20	8.8	11.7	13.0	15.8	14.7	14.9	3.9	8.5	12.6	12.4	3.2	9.2	9.0	11.3	12.2	12.3	13.3	15.0	14.3	13.6	10.7
24	8.7	10.7	11.2	13.3	13.0	14.0	3.9	8.4	10.9	10.1	3.2	8.7	9.0	10.8	10.6	11.1	11.6	11.6	12.8	12.6	10.2
28	8.4	9.6	10.4	11.8	11.0	11.4	3.9	8.4	9.4	9.0	3.2	8.4	8.7	9.9	10.1	10.2	10.8	10.4	10.4	10.3	9.9
32	8.2	9.0	9.5	10.2	9.6	9.6	3.9	8.1	8.9	8.4	3.2	8.1	8.5	9.3	9.4	9.5	10.0	9.7	9.7	9.4	9.7
36	7.9	8.4	8.6	9.1	8.9	8.8	3.9	7.9	8.4	8.0	3.2	7.9	8.3	9.0	8.9	8.9	9.3	9.2	9.1	8.8	9.4
40	7.6	8.0	8.1	8.6	8.5	8.3	3.9	7.7	8.0	7.7	3.2	7.6	8.3	8.6	8.5	8.5	8.7	8.8	8.7	8.4	8.9
44	7.4	7.7	7.8	8.2	8.2	8.0	3.9	7.6	7.8	7.5	3.2	7.5	8.0	8.4	8.3	8.1	8.3	8.4	8.4	8.1	8.3
48	7.3	7.5	7.6	7.9	7.8	7.8	3.9	7.5	7.6	7.3	3.2	7.3	7.9	8.0	8.0	7.9	8.1	8.2	8.2	7.9	8.0
52	7.2	7.5	7.5	7.7	7.6	7.6	3.9	7.0	7.5	7.2	3.2	7.2	7.8	7.7	7.9	7.7	7.9	7.9	8.0	7.7	7.7

Table 5. Water temperature (ºC) profiles, continued.

Water depth (m)	21-May-19	05-Jun-19	25-Jul-19	28-Jul-19	08-Aug-19	18-Sep-19	30-Sep-19	03-Oct-19	24-Oct-19	11-Nov-19	23-Nov-19	29-Feb-20	9-Mar-21	13-May-21	16-Jun-21	28-Jul-21	23-Aug-21	21-Sep-21	28-Oct-21
1	8.3	10.8	16.8	17.8	20.7	16.8	14.7	14.4	11.9	9.7	8.5	3.5	2.9	8.4	10.9	18.1	17.4	15.2	11.5
2	8.2	10.6	16.8	17.6	20.2	16.9	14.8	14.5	11.8	9.7	8.5	3.5	2.9	7.9	10.8	17.9	17.2	15.3	11.5
3	8.2	10.4	16.7	17.5	19.7	16.9	14.8	14.5	11.8	9.7	8.5	3.5	3.0	7.7	10.6	17.8	17.3	15.3	11.5
4	8.2	10.3	16.7	17.5	19.5	16.9	14.8	14.5	11.8	9.7	8.5	3.5	3.0	7.6	10.4	17.7	17.3	15.3	11.5
5	8.2	10.2	16.6	17.0	19.4	16.9	28.3	14.5	11.8	9.7	8.5	3.5	3.0	7.5	10.2	17.6	17.4	15.3	11.6
6	8.2	10.2	16.1	17.0	19.2	16.9	14.8	14.5	11.8	9.7	8.5	3.5	3.0	7.4	10.0	17.5	17.3	15.3	11.6
7	8.2	10.1	15.8	16.2	18.8	17.0	14.8	14.5	11.8	9.8	8.5	3.5	3.0	7.4	9.6	17.4	17.4	15.4	11.6
8	8.2	10.0	15.7	15.9	18.2	17.0	14.8	14.5	11.8	9.7	8.5	3.5	3.0	7.4	9.2	17.3	17.4	15.4	11.6
9	8.0	9.8	15.4	15.8	17.9	17.0	14.8	14.6	11.8	9.7	8.5	3.5	3.0	7.4	9.1	17.2	17.4	15.4	11.6
10	8.0	9.6	15.2	15.5	17.5	17.0	14.8	14.6	11.7	9.7	8.5	3.5	3.0	7.3	9.1	17.0	17.4	15.4	11.6
11	7.9	9.5	15.0	15.3	17.2	17.0	14.8	14.6	11.7	9.7	8.4	3.5	3.0	7.3	8.9	16.9	17.3	15.4	11.6
12	7.8	9.4	14.9	15.2	16.9	17.0	14.8	14.6	11.7	9.7	8.4	3.5	3.0	7.3	8.5	16.8	17.3	15.4	11.6
13	7.7	9.3	14.7	15.1	16.7	17.0	14.8	14.6	11.8	9.7	8.4	3.5	3.0	7.3	8.3	16.5	17.3	15.4	11.6
14	7.6	9.2	14.6	15.3	16.0	17.0	14.8	14.5	11.7	9.7	8.4	3.5	3.0	7.2	8.2	15.4	17.3	15.4	11.6
15	7.5	9.2	14.6	15.0	15.4	17.0	14.8	14.5	11.7	9.7	8.4	3.5	3.0	7.1	8.2	14.9	17.3	15.4	11.6
16	7.4	9.1	14.5	14.9	15.1	17.0	14.8	14.5	11.7	9.7	8.4	3.5	3.0	7.1	8.1	14.8	17.2	15.4	11.6
17	7.4	9.0	14.4	14.7	14.8	17.0	14.8	14.5	11.7	9.7	8.4	3.5	3.0	7.0	8.0	14.7	17.2	15.4	11.6
18	7.2	8.7	14.1	14.5	14.2	16.7	14.8	14.5	11.6	9.7	8.4	3.5	3.0	7.0	8.0	14.2	17.1	15.4	11.6
19	7.1	8.7	14.0	14.2	14.1	16.4	14.8	14.5	11.5	9.7	8.4	3.5	3.0	6.9	7.8	13.8	17.0	15.3	11.6
20	7.1	8.6	13.6	13.8	13.9	16.0	14.8	14.5	11.4	9.7	8.4	3.5	3.0	6.9	7.8	13.6	16.5	15.3	11.6
24	6.8	8.3	12.8	12.4	12.6	14.0	14.7	14.1	11.3	9.7	8.4	3.5	3.0	6.8	7.5	11.5	12.8	14.4	11.5
28	6.7	8.0	11.5	11.4	11.1	11.9	12.4	12.8	11.0	9.5	8.4	3.5	3.0	6.6	7.3	9.7	10.9	10.9	11.0
32	6.5	7.6	10.2	10.0	9.8	10.5	10.1	10.6	10.7	9.4	8.3	3.5	3.0	6.3	7.3	8.5	9.0	9.1	10.3
36	6.4	7.3	9.0	8.4	8.9	9.3	8.7	9.3	10.2	9.1	8.2	3.5	3.1	6.2	7.1	7.9	8.2	8.3	8.7
40	6.3	7.1	8.2	7.9	8.0	8.5	8.2	8.4	9.1	8.8	8.1	3.4	3.1	6.1	7.0	7.4	7.7	7.7	7.8
44	6.2	6.9	7.8	7.4	7.5	7.8	7.5	7.9	7.5	8.1	7.9	3.4	3.1	6.0	6.8	7.2	7.4	7.4	7.4
48	6.2	6.7	7.4	7.0	7.1	7.5	7.1	7.5	7.0	7.5	7.4	3.4	3.1	5.9	6.6	6.9	7.1	7.1	7.2
52	6.1	6.4	7.1	6.7	7.0	7.1	6.8	7.2	6.8	7.2	7.2	3.4	3.1	5.9	6.6	6.8	7.0	7.0	7.0

Table 6. Water temperature (ºC) profiles, continued.

Water depth (m)	09-Mar-22	27-Jun-22	20-Jul-22	08-Aug-22	26-Sep-22	12-Oct-22	02-Nov-22
1	2.9	12.5	14.0	17.3	16.3	14.6	11.3
2	2.9	12.2	13.9	17.2	16.2	14.7	11.3
3	3.0	10.8	13.9	17.2	16.0	14.7	11.3
4	3.0	9.9	13.8	17.1	15.9	14.7	11.3
5	3.0	9.7	13.8	16.6	15.8	14.7	11.3
6	3.0	9.4	13.8	16.3	15.7	14.7	11.3
7	3.0	9.2	13.4	16.2	15.7	14.7	11.3
8	3.0	9.1	13.1	16.1	15.7	14.7	11.4
9	3.0	9.0	12.9	16.0	15.7	14.7	11.4
10	3.0	8.9	12.6	15.9	15.6	14.7	11.4
11	3.0	8.8	12.5	15.8	15.6	14.7	11.4
12	3.0	8.8	12.2	15.2	15.5	14.7	11.4
13	3.0	8.7	11.6	14.1	15.5	14.7	11.4
14	3.0	8.7	11.3	13.5	15.5	14.7	11.4
15	3.0	8.7	11.1	13.1	15.4	14.7	11.4
16	3.0	8.6	11.1	13.0	15.3	14.6	11.4
17	3.0	8.5	11.0	12.8	15.2	14.5	11.4
18	3.0	8.4	10.9	12.7	14.9	14.4	11.4
19	3.0	8.3	10.9	12.3	14.7	14.0	11.4
20	3.0	8.2	10.8	12.0	14.0	13.1	11.4
24	3.0	8.0	10.1	11.3	10.8	11.9	11.4
28	3.0	7.7	9.6	10.7	9.5	9.8	10.9
32	3.0	7.5	8.6	10.3	8.8	9.1	9.5
36	3.1	7.4	8.1	9.8	8.2	8.5	8.7
40	3.1	7.2	7.7	8.9	7.9	8.1	8.1
44	3.1	7.2	7.5	8.4	7.6	7.8	7.6
48	3.1	7.0	7.3	8.0	7.5	7.6	7.4
52	3.1	6.9	7.2	7.7	7.4	7.5	7.3

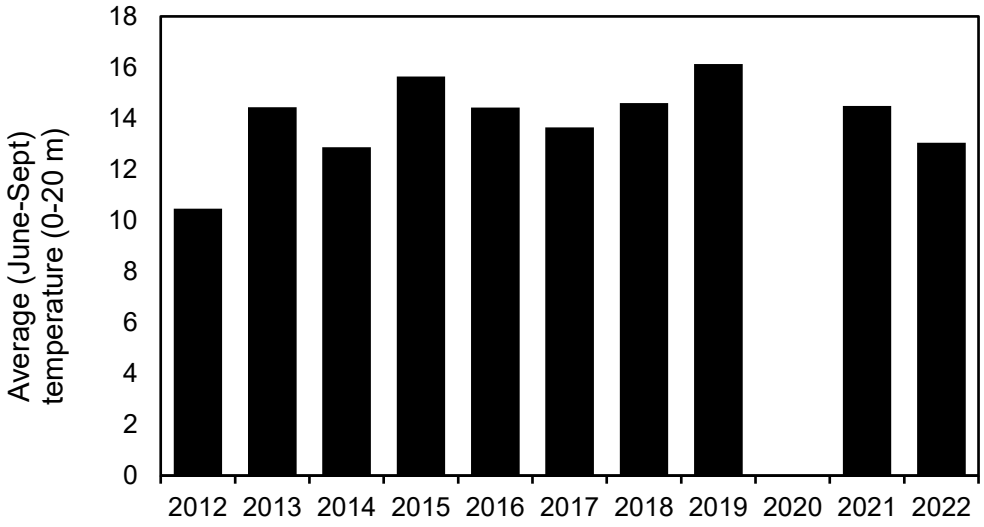


Figure 4. Average 0-20 m water temperatures June to September.

Lake Wenatchee Oxygen Concentrations

Table 7. Oxygen concentration (ppm) profiles. Profiles are averaged from data collected from two sampling locations (Figure 3).

Water depth (m)	04-Jun-12	05-Jul-12	09-Aug-12	06-Oct-12	25-Jun-13	30-Jul-13	26-Aug-13	23-Sep-13	05-Jun-14	23-Jun-14	14-Jul-14	11-Aug-14	04-Sep-14	08-Oct-14	01-Jun-15	25-Jun-15	14-Jul-15	05-Aug-15	28-Aug-15	16-Sep-15
1	10.2	12.8	9.9	10.0	11.3	9.0	9.0	9.3	10.9	10.4	10.0	9.1	9.1	9.3	10.5	9.7	8.8	9.2	9.1	9.1
2	10.2	13.0	10.0	10.0	11.3	9.1	9.0	9.3	10.9	10.4	10.0	9.1	9.1	9.4	10.5	9.7	8.8	9.2	9.1	9.2
3	10.2	13.1	10.0	10.0	11.3	9.1	9.0	9.3	10.9	10.5	10.0	9.2	9.1	9.4	10.5	9.7	8.8	9.2	9.0	9.2
4	10.2	13.2	10.0	9.9	11.3	9.1	9.0	9.2	10.9	10.5	10.0	9.3	9.1	9.4	10.5	9.8	8.8	9.1	9.5	9.2
5	10.2	13.3	10.0	9.8	11.2	9.1	9.0	9.2	10.9	10.5	10.0	9.3	9.1	9.4	10.5	9.7	8.8	9.1	9.5	9.2
6	10.2	13.3	10.0	9.8	11.2	9.1	9.0	9.1	10.9	10.5	10.0	9.3	9.1	9.4	10.6	9.7	8.8	9.1	9.5	9.2
7	10.3	13.4	10.0	9.7	11.2	9.2	9.0	9.1	10.9	10.5	10.0	9.3	9.1	9.3	10.7	9.8	8.8	9.1	9.0	9.1
8	10.3	13.5	10.0	9.7	11.1	9.2	9.0	9.1	10.9	10.5	10.1	9.3	9.1	9.3	10.6	9.8	8.8	9.1	8.9	9.1
9	10.3	13.5	10.0	10.2	11.1	9.2	9.0	9.1	10.9	10.5	10.0	9.3	9.1	9.3	10.7	9.8	8.8	9.1	8.9	9.1
10	10.3	13.5	10.0	9.7	11.0	9.2	9.0	9.0	10.9	10.5	10.0	9.3	9.0	9.3	10.6	9.8	8.8	9.1	8.9	9.1
11	10.3	13.6	10.0	9.7	11.0	9.2	8.9	9.0	10.9	10.5	10.0	9.2	9.0	9.3	10.6	9.8	8.8	9.0	8.9	9.1
12	10.3	13.6	10.0	9.6	10.9	9.2	8.9	9.0	10.9	10.4	10.1	9.2	8.9	9.2	10.6	9.8	8.9	9.0	8.9	9.0
13	9.4	13.6	10.0	9.6	10.9	9.2	8.9	9.0	10.8	10.4	10.1	9.2	8.9	9.2	10.6	9.8	9.0	9.0	8.8	9.0
14	10.5	13.4	9.9	9.6	10.9	9.1	8.8	8.9	10.8	10.4	10.1	9.2	9.3	9.2	10.5	9.8	9.1	9.0	8.8	9.0
15	10.4	13.7	9.9	9.6	10.9	9.3	8.7	8.7	10.8	10.3	10.1	9.1	8.8	9.1	10.5	9.7	9.2	9.0	8.8	9.0
16	10.3	13.7	10.0	9.6	10.9	9.3	8.7	8.6	10.8	10.3	10.1	9.1	8.8	9.1	10.5	9.8	9.2	9.0	8.8	9.0
17	10.2	13.8	10.0	9.6	10.8	9.5	8.7	8.6	10.8	10.3	10.1	9.1	8.8	9.0	10.5	9.8	9.3	9.0	8.7	8.9
18	10.3	13.8	10.0	9.5	10.8	9.5	8.7	8.5	10.8	10.3	10.0	9.2	8.8	9.0	10.5	9.7	9.3	9.0	8.7	8.9
19	10.2	13.8	9.9	9.5	10.8	9.5	8.7	8.5	10.8	10.3	10.0	9.2	8.7	8.9	10.5	9.7	9.3	8.9	8.6	8.9
20	10.0	13.9	10.0	9.5	10.8	9.5	9.2	8.6	10.8	10.3	10.0	9.2	8.7	8.9	10.4	9.7	9.3	8.8	8.5	8.9
24	6.0	13.9	10.2	9.4	10.7	9.5	9.1	8.8	10.7	10.3	10.0	9.4	8.8	8.6	10.4	9.8	9.3	8.9	8.3	8.6
28	6.6	14.0	10.3	9.8	10.7	9.6	9.3	8.9	10.6	10.2	10.0	9.4	8.9	8.4	10.4	9.8	9.4	9.0	8.4	8.4
32	6.9	14.0	10.3	10.1	10.6	9.5	9.3	8.8	10.6	10.2	9.9	9.5	9.1	8.5	10.4	9.8	9.5	9.2	8.6	8.4
36	7.1	14.0	10.3	9.9	10.5	9.5	9.3	8.9	10.5	10.1	9.9	9.5	9.2	8.6	10.3	9.8	9.5	9.3	8.7	8.4
40	7.1	14.0	10.4	9.8	10.5	9.4	9.3	8.9	10.5	10.1	9.9	9.4	9.2	8.8	10.3	9.8	9.5	9.3	8.8	8.4
44	7.1	14.2	10.4	9.7	10.4	9.3	9.2	8.9	10.5	10.0	9.8	9.4	9.2	8.7	10.2	9.8	9.5	9.3	8.9	8.4
48	7.1	14.2	10.4	9.7	10.3	9.2	9.1	8.9	10.4	10.0	9.8	9.3	9.1	8.7	10.1	9.7	9.5	9.3	8.9	8.4
52	7.2	14.2	10.4	9.7	0.0	0.0	0.0	0.0	10.4	9.9	9.6	9.2	9.0	8.6	10.1	9.6	9.5	9.3	8.9	8.4

Table 8. Oxygen concentration (ppm) profiles, continued.

Water depth (m)	08-Jun-16	29-Jun-16	20-Jul-16	10-Aug-16	31-Aug-16	29-Sep-16	12-Apr-17	28-Jun-17	21-Aug-17	15-Sep-17	15-Mar-18	15-Jun-18	11-Jul-18	04-Aug-18	22-Aug-18	10-Sep-18	13-Aug-18	03-Oct-18	09-Oct-18	06-Nov-18
1	10.7	10.4	9.5	9.2	8.8	9.4	10.9	10.5	9.1	9.5	12.5	10.8	10.1	9.2	9.2	9.3	9.7	9.7	10.1	17.4
2	10.7	10.5	9.7	9.2	8.9	9.4	10.9	10.6	9.1	9.4	12.5	11.0	10.1	9.1	9.2	9.3	9.8	9.7	9.9	17.0
3	10.7	10.4	9.7	9.2	8.9	9.4	10.9	10.6	9.1	9.4	12.6	11.0	10.1	9.1	9.2	9.3	9.8	9.6	9.8	16.9
4	10.7	10.4	9.7	9.2	8.9	9.4	10.9	10.7	9.1	9.4	12.6	11.0	10.2	9.1	9.2	9.3	9.8	9.6	9.8	16.7
5	10.7	10.5	9.8	9.2	8.9	9.4	10.8	10.7	9.1	9.4	12.6	11.0	10.1	9.1	9.2	9.3	9.8	9.5	9.7	16.6
6	10.7	10.5	9.8	9.1	8.9	9.4	10.8	10.7	9.1	9.4	12.7	11.0	10.2	9.1	9.2	9.2	9.8	9.5	9.7	16.6
7	10.8	10.4	9.8	9.1	8.9	9.3	10.8	10.7	9.1	9.4	12.8	11.0	10.2	9.1	9.2	9.2	9.8	9.5	9.7	16.5
8	10.8	10.4	9.8	9.1	8.9	9.3	10.8	10.7	9.1	9.4	12.8	11.0	10.2	9.1	9.1	9.2	9.8	9.4	9.7	16.5
9	10.8	10.4	9.8	9.1	8.9	9.3	10.8	10.7	9.1	9.3	12.8	10.9	10.2	9.1	9.1	9.2	9.8	9.4	9.7	16.4
10	10.8	10.4	9.8	9.1	8.9	9.3	10.9	10.7	9.1	9.3	12.9	11.0	10.2	9.1	9.1	9.2	9.8	9.4	9.6	16.4
11	10.7	10.4	9.8	9.1	8.8	9.3	10.9	10.7	9.1	9.3	12.8	11.0	10.1	9.1	9.0	9.1	9.9	9.4	9.6	16.4
12	10.7	10.4	9.7	9.1	8.8	9.2	10.9	10.7	9.0	9.3	12.8	11.0	10.1	9.1	9.0	9.1	9.8	9.3	9.6	16.4
13	10.7	10.4	9.7	9.1	8.8	9.2	10.8	10.7	9.0	9.2	12.8	11.0	10.1	9.2	8.9	9.1	9.8	9.3	9.6	16.4
14	10.7	10.4	9.7	9.0	8.8	9.2	10.8	10.7	9.5	9.2	12.8	11.0	10.1	9.2	8.9	9.1	9.8	9.3	9.6	16.4
15	10.7	10.4	9.7	9.0	8.8	9.2	10.8	10.7	9.0	9.1	12.8	10.9	10.1	9.3	8.8	9.1	9.7	9.3	9.6	16.3
16	10.7	10.4	9.7	9.0	8.7	9.1	10.8	10.7	9.0	9.1	12.8	10.9	10.1	9.3	8.8	9.1	9.7	9.2	9.5	16.3
17	10.7	10.4	9.7	9.0	8.7	9.1	10.7	10.7	9.1	9.0	12.8	10.9	10.0	9.3	8.8	9.0	9.7	9.2	9.5	16.2
18	10.7	10.4	9.6	9.0	8.6	9.0	10.7	10.7	9.0	8.9	12.8	10.9	10.0	9.3	8.8	9.0	9.7	9.2	9.5	16.2
19	10.7	10.3	9.6	8.9	8.4	9.0	10.7	10.6	9.0	8.8	12.8	10.9	10.0	9.3	8.8	8.9	9.8	9.2	9.5	16.1
20	10.7	10.3	9.6	8.9	8.4	9.0	10.7	10.6	9.6	8.8	12.8	10.9	10.0	9.3	8.8	8.8	9.8	9.1	9.4	16.1
24	10.6	10.2	9.7	8.9	8.5	8.7	10.7	10.6	9.3	9.0	12.8	10.8	9.9	9.4	8.9	8.7	9.9	8.8	9.4	15.9
28	10.6	10.1	9.6	8.9	8.5	8.4	10.6	10.6	9.5	9.2	12.8	10.8	9.9	9.4	9.0	8.8	9.9	8.7	9.0	15.9
32	10.5	10.1	9.6	9.0	8.7	8.4	10.6	10.5	9.5	9.3	12.8	10.7	9.8	9.5	9.0	8.9	10.0	8.6	8.9	15.9
36	10.4	10.0	9.6	9.1	8.8	8.5	10.6	10.5	9.5	9.4	12.8	10.7	9.8	9.5	9.0	8.9	10.0	8.6	8.8	15.8
40	10.4	10.0	9.6	9.1	8.8	8.5	10.5	10.6	9.5	9.5	12.7	10.6	9.7	9.5	9.1	8.9	10.0	8.6	8.9	15.3
44	10.3	9.9	9.5	9.1	8.8	8.5	10.5	10.6	9.4	9.5	12.7	10.5	9.7	9.4	9.0	8.8	10.1	8.6	8.9	14.6
48	10.3	9.9	9.4	9.1	8.9	8.4	10.5	10.5	9.4	9.6	12.7	10.5	9.6	9.2	9.0	8.7	10.0	8.5	8.8	14.2
52	10.2	9.9	9.3	9.1	8.7	8.2	10.4	10.4	9.5	9.6	12.7	10.4	9.6	9.1	8.9	8.6	10.0	8.4	8.8	13.7

Table 9. Oxygen concentration (ppm) profiles, continued.

Water depth (m)	21-May-19	05-Jun-19	25-Jul-19	28-Jul-19	08-Aug-19	18-Sep-19	30-Sep-19	03-Oct-19	24-Oct-19	11-Nov-19	23-Nov-19	29-Feb-20	9-Mar-21	13-May-21	16-Jun-21	28-Jul-21	23-Aug-21	21-Sep-21	28-Oct-21
1	11.2	10.4	9.5	9.3	8.5	9.4	10.3	9.3	9.4	10.5	10.9	12.2	14.4	11.7	12.7	10.8	10.7	10.1	11.5
2	11.2	10.6	9.6	9.5	8.5	9.4	10.2	9.2	9.4	10.4	10.8	12.1	14.3	11.8	12.7	10.8	10.6	10.0	11.5
3	11.2	10.6	9.6	9.6	8.6	9.3	10.2	9.2	9.4	10.5	10.7	12.0	14.3	11.8	12.7	10.8	10.6	9.9	11.5
4	11.2	10.7	9.6	9.7	8.6	9.3	10.2	9.2	9.4	10.3	10.6	12.0	14.2	11.9	12.8	10.8	10.6	9.9	11.4
5	11.2	10.7	9.6	9.8	8.7	9.3	10.2	9.1	9.4	10.3	10.5	12.0	14.2	11.9	12.8	10.8	10.6	9.9	11.4
6	11.2	10.7	9.6	9.7	8.7	9.3	10.1	9.1	9.4	10.3	10.4	11.9	14.2	11.9	12.8	10.8	10.6	9.9	11.4
7	11.2	10.7	9.6	9.8	8.7	9.2	10.1	9.1	9.4	10.2	10.3	11.9	14.1	11.9	12.8	10.8	10.6	9.8	11.4
8	11.2	10.7	9.6	9.8	8.8	9.2	10.1	9.0	9.3	10.2	10.2	11.8	14.1	11.9	12.8	10.8	10.5	9.8	11.4
9	11.2	10.7	9.6	9.8	8.9	9.2	10.1	9.0	9.3	10.2	10.2	11.8	14.1	11.9	12.7	10.8	10.5	9.8	11.3
10	11.2	10.7	9.6	9.8	8.9	9.2	10.1	9.0	9.3	10.2	10.1	11.8	14.1	11.9	12.7	10.8	10.5	9.7	11.3
11	11.1	10.7	9.6	9.8	8.9	9.2	10.1	9.0	9.3	10.1	10.1	11.7	14.1	11.8	12.7	10.8	10.5	9.7	11.3
12	11.2	10.7	9.5	9.8	8.8	9.1	10.1	9.0	9.3	10.1	10.1	11.7	14.0	11.8	12.6	10.8	10.5	9.7	11.3
13	11.1	10.7	9.5	9.8	8.8	9.1	10.1	9.0	9.3	10.1	10.0	11.7	14.0	11.8	12.6	10.8	10.5	9.7	11.3
14	11.1	10.7	9.5	9.8	8.6	9.1	10.0	8.9	9.3	10.1	10.0	11.7	14.0	11.8	12.6	10.8	10.5	9.6	11.2
15	11.1	10.7	9.5	9.8	8.6	9.0	10.0	8.9	9.3	10.1	10.0	11.7	13.9	11.8	12.5	10.9	10.4	9.6	11.2
16	11.1	10.7	9.5	9.8	8.6	9.0	10.0	8.9	9.2	10.1	10.0	11.7	13.9	11.8	12.5	10.9	10.4	9.6	11.2
17	11.1	10.7	9.5	9.8	8.6	9.0	10.0	8.9	9.2	10.0	9.9	11.6	13.9	11.7	12.5	10.8	10.4	9.6	11.2
18	11.1	10.7	9.5	9.7	8.6	8.9	10.0	8.9	9.2	10.0	9.9	11.7	13.9	11.7	12.5	10.8	10.4	9.6	11.2
19	11.1	10.7	9.4	9.8	8.6	8.9	10.0	8.8	9.2	10.0	9.9	11.6	13.9	11.7	12.5	10.9	10.3	9.5	11.2
20	11.1	10.7	9.4	9.8	8.6	8.7	10.0	8.9	9.2	10.0	9.9	11.6	13.8	11.7	12.5	10.9	10.2	9.5	11.1
24	11.0	10.7	9.4	9.7	8.6	8.5	9.9	8.6	9.2	9.8	9.8	11.5	13.8	11.7	12.4	11.1	10.2	9.2	11.0
28	10.9	10.6	9.4	9.7	8.6	8.6	9.6	8.4	9.2	9.7	9.4	11.5	13.7	11.6	12.3	11.3	10.4	9.0	10.7
32	10.9	10.6	9.5	9.7	8.7	8.7	9.4	8.2	9.2	9.6	9.8	11.4	13.6	11.6	12.3	11.5	10.7	9.2	10.4
36	10.8	10.5	9.5	9.8	8.8	8.9	9.4	8.3	9.1	9.4	9.7	11.4	13.5	11.5	12.2	11.3	10.8	9.3	10.0
40	10.8	10.5	9.5	9.8	8.9	8.9	9.4	8.3	8.8	9.0	9.6	11.3	13.4	11.4	12.2	11.4	10.8	9.3	9.8
44	10.7	10.4	9.6	9.8	8.9	8.9	9.5	8.3	8.6	8.5	9.5	11.3	13.4	11.4	12.1	11.3	10.9	9.3	9.9
48	10.7	10.4	9.5	9.9	8.9	9.0	9.5	8.2	8.4	8.4	9.2	11.3	13.3	11.3	12.0	11.3	10.9	9.2	9.7
52	10.6	10.3	9.5	9.9	8.9	8.9	9.4	8.2	8.4	8.1	8.9	11.2	13.2	11.2	11.9	11.3	10.9	9.3	10.0

Table 10. Oxygen concentration (ppm) profiles, continued.

Water depth (m)	09-Mar-22	27-Jun-22	20-Jul-22	08-Aug-22	26-Sep-22	12-Oct-22	02-Nov-22	03-Nov-22
1	14.4	10.1	11.8	11.2	10.0	10.7	11.6	10.2
2	14.3	10.2	11.8	11.2	10.0	10.7	11.6	10.1
3	14.3	10.5	11.8	11.2	10.0	10.6	11.5	9.9
4	14.2	10.5	11.8	11.3	10.0	10.6	11.5	10.0
5	14.2	10.6	11.8	11.3	10.0	10.6	11.4	9.8
6	14.2	10.7	11.8	11.3	9.9	10.5	11.4	9.8
7	14.1	10.7	11.8	11.3	9.8	10.5	11.4	9.7
8	14.1	10.8	11.8	11.3	9.8	10.5	11.4	9.7
9	14.1	10.8	11.8	11.3	9.8	10.5	11.3	9.7
10	14.1	10.8	11.8	11.3	9.7	10.5	11.3	9.7
11	14.1	10.8	11.8	11.3	9.7	10.4	11.3	9.7
12	14.0	10.8	11.8	11.3	9.6	10.4	11.3	9.7
13	14.0	10.8	11.8	11.3	9.6	10.4	11.3	9.6
14	14.0	10.8	11.8	11.3	9.5	10.4	11.3	9.6
15	13.9	10.8	11.8	11.3	9.5	10.3	11.2	9.6
16	13.9	10.8	11.7	11.3	9.4	10.3	11.2	9.6
17	13.9	10.8	11.7	11.3	9.4	10.2	11.2	9.6
18	13.9	10.8	11.7	11.3	9.3	10.2	11.2	9.6
19	13.9	10.8	11.7	11.3	9.2	10.1	11.2	9.6
20	13.8	10.7	11.7	11.3	9.1	10.0	11.1	9.6
24	13.8	10.7	11.7	11.3	9.3	10.0	11.1	9.5
28	13.7	10.7	11.7	11.4	9.4	9.9	10.8	9.3
32	13.6	10.7	11.7	11.4	9.6	9.9	10.5	9.0
36	13.5	10.7	11.7	11.4	9.7	10.0	10.4	8.8
40	13.4	10.6	11.6	11.4	9.7	10.2	10.1	8.8
44	13.4	10.6	11.6	11.5	9.6	10.2	9.8	8.8
48	13.3	10.6	11.6	11.5	9.5	10.2	9.6	8.7
52	13.2	10.6	11.4	11.5	9.5	10.3	9.5	8.7

Lake Wenatchee Secchi Depths

Table 11. Lake Wenatchee Secchi Depths from 2012-19, 2021-22. Values were averaged across two sampling locations per date (Figure 3). Secchi-depth samples were taken only in conjunction with other daylight sampling. When other samples (i.e. zooplankton, fish) were taken at night, Secchi depths were not available.

Year	Date	Secchi Depth (m)
2012	04-Jun-12	5.8
2012	05-Jul-12	5.9
2012	09-Aug-12	4.3
2012	06-Oct-12	7.2
2013	25-Jun-13	5.6
2013	30-Jul-13	5.4
2013	26-Aug-13	6.6
2013	23-Sep-13	6.9
2014	05-Jun-14	7.5
2014	23-Jun-14	7.7
2014	14-Jul-14	5.3
2014	04-Sep-14	8.0
2014	08-Oct-14	9.2
2015	01-Jun-15	5.7
2015	14-Jul-15	7.8
2015	28-Aug-15	7.9
2015	16-Sep-15	7.0
2016	08-Jun-16	5.5
2016	20-Jul-16	4.9
2016	31-Aug-16	7.1
2016	29-Sep-16	10.5
2017	12-Apr-17	6.8
2018	15-Jun-18	6.0
2018	01-Aug-18	5.9
2018	10-Sep-18	9.8
2018	03-Oct-18	10.5
2019	05-June-19	6.7
2019	08- Aug-19	7.6
2021	13-May-21	11.75
2021	16-June-21	7.7
2021	21-Sept-21	9.05
2022	30-June-22	6.0
2022	26-Sept-22	7.6

Lake Wenatchee Water Chemistry

Table 12. Lake Wenatchee water chemistry parameters for 2012, 2013 and 2017. Values are presented for both limnological stations and the average value across both stations. These are the only Fisheries and Oceans Canada data that were collected. Stations 1 and 2 are Limno 1 and Limno 2 shown in Figure 3.

Lake Wenatchee 2012		Station 1		Station 2			**Average**	
Date		Epilimnion	Hypolimnion	Epilimnion	Hypolimnion		**Epilimnion**	**Hypolimnion**
12-Jun-12	Phosphorus (total µg L^{-1})	6.5	7.4	nd	nd		**6.5**	**7.4**
	Alkalinity (total mg L^{-1})	12.8	nd	nd	nd		**12.8**	
	Calcium (Ca total mg L^{-1})	2.5	nd	nd	nd		**2.5**	
18-Sep-12	Phosphorus (total µg L^{-1})	5.3	9.8	5.0	5.2		**5.2**	**7.5**

Lake Wenatchee 2013		Station 1		Station 2			**Average**	
Date		Epilimnion	Hypolimnion	Epilimnion	Hypolimnion		**Epilimnion**	**Hypolimnion**
10-Jul-13	Alkalinity (total mg L^{-1})	7.2	nd	5.4	nd		**6.3**	**nd**
	Calcium (Ca total mg L^{-1})	2.0	nd	1.5	nd		**1.8**	**nd**

Lake Wenatchee 2017		Station 1		Station 2			**Average**	
Date		Epilimnion	Hypolimnion	Epilimnion	Hypolimnion		**Epilimnion**	**Hypolimnion**
23-Aug-17	Nitrogen (total µg L^{-1})	75.0	71.0	65.0	65.0		**70.0**	**68.0**
	Phosphorus (total µg L^{-1})	5.0	5.0	5.0	5.0		**5.0**	**5.0**
	Alkalinity (total mg L^{-1})	9.4	8.1	8.9	8.8		**9.2**	**8.5**
	Calcium (Ca total mg L^{-1})	2.6	2.5	2.6	2.5		**2.6**	**2.5**
21-Sep-17	Nitrogen (total µg L^{-1})	64.0	63.0	43.0	75.0		**53.5**	**69.0**
	Phosphorus (total µg L^{-1})	5.6	5.0	5.0	5.5		**5.3**	**5.3**
	Alkalinity (total mg L^{-1})	9.8	9.4	9.5	9.7		**9.7**	**9.6**
	Calcium (Ca total mg L^{-1})	2.7	2.6	2.7	2.6		**2.7**	**2.4**

Lake Wenatchee Phytoplankton

Table 13. Lake Wenatchee 2012-19, 2021-22 total (edible and non-edible) phytoplankton biovolumes (mm3 · m-3). Values approximate µg · L-1 wet weight. Euglena and Raphidophyta were not found to be present.

Date	Lake	Cyanophyta	Dinophyta	Cryptophyta	Euglenophyta	Chrysophyta	Haptophyta	Tribophyta	Chlorophyta	Raphidophyta	Bacillariophyta	**TOTAL**
04-Jun-12	Wenatchee	9.6	0.0	28.6	0.0	13.4	0.8	0.0	10.8	0.0	40.1	**103.3**
25-Jun-12	Wenatchee	2.8	0.8	13.4	0.0	1.2	0.1	0.0	38.2	0.0	53.1	**109.5**
05-Jul-12	Wenatchee	24.9	3.5	8.2	0.0	31.9	1.8	0.0	16.4	0.0	101.4	**188.2**
08-Aug-12	Wenatchee	63.0	5.9	24.1	0.0	23.9	0.0	0.0	16.4	0.0	245.3	**378.5**
10-Sep-12	Wenatchee	105.2	10.2	12.5	0.0	8.4	0.1	0.0	15.0	0.0	39.4	**190.9**
18-Sep-12	Wenatchee	1.8	19.0	21.2	0.0	210.0	1.0	0.0	9.0	0.0	19.6	**281.6**
6-Oct-12	Wenatchee	8.4	44.0	77.8	0.0	63.4	2.4	0.0	82.8	0.0	62.8	**341.6**
25-Jun-13	Wenatchee	19.5	4.0	28.2	0.0	253.5	0.3	0.0	17.1	0.0	62.8	**385.3**
29-Jul-13	Wenatchee	22.1	12.5	10.2	0.0	53.9	2.4	0.0	34.8	0.0	135.0	**270.8**
26-Aug-13	Wenatchee	2.3	109.3	12.2	0.0	12.6	11.4	1.1	17.0	0.0	69.0	**234.8**
23-Sep-13	Wenatchee	0.0	86.9	26.8	0.0	60.3	4.0	0.0	58.4	0.0	23.0	**259.3**
5-Jun-14	Wenatchee	4.1	0.0	29.1	0.0	4.8	8.8	0.0	2.5	0.0	66.4	**115.7**
14-Jul-14	Wenatchee	15.4	6.6	5.9	0.0	31.3	7.6	0.0	9.9	0.0	39.5	**116.2**
4-Sep-14	Wenatchee	1.7	93.7	17.7	0.0	57.3	2.1	0.0	47.1	0.0	80.1	**299.8**
30-Sep-14	Wenatchee	1.3	50.3	33.8	0.0	42.4	7.5	0.9	46.0	0.0	49.1	**231.4**
1-Jun-15	Wenatchee	3.2	16.9	10.7	0.0	52.2	3.1	0.0	9.8	0.0	109.7	**205.5**
14-Jul-15	Wenatchee	0.0	12.1	20.1	0.0	30.2	0.4	0.0	3.4	0.0	44.1	**110.3**
25-Aug-15	Wenatchee	0.0	55.2	16.8	0.0	46.3	1.0	0.0	1.4	0.0	10.7	**131.3**
16-Sep-15	Wenatchee	0.0	74.3	30.5	0.0	56.3	0.5	0.0	1.5	0.0	17.9	**181.1**
8-Jun-16	Wenatchee	0.3	4.5	20.1	0.0	6.3	1.8	0.0	0.7	0.0	26.4	**60.1**
20-Jul-16	Wenatchee	17.9	38.6	24.1	0.0	110.2	4.2	0.0	3.2	0.0	346.9	**545.0**
31-Aug-16	Wenatchee	1.1	53.9	30.8	0.0	25.7	0.8	0.0	3.9	0.0	664.2	**780.4**
14-Jun-17	Wenatchee	1.0	10.4	52.8	0.0	18.2	2.9	0.0	1.1	0.0	44.7	**131.1**
27-Jul-17	Wenatchee	18.4	6.9	14.1	0.0	76.4	7.6	0.0	8.4	0.0	181.1	**312.9**
8-Sep-17	Wenatchee	0.2	35.8	14.3	0.0	43.2	0.8	0.0	3.1	0.0	18.6	**116.0**
4-Oct-17	Wenatchee	0.3	32.1	30.3	0.0	49.8	4.3	0.0	2.6	0.0	61.9	**181.2**
14-Jun-18	Wenatchee	1.0	145.0	98.0	0.0	17.0	0.0	0.0	3.0	0.0	60.3	**324.3**
04-Aug-18	Wenatchee	1.0	164.0	104.0	0.0	29.0	0.0	0.0	11.0	0.0	156.0	**465.0**
10-Sep-18	Wenatchee	1.0	125.0	70.0	0.0	11.0	0.0	0.0	5.0	0.0	83.5	**295.5**
01-Oct-18	Wenatchee	1.0	110.0	144.0	0.0	12.0	0.0	0.0	16.0	0.0	90.0	**373.0**
05-Jun-19	Wenatchee	0.2	9.2	24.1	0.0	6.8	0.0	0.0	1.8	0.0	27.6	**69.8**
08-Aug-19	Wenatchee	0.2	19.5	119.5	0.0	35.5	0.0	0.0	41.0	0.0	109.4	**325.1**
03-Oct-19	Wenatchee	2.2	18.0	35.3	0.0	18.0	0.0	0.0	27.4	0.0	18.8	**119.8**
13-May-21	Wenatchee	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	**0.4**
28-Jul-21	Wenatchee	0.0	5.4	4.0	0.0	10.2	0.0	0.0	3.2	0.0	620.8	**643.7**
21-Sep-21	Wenatchee	0.2	4.7	11.3	0.0	3.4	0.0	0.0	11.5	0.0	76.3	**107.3**

20-Jun-22	Wenatchee	0.0	7.5	15.4	0.0	4.9	0.0	0.0	9.0	0.0	8.1	**44.9**
12-Oct-22	Wenatchee	0.0	14.9	27.2	0.0	5.9	0.0	0.0	7.0	0.0	3.5	**58.5**

Table 14. Lake Wenatchee TOTAL phytoplankton summary (µg per L wet weight) averaged over June-October.

	Cyanophyta	Dinophyta	Cryptophyta	Euglenophyta	Chrysophyta	Haptophyta	Tribophyta	Chlorophyta	Raphidophyta	Bacillariophyta
2012	31	12	27	0	50	1	0	27	0	80
2013	11	53	19	0	95	4	0	32	0	72
2014	6	38	22	0	34	7	0	26	0	59
2015	1	40	20	0	46	1	0	4	0	46
2016	6	32	25	0	47	2	0	3	0	346
2017	5	21	28	0	47	4	0	4	0	77
2018	1	136	104	0	17	0	0	9	0	97
2019	1	16	60	0	20	0	0	23	0	52
2020										
2021	0	3	5	0	5	0	0	5	0	232
2022	0	11	21	0	7			8		31

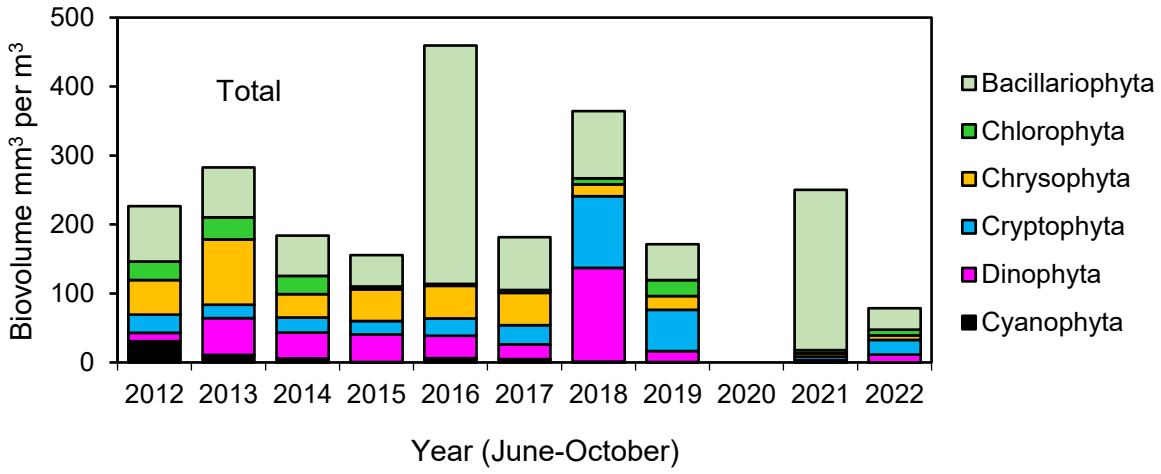


Table 15. Average June-October phytoplankton biovolume as mm3 per m3 (wet weight ug per L).

Table 16. Lake Wenatchee edible phytoplankton biovolumes (mm3 · m-3). Values approximate µg · L-1 wet weight.

Date	Lake	Cyanophyta	Dinophyta	Cryptophyta	Euglenophyta	Chrysophyta	Haptophyta	Tribophyta	Chlorophyta	Raphidophyta	Bacillariophyta	**TOTAL**
04-Jun-12	Wenatchee	9.6	0.0	28.6	0.0	13.4	0.8	0.0	3.2	0.0	26.4	**82.0**
25-Jun-12	Wenatchee	2.8	0.8	13.0	0.0	1.2	0.1	0.0	2.5	0.0	32.2	**52.5**
05-Jul-12	Wenatchee	24.9	3.5	8.2	0.0	31.9	1.8	0.0	16.4	0.0	79.4	**166.1**
08-Aug-12	Wenatchee	63.0	5.9	24.1	0.0	18.6	0.0	0.0	8.6	0.0	206.8	**326.9**
10-Sep-12	Wenatchee	105.2	10.2	12.5	0.0	5.7	0.1	0.0	13.4	0.0	24.0	**171.1**
18-Sep-12	Wenatchee	1.8	19.0	21.2	0.0	205.2	1.0	0.0	5.3	0.0	17.9	**271.4**
6-Oct-12	Wenatchee	8.3	36.3	77.8	0.0	50.1	2.4	0.0	80.6	0.0	24.0	**279.4**
25-Jun-13	Wenatchee	19.5	4.0	28.2	0.0	253.5	0.3	0.0	5.3	0.0	40.8	**351.4**
29-Jul-13	Wenatchee	22.1	12.5	10.2	0.0	42.9	2.4	0.0	8.5	0.0	107.3	**205.8**
26-Aug-13	Wenatchee	0.5	109.3	12.2	0.0	12.6	11.4	1.1	0.3	0.0	43.2	**190.5**
23-Sep-13	Wenatchee	0.0	86.9	26.8	0.0	60.3	4.0	0.0	54.4	0.0	12.8	**245.3**
5-Jun-14	Wenatchee	4.1	0.0	29.1	0.0	4.8	8.8	0.0	1.5	0.0	13.9	**62.3**
14-Jul-14	Wenatchee	15.4	6.6	5.9	0.0	31.3	7.6	0.0	6.7	0.0	22.1	**95.6**
4-Sep-14	Wenatchee	1.7	93.7	17.7	0.0	36.1	2.1	0.0	45.3	0.0	32.7	**229.4**
30-Sep-14	Wenatchee	1.3	50.3	33.8	0.0	41.8	7.5	0.9	44.5	0.0	25.5	**205.7**
1-Jun-15	Wenatchee	3.1	13.2	10.7	0.0	51.8	3.1	0.0	9.1	0.0	104.1	**195.1**
14-Jul-15	Wenatchee	0.0	6.7	20.1	0.0	29.7	0.4	0.0	0.8	0.0	8.4	**66.1**
25-Aug-15	Wenatchee	0.0	21.6	16.8	0.0	46.3	1.0	0.0	0.9	0.0	0.6	**87.3**
16-Sep-15	Wenatchee	0.0	23.1	30.5	0.0	55.0	0.5	0.0	0.7	0.0	0.0	**109.8**
8-Jun-16	Wenatchee	0.3	4.5	20.1	0.0	5.1	1.8	0.0	0.7	0.0	13.6	**46.0**
20-Jul-16	Wenatchee	17.9	38.6	24.1	0.0	12.9	4.2	0.0	3.1	0.0	322.0	**422.7**
31-Aug-16	Wenatchee	0.4	53.9	30.8	0.0	24.4	0.8	0.0	1.8	0.0	45.3	**157.4**
14-Jun-17	Wenatchee	1.0	2.4	52.8	0.0	18.2	2.9	0.0	1.1	0.0	1.2	**79.6**
27-Jul-17	Wenatchee	18.0	6.9	14.1	0.0	63.3	7.6	0.0	8.2	0.0	181.1	**299.2**
8-Sep-17	Wenatchee	0.2	21.9	14.3	0.0	11.7	0.8	0.0	2.5	0.0	4.7	**56.1**
4-Oct-17	Wenatchee	0.3	32.1	30.3	0.0	41.7	4.3	0.0	1.5	0.0	3.1	**113.2**
14-Jun-18	Wenatchee	1.0	145.0	98.0	0.0	17.0	0.0	0.0	1.0	0.0	14.0	**276.0**
04-Aug-18	Wenatchee	1.0	164.0	104.0	0.0	29.0	0.0	0.0	7.0	0.0	10.0	**315.0**
10-Sep-18	Wenatchee	1.0	125.0	70.0	0.0	11.0	0.0	0.0	4.0	0.0	24.0	**235.0**
01-Oct-18	Wenatchee	1.0	110.0	144.0	0.0	12.0	0.0	0.0	14.0	0.0	14.0	**295.0**
05-Jun-19	Wenatchee	0.2	9.2	24.1	0.0	6.6	0.0	0.0	0.5	0.0	5.5	**46.5**
08-Aug-19	Wenatchee	0.2	19.5	119.5	0.0	23.2	0.0	0.0	16.4	0.0	23.1	**202.2**
03-Oct-19	Wenatchee	2.2	18.0	35.3	0.0	2.0	0.0	0.0	7.2	0.0	9.0	**73.7**
13-May-21	Wenatchee	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.3**
28-Jul-21	Wenatchee	0.0	5.4	4.0	0.0	7.7	0.0	0.0	3.0	0.0	600.6	**620.8**
21-Sep-21	Wenatchee	0.2	4.7	11.3	0.0	1.5	0.0	0.0	11.2	0.0	11.0	**39.9**
20-Jun-22	Wenatchee	0.0	7.5	15.4	0.0	4.9	0.0	0.0	9.0	0.0	8.1	**44.9**
12-Oct-22	Wenatchee	0.0	14.9	27.2	0.0	5.9	0.0	0.0	7.0	0.0	3.5	**58.5**

Lake Wenatchee Zooplankton

Table 17. Lake Wenatchee zooplankton biomasses (µg · L-1 dry weight). Diaphanosoma were present (see Table 25 characterizing Sockeye fry stomach data), but were so rare that they were not detected in sampling. Cop. = copepodids. Only one Leptodiaptomus has been seen so far in Wenatchee during sampling from 2012-2022, so that genus of zooplankton is left out of the table.

Date	Rotifer total	Nauplii total	Diacyclops adults & copepodids	Hesperodiaptomus kenai adults & cop.	Epischura	Bosmina	Daphnia	Diaphanosoma	Leptodora	Total
06-Jun-12	0.14	0.13	0.04	32.97	0.00	0.00	0.65	0.00	0.00	**33.93**
05-Jul-12	0.18	0.30	0.06	32.84	0.00	0.23	2.20	0.00	0.00	**35.82**
08-Aug-12	4.40	0.15	1.45	10.61	0.00	5.46	4.11	0.00	0.00	**26.17**
09-Sep-12	19.00	0.09	1.05	15.07	0.00	1.24	0.34	0.00	0.36	**37.15**
06-Oct-12	0.97	0.03	1.00	3.32	0.00	2.65	0.18	0.00	0.57	**8.71**
25-Jun-13	1.09	0.30	0.64	36.93	0.00	4.07	5.38	0.00	0.04	**48.45**
30-Jul-13	2.68	0.40	0.46	6.78	0.00	1.96	3.76	0.00	0.27	**16.30**
26-Aug-13	0.34	1.52	1.02	2.96	0.00	0.00	0.07	0.00	0.39	**6.30**
23-Sep-13	0.15	0.23	1.21	7.14	0.00	0.00	0.17	0.00	0.42	**9.32**
05-Jun-14	0.07	0.26	0.38	5.43	0.00	0.08	0.23	0.00	0.00	**6.45**
26-Jun-14	0.15	0.17	1.26	37.35	0.00	0.45	0.49	0.00	0.00	**39.88**
14-Jul-14	1.17	0.18	2.78	14.19	0.00	5.29	0.39	0.00	0.01	**24.01**
11-Aug-14	3.47	0.34	1.17	5.79	0.00	6.39	0.34	0.00	0.97	**18.46**
04-Sep-14	0.07	0.49	1.16	6.38	0.00	0.04	0.43	0.00	6.04	**14.60**
29-Sep-14	0.10	0.29	0.89	2.34	0.00	0.16	0.88	0.00	0.24	**4.91**
04-Jun-15	0.22	0.26	0.12	4.20	0.00	0.26	5.13	0.00	0.00	**10.18**
25-Jun-15	0.41	0.04	0.13	28.80	0.00	1.17	27.46	0.00	0.44	**58.46**
14-Jul-15	0.20	0.24	0.08	10.68	0.00	2.57	41.05	0.00	1.39	**56.19**
05-Aug-15	0.26	0.11	0.07	15.44	0.00	5.07	10.49	0.00	15.29	**46.73**
27-Aug-15	0.26	0.52	0.49	1.88	0.00	0.39	0.81	0.00	4.86	**9.21**
16-Sep-15	0.03	0.19	0.25	5.67	0.00	26.84	0.70	0.00	0.00	**33.67**
09-Jun-16	0.12	0.03	0.15	15.16	0.13	0.70	0.95	0.00	0.00	**17.24**
29-Jun-16	0.35	0.05	1.00	10.67	0.00	1.23	0.38	0.00	0.08	**13.74**
20-Jul-16	2.14	0.08	1.04	19.91	0.00	0.76	2.76	0.00	0.18	**26.85**
10-Aug-16	0.93	0.08	0.40	4.86	0.00	3.11	2.55	0.00	1.00	**12.92**
31-Aug-16	1.55	0.18	0.57	4.81	0.00	0.10	2.22	0.00	0.00	**9.42**
06-Oct-16	0.19	0.05	0.17	9.34	0.00	6.96	9.86	0.00	0.30	**26.86**
14-Jun-17	1.10	0.09	0.02	65.80	0.00	0.03	0.27	0.00	0.00	**67.31**
6-Jul-17	0.72	0.25	0.26	12.42	0.00	0.44	0.12	0.00	0.00	**14.22**
27-Jul-17	6.84	0.06	1.91	5.05	0.00	7.44	1.05	0.00	0.12	**22.48**
21-Aug-17	2.84	0.21	1.84	22.04	0.00	22.67	6.88	0.00	18.56	**75.02**
9-Sep-17	1.35	0.29	0.77	7.58	0.00	0.15	2.54	0.00	0.82	**13.49**
4-Oct-17	0.42	0.11	0.29	2.57	0.00	0.45	1.99	0.00	0.52	**6.33**

Table 18. Lake Wenatchee zooplankton biomasses (µg · L^{-1} dry weight), continued.

Date	Rotifer total	Nauplii total	Diacyclops adults & cop	Hesperodiaptomus kenai adults & cop	Epischura	Bosmina	Daphnia	Diaphanosoma	Leptodora	Total
14-Jun-18	1.24	0.06	0.04	9.41	0.00	0.16	0.20	0.00	0.00	**11.11**
11-Jul-18	8.35	0.01	0.50	5.30	0.00	10.87	0.57	0.00	0.00	**25.60**
01-Aug-18	0.87	0.15	0.34	2.67	0.00	0.21	1.01	0.00	3.42	**8.68**
10-Sep-18	0.34	0.12	0.16	4.79	0.00	0.06	4.29	0.00	0.11	**9.87**
04-Oct-18	1.28	0.05	0.15	8.83	0.00	0.42	5.33	0.00	0.00	**16.07**
19-Mar-19	0.01	0.10	0.00	2.33	0.00	0.03	1.23	0.00	0.00	**3.70**
17-Apr-19	0.00	0.24	0.00	11.33	0.00	0.16	2.62	0.00	0.00	**14.36**
21-May-19	0.01	0.04	0.00	9.34	0.00	0.08	3.85	0.00	0.00	**13.33**
27-Jun-19	0.14	0.01	0.01	9.62	0.00	1.22	25.75	0.00	0.00	**36.75**
25-Jul-19	0.79	0.00	0.00	7.23	0.00	0.15	31.48	0.00	1.15	**40.79**
15-Aug-19	0.76	0.02	0.00	0.85	0.00	0.09	1.59	0.00	0.59	**3.91**
18-Sep-19	0.02	0.03	0.01	3.87	0.00	0.31	2.25	0.00	2.99	**9.47**
03-Oct-19	0.00	0.00	0.00	3.52	0.00	0.42	2.60	0.00	0.00	**6.55**
07-Nov-19	0.03	0.00	0.00	1.22	0.00	7.27	5.72	0.00	0.00	**14.23**
13-May-21	0.40	0.09	0.03	16.71	0.00	0.81	0.42	0.00	0.00	**18.44**
16-Jun-21	2.16	0.13	0.03	28.07	0.00	0.54	1.41	0.00	0.00	**32.34**
28-Jul-21	3.60	0.06	0.68	11.45	0.00	0.57	2.78	0.00	0.36	**19.50**
23-Aug-21	3.09	0.39	0.27	8.34	0.00	2.48	1.21	0.00	1.67	**17.44**
28-Oct-21	4.01	0.02	0.00	8.74	0.00	1.98	0.00	0.00	0.25	**15.00**
09-Mar-22	0.00	0.11	0.00	1.44	0.00	0.36	0.00	0.00	0.00	**1.91**
20-Apr-22	0.00	0.15	0.04	4.12	0.00	0.35	0.15	0.00	0.00	**4.81**
29-Jun-22	0.02	0.05	0.03	9.90	0.00	0.34	0.00	0.00	0.00	**10.32**
20-Jul-22	0.42	0.07	0.20	5.19	0.00	0.37	0.48	0.00	0.00	**6.74**
11-Aug-22	1.10	0.13	0.30	0.96	0.00	3.33	0.21	0.00	0.00	**6.02**
26-Sep-22	1.26	0.16	0.08	19.21	0.00	2.26	1.55	0.00	0.91	**25.42**
12-Oct-22	0.79	0.05	0.03	9.47	0.00	2.34	0.83	0.00	2.13	**15.63**
02-Nov-22	1.38	0.00	0.04	47.35	0.00	7.32	1.56	0.00	0.66	**58.31**

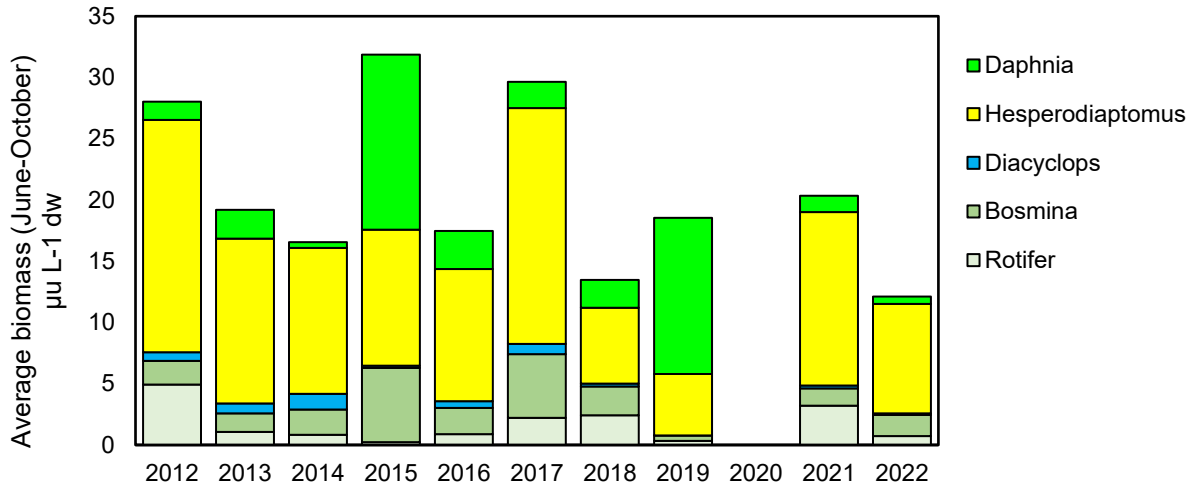


Figure 5. Annual zooplankton community composition and taxa-specific biomass estimates for Lake Wenatchee. Zooplankton were sampled between June and September or October of each year.

Table 19. Lake Wenatchee zooplankton density per L.

Date	Rotifer total	Nauplii total	Diacyclops adults & cop	Hesperodiaptomus kenai adults & cop	Epischura	Bosmina and Eubosmina	Daphnia	Diaphanosoma	Leptodora	Total
06-Jun-12	1.12	0.48	0.03	1.32	0.00	0.00	0.09	0.00	0.00	3.05
05-Jul-12	1.67	1.30	0.04	0.95	0.00	0.06	0.19	0.00	0.00	4.19
08-Aug-12	40.00	0.72	1.06	0.42	0.00	1.75	0.45	0.00	0.00	44.40
09-Sep-12	193.33	0.23	0.45	0.83	0.00	0.76	0.08	0.00	0.04	195.72
06-Oct-12	3.58	0.15	0.35	0.45	0.00	1.17	0.02	0.00	0.01	5.74
25-Jun-13	9.33	1.30	0.59	2.19	0.00	1.53	0.63	0.00	0.01	15.58
30-Jul-13	26.67	1.14	0.23	0.33	0.00	1.07	0.84	0.00	0.01	30.29
26-Aug-13	3.67	3.42	0.61	1.41	0.00	0.00	0.03	0.00	0.02	9.14
23-Sep-13	1.52	0.54	0.45	1.04	0.00	0.00	0.04	0.00	0.03	3.63
05-Jun-14	0.59	1.26	0.25	0.38	0.00	0.02	0.04	0.00	0.00	2.54
26-Jun-14	1.44	0.83	0.75	1.58	0.00	0.16	0.09	0.00	0.00	4.84
14-Jul-14	9.25	0.72	1.23	0.63	0.00	1.80	0.07	0.00	0.00	13.71
11-Aug-14	8.60	1.28	0.73	0.24	0.00	3.67	0.09	0.00	0.06	14.66
04-Sep-14	0.75	1.42	0.46	0.57	0.00	0.02	0.03	0.00	0.14	3.39
29-Sep-14	0.52	0.93	0.30	0.46	0.00	0.07	0.17	0.00	0.01	2.45
04-Jun-15	2.08	1.25	0.08	0.22	0.00	0.07	0.57	0.00	0.00	4.26
25-Jun-15	3.78	0.17	0.06	1.05	0.00	0.46	3.33	0.00	0.05	8.90
14-Jul-15	2.08	0.72	0.02	0.43	0.00	0.90	3.00	0.00	0.04	7.19
05-Aug-15	2.56	0.41	0.04	0.82	0.00	1.73	0.35	0.00	0.17	6.08
27-Aug-15	8.00	0.67	0.09	0.51	0.00	12.33	0.22	0.00	0.01	21.82
16-Sep-15	0.38	0.78	0.13	0.65	0.00	12.00	0.32	0.00	0.00	14.26
09-Jun-16	1.43	0.11	0.11	0.78	0.01	0.21	0.11	0.00	0.00	2.75
29-Jun-16	4.03	0.15	0.47	0.51	0.00	0.46	0.09	0.00	0.01	5.71
20-Jul-16	25.72	0.26	0.42	0.79	0.00	0.44	0.46	0.00	0.01	28.10
10-Aug-16	11.69	0.21	0.22	0.49	0.00	0.90	0.36	0.00	0.05	13.91
31-Aug-16	17.11	0.70	0.32	0.37	0.00	0.07	0.32	0.00	0.00	18.88
06-Oct-16	2.09	0.18	0.05	0.60	0.00	2.14	1.10	0.00	0.01	6.17
14-Jun-17	3.08	0.25	0.03	3.26	0.00	0.02	0.03	0.00	0.00	6.66
6-Jul-17	7.50	0.91	0.27	0.57	0.00	0.20	0.02	0.00	0.00	9.45
27-Jul-17	74.67	0.22	0.74	0.25	0.00	3.67	0.18	0.00	0.01	79.73
21-Aug-17	35.67	0.64	0.72	1.10	0.00	4.67	0.60	0.00	0.36	43.75
9-Sep-17	14.17	1.02	0.28	0.67	0.00	0.07	0.23	0.00	0.03	16.45
4-Oct-17	2.67	0.39	0.10	0.23	0.00	0.13	0.33	0.00	0.02	3.85

Table 20. Lake Wenatchee zooplankton density per L, continued.

Date	Rotifer total	Nauplii total	Diacyclops adults & cop	Hesperodiaptomus kenai adults & cop	Epischura	Bosmina and Eubosmina	Daphnia	Diaphanosoma	Leptodora	Total
14-Jun-18	12.33	0.24	0.06	0.47	0.00	0.07	0.03	0.00	0.00	13.19
11-Jul-18	82.67	0.03	0.24	0.23	0.00	4.50	0.15	0.00	0.00	87.81
01-Aug-18	16.00	0.49	0.13	0.19	0.00	0.11	0.28	0.00	0.09	17.28
10-Sep-18	3.56	0.28	0.05	0.37	0.00	0.04	0.73	0.00	0.01	5.02
04-Oct-18	11.67	0.14	0.06	0.46	0.00	0.29	2.67	0.00	0.00	15.27
19-Mar-19	0.08	0.26	0.00	0.32	0.00	0.01	0.46	0.00	0.00	1.12
17-Apr-19	0.02	0.24	0.00	0.71	0.00	0.06	0.44	0.00	0.00	1.46
21-May-19	0.07	0.10	0.00	0.65	0.00	0.04	0.52	0.00	0.00	1.38
27-Jun-19	1.83	0.05	0.01	0.47	0.00	0.69	6.50	0.00	0.00	9.55
25-Jul-19	9.83	0.02	0.01	0.38	0.00	0.09	3.17	0.00	0.03	13.51
15-Aug-19	10.33	0.07	0.01	0.09	0.00	0.03	0.29	0.00	0.02	10.83
18-Sep-19	0.24	0.05	0.01	0.82	0.00	0.14	0.91	0.00	0.04	2.21
03-Oct-19	0.02	0.01	0.00	0.41	0.00	0.21	1.30	0.00	0.00	1.95
07-Nov-19	0.37	0.01	0.00	0.11	0.00	3.53	1.97	0.00	0.00	5.98
26-Feb-20	2.22	0.13	0.00	0.08	0.00	0.06	0.01	0.00	0.00	2.49
13-May-21	4.17	0.19	0.02	0.96	0.00	0.26	0.09	0.00	0.00	5.69
16-Jun-21	22.33	0.41	0.04	1.42	0.00	0.16	0.21	0.00	0.00	24.55
28-Jul-21	37.33	0.12	0.21	0.56	0.00	0.30	0.39	0.00	0.01	38.92
23-Aug-21	13.33	0.87	0.08	0.60	0.00	1.57	0.09	0.00	0.06	16.59
28-Oct-21	40.33	0.13	0.01	0.45	0.00	0.86	0.00	0.00	0.01	41.78
09-Mar-22	0.02	0.30	0.00	0.25	0.00	0.13	0.00	0.00	0.00	0.70
20-Apr-22	0.04	0.43	0.03	0.52	0.00	0.12	0.02	0.00	0.00	1.15
29-Jun-22	0.17	0.13	0.03	0.44	0.00	0.11	0.00	0.00	0.00	0.89
20-Jul-22	3.67	0.18	0.13	0.22	0.00	0.14	0.03	0.00	0.00	4.36
11-Aug-22	4.22	0.27	0.11	0.17	0.00	1.57	0.06	0.00	0.00	6.39
26-Sep-22	5.83	0.33	0.03	1.05	0.00	1.39	0.21	0.00	0.02	8.85
12-Oct-22	6.42	0.11	0.03	0.42	0.00	1.11	0.14	0.00	0.03	8.25
02-Nov-22	4.33	0.02	0.02	1.16	0.00	1.42	0.14	0.00	0.02	7.10

Lake Wenatchee Fish Length, Weight, Density, and Water Depth

*Table 21. Lake Wenatchee age-0 and age-1 Sockeye Salmon densities, lengths and weights. The estimated total number of limnetic fish were split into age-0, age-1, and other fish (>15cm) as per the methods section. As noted in there, the release of hatchery-origin Sockeye Salmon was terminated after brood year 2011, and thus densities for surveys in 2011 and 2012 represent a mixture of both hatchery and wild-origin fish of unknown proportions. Larger fish (>15 cm fork length) are likely Mountain Whitefish (*Prosopium williamsoni*) and Bull Trout (*Salvelinus confluentus*). In earlier years, age-0 and age-1 juveniles were not split (see text). Note that 12-Apr-17 is included as BY 2014, even though the usual cut-off date is March 20th or thereabouts. "nd" means "no data." For December 20, 2020 through March 31, 2022, a US Geological Survey crew conducted the echosounding and collected biological samples, but ONA fisheries staff reported lengths and weights.*

Brood year	Sample date	Sockeye age	Total no. limnetic fish per lake	95% inter-transect variation	Mean juvenile Sockeye density (/ha)	Mean length mm (SD)	Mean weight g (SD)	Sockeye biosample size	Mean fish >15 cm density (/ha)	Provenance
2009	21-Sep-10	0,1	1,555,294	25%	1,549	58	2.02	64	nd	DFO
2010	20-Sep-11	0,1	2,343,003	28%	2,278	56	1.74	64	56	DFO
2010	1-Nov-11	0,1	1,977,114	23%	1,914	62	2.69	106	55	DFO
2011	25-Jun-12	0,1	1,800,734	22%	1,783	31	0.27	>125	11	DFO
2011	18-Sep-12	0,1	2,833,867	25%	2,789	56	1.89	>183	34	DFO
2012	10-Jul-13	0,1	2,934,335	26%	2,917	38 (3.4)	0.66 (0.22)	102	6	DFO
2012	23-Sep-13	0,1	2,778,970	47%	2,726	60	nd	89	42	DFO
2013	27-Oct-14	0,1	1,806,896	16%	1,787	58 (7.1)	2.06 (1.00)	178	13	DFO
2013	23-Feb-15	0,1	1,613,463	13%	1,583	74 (8.0)	4.15 (1.23)	102	24	ONA
2014	21-Sep-15	0,1	2,490,697	16%	2,478	59 (7.5)	2.11 (0.96)	146	2	DFO
2014	11-Mar-16	0	2,345,542	18%	2,173	70 (12.0)	3.67 (1.26)	102	75	ONA
2013	11-Mar-16	1			91	117 (5.9)	13.9 (2.82)	4		
2015	1-Sep-16	0	1,524,396	44%	1,203	60 (9.0)	2.4 (1.19)	115	87	ONA
2015	2-Nov-16	0	1,229,449	17%	1,094	73 (9.6)	4.2 (1.70)	106	61	ONA
2015	12-Apr-17	0	665,662	16%	574	72 (22.7)	4.01 (2.54)	120	39	ONA
2014	1-Sep-16	1			229	105 (6.7)	13.8 (2.63)	22		
2014	2-Nov-16	1			70	109 (7.5)	13.4 (2.78)	7		
2014	12-Apr-17	1			50	113 (4.1)	12.1 (1.30)	10		
2016	28-Jun-17	0	3,546,196	29%	3,486	35 (4.0)	0.31 (0.18)	158	11	ONA
2016	21-Aug-17	0	2,964,520	48%	2,864	54 (4.5)	1.61 (0.41)	155	59	ONA
2016	15-Sep-17	0	2,578,650	24%	2,291	56 (7.5)	1.81 (0.77)	100	46	ONA
2016	20-Nov-17	0	2,118,024	8%	1,856	72 (8.1)	3.79 (1.24)	138	21	ONA
2016	15-Mar-18	0	1,961,536	15%	1,856	72 (18.5)	3.75 (1.95)	37	41	ONA
2015	28-Jun-17	1			35	65	2.67	2		
2015	21-Aug-17	1			30	77	5.00	1		
2015	15-Sep-17	1			231	93	9.3	1		
2015	20-Nov-17	1			232	—	—	0		
2015	15-Mar-18	1			57	98	8.64	1		

Table 22. Continued. Lake Wenatchee age-0 and age-1 Sockeye Salmon densities, lengths and weights.

Brood year	Sample date	Sockeye age	Total no. limnetic fish per lake	95% inter-transect variation	Mean juvenile Sockeye density (/ha)	Mean length mm (SD)	Mean weight g (SD)	Sockeye biosample size	Mean fish >15 cm density (/ha)	Provenance
2017	13-Jun-18	0	1,756,739	35%	1,671	30 (3.5)	0.24 (0.24)	487	9	ONA
2017	13-Aug-18	0	1,991,128	62%	1,793	54 (6.5)	1.60 (0.64)	112	83	ONA
2017	9-Oct-18	0	1,438,910	15%	1,286	68 (7.0)	3.09 (0.96)	148	46	ONA
2017	6-Nov-18	0	1,119,895	19%	1,027	69 (4.3)	3.31 (0.96)	56	26	ONA
2016	13-Jun-18	1			70	72 (6.9)	3.70 (0.69)	14		
2016	13-Aug-18	1			107	104 (6.3)	12.42 (2.22)	38		
2016	9-Oct-18	1			102	109 (9.6)	13.83 (3.42)	5		
2016	6-Nov-18	1			62	nd	nd	0		
2018	28-Jul-19	0	1,801,650	26%	1,655	52 (8.0)	1.50 (0.98)	123	70	ONA
2018	30-Sep-19	0	1,907,140	22%	1,694	62 (9.8)	2.53 (1.14)	106	74	ONA
2018	24-Oct-19	0	1,174,076	24%	1,090	64 (9.7)	2.92 (1.48)	100	26	`
2018	29-Feb-20	0	458,992	26%	435	nd	nd	0	4	ONA
2017	28-Jul-19	1			72	118 (12.4)	19.53 (6.23)	7		
2017	30-Sep-19	1			131	15.3	39.91	1		
2017	24-Oct-19	1			55	14.15 (0.07)	28.82 (0.36)	2		
2017	29-Feb-20	1			19	nd	nd	0		
2019	7-Dec-20	0	1,202,763	21%	1,142	72.7 (8.7)	3.5 (1.30)	3	1	USGS, ONA
2019	31-Mar-21	0	929,416	16%	903	72 (1.3)	3.91 (1.33)	49	0	USGS, ONA
2019	7-Dec-20	1			54	nd	nd	nd		
2019	31-Mar-21	1			2152	nd	nd	1		
2020	24-Aug-21	0	2,622,438	25%	2,152	61 (7.2)	2.67 (0.78)	91	71	USGS, ONA
2020	28-Sep-21	0	2,683,353	24%	2,226	71 (8.1)	3.36 (1.11)	348	24	USGS, ONA
2020	11-Nov-21	0	2,121,376	15%	2,003	69 (9.8)	3.37 (0.97)	69	2	USGS, ONA
2020	31-Mar-22	0	1,827,568	12%	1,738	76 (9.0)	2.96 (0.94)	173	2	USGS, ONA
2019	24-Aug-21	1			389	nd	nd	0		
2019	28-Sep-21	1			422	117 (6.8)	16.37 (2.76)	8		
2019	11-Nov-21	1			108	111 (6.4)	14.83 (3.26)	2		
2019	31-Mar-22	1			80	121 (8.2)	11.51 (2.71)	9		
2021	27-Jun-22	0	1,032,255	43%	999	32 (2.2)	0.24 (0.07)	76	2	ONA
2021	10-Aug-22	0	1,183,437	55%	1077	nd	nd	0	11	ONA
2021	28-Sep-22	0	992,404	19%	901	64 (9.8)	2.83 (1.20)	11	4	ONA
2021	3-Nov-22	0	879,092	39%	778	68 (7.6)	3.27 (1.24)	11	6	ONA
2021	30-Mar-23	0	793,721	22%	693	30	0.15	28	2	ONA
2020	27-Jun-22	1			27	72 (8.2)	4.24 (1.23)	7		
2020	10-Aug-22	1			91	nd	nd	0		
2020	28-Sep-22	1			83	103	11.59	1		
2020	3-Nov-22	1			91	nd	nd	0		
2021	30-Mar-23	1			95	nd	nd	0		

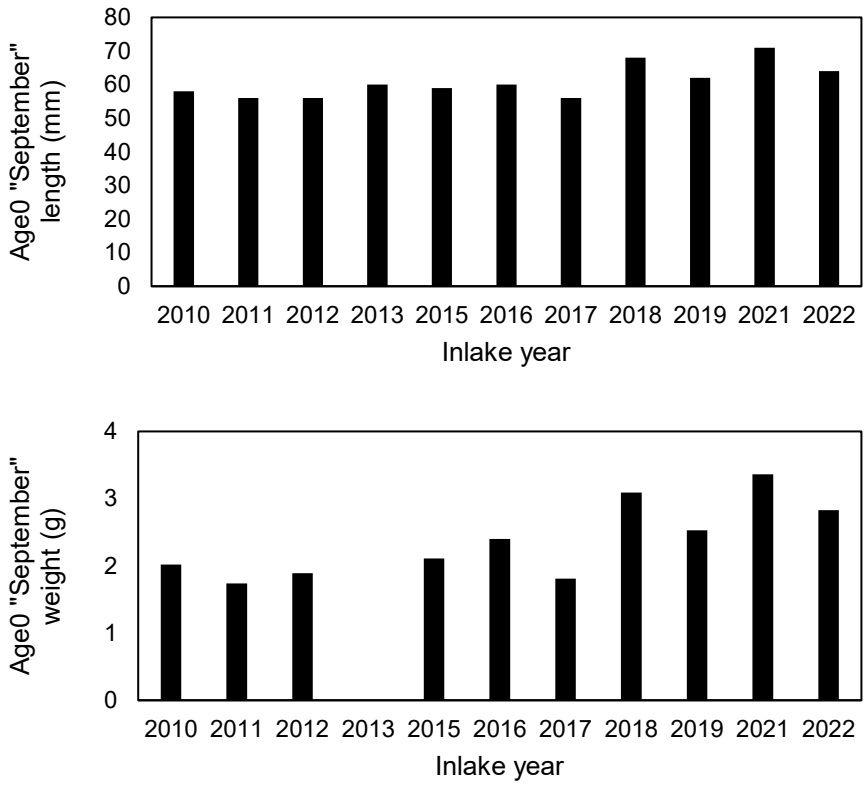


Figure 6. Age-0 lengths and weights recorded at the end of the summer. Sample data varied from year to year from (01 September to 09 October).

Table 23. Percent of juvenile Sockeye Salmon population with respect to water depth. Due to rounding error, not all of the columns add up to 100%.

2013	Depth	10-Jul-13	23-Sep-13
	2-5	nd	nd
	5-10	32	0
	10-15	35	0
	15-20	26	2
	20-30	6	27
	30-40	1	57
	40-50	1	14
	50-60	0	0

2017	Depth	28-Jun-17	21-Aug-17	15-Sep-17	20-Nov-17	15-Mar-18
	2-5	nd	nd	nd	nd	nd
	5-10	45	2	1	1	1
	10-15	30	4	1	2	1
	15-20	14	49	2	3	2
	20-30	9	43	52	22	6
	30-40	2	2	41	40	33
	40-50	0	0	3	21	46
	50-60	0	0	0	10	12

2018	Depth	13-Jun-18	13-Aug-18	09-Oct-18	06-Nov-18
	2-5	nd	nd	nd	nd
	5-10	51	1	1	1
	10-15	28	5	2	2
	15-20	11	28	3	2
	20-30	7	59	26	25
	30-40	1	7	55	49
	40-50	1	1	12	17
	50-60	1	0	2	3

Table 24. Continued. Percent of juvenile Sockeye Salmon population with respect to water depth.

2019	Depth	28-Jul-19	30-Sep-19	24-Oct-19	29-Feb-20
	2-5	nd	nd	nd	nd
	5-10	3	1	1	1
	10-15	5	2	1	4
	15-20	12	1	1	0
	20-30	64	15	13	2
	30-40	14	56	56	13
	40-50	1	20	24	31
	50-60	0	5	5	49

2021	Depth	24-Aug-21	28-Sep-21	11-Nov-21	29-Feb-20
	2-5	nd	nd	nd	nd
	5-10	2	0	0	0
	10-15	5	0	0	0
	15-20	1	1	3	1
	20-30	50	17	27	17
	30-40	35	60	34	49
	40-50	4	19	23	29
	50-60	3	3	11	4

2022	Depth	27-Jun-22	10-Aug-22	28-Sep-22	03-Nov-22
	2-5				
	5-10	31	16	8	3
	10-15	22	11	5	2
	15-20	9	13	4	3
	20-30	20	37	17	25
	30-40	10	14	37	48
	40-50	8	5	23	15
	50-60	2	3	6	3

Lake Wenatchee Fish Bioenergetics-Based Consumption vs. Zooplanktonic Prey Production

Bioenergetics-based production and consumption analysis demonstrated that the percentage of prey production that was consumed per day by Sockeye fry was always much lower than the carrying capacity (i.e. 2017 = average 6.0% of prey production consumed per day, 2018 = 14.1%, 2019 = 14.0%, 2021 = 25.5%, 2022 = 5.1%). In no case was there any indication that consumption by age-0 and age-1 Sockeye Salmon fry was capable of limiting prey availability. We conclude that for the summer-early fall period, Lake Wenatchee has unused zooplankton production capacity that could be consumed by Sockeye fry. We suggest that the lake would be able to support September Sockeye fry population densities of 4000 ha^{-1}, and that the lake could be managed for that density.

Table 25. Average number of prey per juvenile Sockeye Salmon stomach. When there are no data for age-1 fish on a given sampling date, that is because none were caught in the survey.

Date	Age	n	Diacyclops	Hesperodiaptomus	Epischura	Daphnia	Bosmina	Leptodora	Diaphanosoma	Chironomid larvae	Adult fly	
29-Jun-17	0	40	0.4	97.2	0.0	3.3	0.0	0.0	0.3	0.1	0.1	
31-Aug-17	0	30	9.3	0.0	19.8	7.0	144.7	0.0	15.2	0.0	0.8	
16-Sep-17	0	30	0.9	9.3	2.5	6.4	0.0	0.0	1.5	0.0	0.0	
29-Jun-17	1	1	0.0	960.0	24.0	4.0	0.0	0.0	4.0	0.0	1.0	
31-Aug-17	1	1	208.0	62.0	42.0	76.0	72.0	0.0	74.0	0.0	0.0	
16-Sep-17	1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0		25.0
13-Aug-18	0	30	2.3	4.3	2.5	12.5	0.2	0.0	5.8	0.0	0.1	
06-Nov-18	0	30	3.2	0.0	50.4	200.6	0.0	0.0	0.0	0.0	0.0	
13-Aug-18	1	30	6.5	10.8	106.2	93.2	0.0	0.0	45.5	0.0	1.0	
28-Jul-19	0	35	0.0	5.5	0.0	171.6	0.0	0.0	0.0	0.0	0.0	
30-Sep-19	0	30	0.8	7.5	0.0	171.7	9.2	0.0	0.0	0.0	0.0	
24-Oct-19	0	30	0.0	0.0	0.0	744.3	120.2	0.0	0.0	0.0	0.0	
28-Jul-19	1	7	0.0	105.8	0.0	2203.1	0.0	0.0	0.0	0.0	0.0	
30-Sep-19	1	1	0.0	16.0	0.0	10.0	1.0	0.0	0.0	0.0	1.0	
24-Oct-19	1	3	0.0	2.3	0.0	2957.3	389.3	0.0	0.0	0.3	42.7	
28-Sep-21	0	62	0.0	144.4	0.0	11.5	126.5	0.0	0.0	0.0	0.0	
11-Nov-21	0	29	0.0	15.2	0.0	0.0	171.0	0.0	0.0	0.0	0.2	
3-Mar-22	0	31	0.0	36.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	
28-Sep-21	1	8	0.0	144.2	0.0	16.7	0.0	0.8	0.0	0.0	0.4	
11-Nov-21	1	2	0.0	44.0	0.0	0.0	171.0	0.0	0.0	0.0	0.0	
3-Mar-22	2	9	0.0	3.9	0.0	0.0	0.9	0.0	0.0	0.0	0.3	

27-Jun-22	0	76	0.0	9.0	0.0	0.0	0.2	0.0	0.0	0.1	0.0
26-Sep-22	0	11	0.0	24.8	0.0	23.0	520.5	3.6	0.7	0.0	0.0
03-Nov-22	0	11	0.0	232.7	0.0	105.5	221.8	21.8	0.0	0.0	0.0
26-Sep-22	1	1	0.0	141.0	0.0	6.0	978.0	6.0	9.0	0.0	4.0

Table 26. Production vs consumption comparison, brief summary. Red font is used for emphasis.

2017	Average rate of prey (zooplankton) production per day	2.360
	Average rate of zooplankton consumption per day	0.141
	% production consumed	5.99
	Age-0 sockeye density September	2557
	Age-1 sockeye density September	25
2018	Average rate of prey (zooplankton) production per day	0.721
	Average rate of zooplankton consumption per day	0.102
	% production consumed	14.11
	Age-0 sockeye density September	1387
	Age-1 sockeye density September	102
2019	Average rate of prey (zooplankton) production per day	0.954
	Average rate of zooplankton consumption per day	0.133
	% production consumed	13.95
	Age-0 sockeye density September	1821
	Age-1 sockeye density September	131
2021	Average rate of prey (zooplankton) production per day	0.807
	Average rate of zooplankton consumption per day	0.206
	% production consumed	25.50
	Age-0 sockeye density September	2226
	Age-1 sockeye density September	421
2022	Average rate of prey (zooplankton) production per day	2.019
	Average rate of zooplankton consumption per day	0.102
	% production consumed	5.07
	Age-0 sockeye density September	902
	Age-1 sockeye density September	83

Table 27. Detailed summaries of the five bioenergetic simulations that were completed for Lake Wenatchee during 2017, 2018, 2019, 2021 and 2022. Red font is used for emphasis.

2017	
Simulation dates	28 June 2017 - 15 Sept 2017
Duration	80 days
Average age-0 density in simulation	3063 ha^{-1}
Age-0 density in the field	28 June 2017 = 3485 ha^{-1}; 22 Aug = 2936 ha^{-1}; 15 Sept = 2532 ha^{-1}
Average age-0 weight in simulation	1.1 g ww (simulation start weight = 0.3 g, end weight = 1.8 g)
Average age-1 density in simulation	23 ha^{-1}
Age-1 density in the field	28 June 2017 = 44 ha^{-1}; 22 Aug = 19 ha^{-1}; 15 Sept = 25 ha^{-1}
Average age^{-1} weight in simulation	4.9 g ww (simulation start weight = 2.7 g, end weight = 9.3 g)
Average temperature at fish depth	9.8^{O}
Diet collection dates	28 June 2017; 22 Aug 2017; 15 Sept 2017
Average prey biomass in field (by species)	*Daphnia* = 2.1 µg L^{-1} dw; *Bosmina* = 6.1, *Diacyclops* = 1.0; *Hesperodiaptomus* = 22.6
Average total zooplankton biomass	31.8 µg L^{-1} dw
Average zooplankton production (by species)	*Daphnia* = 0.11 µg L^{-1} d^{-1} dw; *Bosmina* = 0.32, *Diacyclops* = 0.024; *Hesperodiaptomus* = 1.90
Average total zooplankton production	2.36 µg L^{-1} d^{-1} dw
Average consumption by fish (by prey species)	*Daphnia* = 0.02 µg L^{-1} d^{-1} dw; *Bosmina* = 0.03, *Diacyclops* = 0.001; *Hesperodiaptomus* = .09
Average consumption of zooplankton by fish	0.14 µg L^{-1} d^{-1} dw ; plus dipterans 0.02 µg L^{-1} d^{-1} dw
Percent prey biomass consumed (by species)	*Daphnia* = 1%; *Bosmina* = 0.5%, *Diacyclops* = 0.1%; *Hesperodiaptomus* = 0.4%
Percent of total prey biomass consumed	0.4% d^{-1}
Percent prey production consumed (by species)	*Daphnia* = 18% d^{-1}; *Bosmina* = 9%, *Diacyclops* = 4%; *Hesperodiaptomus* = 5%
Percent of total prey production consumed	6.0% d^{-1}

Year 2018	
Simulation dates	13 June - 05 Nov 2018
Duration	146 days
Average age-0 density in simulation	1294 ha^{-1}
Age-0 density in the field	13 June 2018 = 1632 ha^{-1}; 13 Aug 1240 ha^{-1}; 09 Oct = 12851 $ha^{-1;}$ 06 Nov = 1027 ha^{-1}
Average age-0 weight in simulation	1.9 g ww (simulation start weight = 0.3 g, end weight = 3.3 g)
Average age-1 density in simulation	68 ha^{-1}
Age-1 density in the field	13 June 2018 = 69 ha^{-1}; 13 Aug 74 ha^{-1}; 09 Oct = 102 $ha^{-1;}$ 06 Nov = 63 ha^{-1}
Average age-1 weight in simulation	10 g ww (simulation start weight = 2.8 g, end weight = 15.5 g)
Average temperature at fish depth	10.5^{O}
Diet collection dates	13 Aug 2018; 06 Nov 2018
Average prey biomass in field (by species)	*Daphnia* = 2.3 µg L^{-1} dw; *Bosmina* = 2.4; *Diacyclops* = 0.2; *Hesperodiaptomus* = 6.2
Average total zooplankton biomass	11.1 µg L^{-1} dw
Average zooplankton production (by species)	*Daphnia* = 0.07 µg L^{-1} d^{-1} dw; *Bosmina* = 0.16, *Diacyclops* = 0.004; *Hesperodiaptomus* = 0.49
Average total zooplankton production	0.72 µg L^{-1} d^{-1} dw
Average consumption by fish (by prey species)	*Daphnia* = 0.03 µg L^{-1} d^{-1} dw; *Bosmina* = 0.001, *Diacyclops* = 0.002; *Hesperodiaptomus* = .06
Average consumption of zooplankton by fish	0.1017 µg L^{-1} d^{-1} dw (zooplankton only); plus dipterans 0.01 µg L^{-1} d^{-1} dw
Percent prey biomass consumed (by species)	*Daphnia* = 1.0%; *Bosmina* = 0.00%, *Diacyclops* = 0.5%; *Hesperodiaptomus* = 0.6%
Percent of total prey biomass consumed	0.5 % d^{-1}
Percent prey production consumed (by species)	*Daphnia* = 36% d^{-1}; *Bosmina* = 0%, *Diacyclops* = 25%; *Hesperodiaptomus* = 8%
Percent of total prey production consumed	8.3% d^{-1}

Year 2019	
Simulation dates	28 July - 24 October 2019
Duration	89 days
Average age-0 density in simulation	1549 ha^{-1}
Age-0 density in the field	28 July 2019 = 1655 ha^{-1}; 30 Sept = 1690 ha^{-1}; 24 Oct = 1091 ha^{-1}
Average age-0 weight in simulation	2.1 g ww (simulation start weight = 1.5 g, end weight = 2.9 g)
Average age-1 density in simulation	68 ha^{-1}
Age-1 density in the field	28 July 2019 = 71 ha^{-1}; 30 Sept = 131 ha^{-1}; 24 Oct = 54 ha^{-1}
Average age-1 weight in simulation	23.6 g ww (simulation start weight = 19.6 g, end weight = 28.8 g)
Average temperature at fish depth	11.0^{O}
Diet collection dates	28 July 2019, 30 Sept 2019, and 24 Oct 2019
Average prey biomass in field (by species)	*Daphnia* = 8.7 µg L^{-1} dw; *Bosmina* = 1.6; *Diacyclops* = 0.0; *Hesperodiaptomus* = 3.3
Average total zooplankton biomass	13.7 µg L^{-1} dw
Average zooplankton production (by species)	*Daphnia* = 0.42 µg L^{-1} d^{-1} dw; *Bosmina* = 0.05, *Diacyclops* = 0.00; *Hesperodiaptomus* = 0.49
Average total zooplankton production	0.95 µg L^{-1} d^{-1} dw
Average consumption by fish (by prey species)	*Daphnia* = 0.11 µg L^{-1} d^{-1} dw; *Bosmina* = 0.004, *Diacyclops* = <0.001; *Hesperodiaptomus.* = 0.02,
Average consumption of zooplankton by fish	0.133 µg L^{-1} d^{-1} dw plus dipterans 0.002 µg L^{-1} d^{-1} dw
Percent prey biomass consumed (by species)	*Daphnia* = 1.3%; *Bosmina* = 0.24%, *Diacyclops* = 0.00%; *Hesperodiaptomus* = .061%
Percent of total prey biomass consumed	1.02 % d^{-1}
Percent prey production consumed (by species)	*Daphnia* = 26.4% d^{-1}; *Bosmina* = 8.2%, *Diacyclops* = 0.0%; *Hesperodiaptomus* = 4.2%
Percent of total prey production consumed	14.11% d^{-1}

Year 2021	
Simulation dates	24 August – 11 Nov 2021
Duration	79 days
Average age-0 density in simulation	2454ha^{-1}
Age-0 density in the field	24 Aug 2021 = 2152 ha^{-1}, 28 Sept 2021 = 2226 ha^{-1}, 11 Nov 2021 = 2003 ha^{-1}
Average age-0 weight in simulation	3.08 g ww (simulation start weight = 2.7g, 3.4g)
Average age-1 density in simulation	293 ha^{-1}
Age-1 density in the field	24 Aug 2021 = 390 ha^{-1}, 28 Sept 2021 = 421 ha^{-1}, 11 Nov 2021 = 108 ha^{-1}
Average age-1 weight in simulation	14.7 g (simulation start weight = 14.8, end weight 14.8g). Low sample sizes, no change is wt.)
Average temperature at fish depth	10.0^{O}
Diet collection dates	28 Sept 2021, 11 Nov 2021
Average prey biomass in field (by species)	*Daphnia* = 1.33 µg L^{-1} dw; *Bosmina* = 1.68; *Diacyclops* = 0.0; *Hesperodiaptomus* = 9.51
Average total zooplankton biomass	12.52 µg L^{-1} dw
Average zooplankton production (by species)	*Daphnia* = 0.006 µg L^{-1} d^{-1} dw; *Bosmina* = 0.197, *Diacyclops* = 0; *Hesperodiaptomus* = 0.604
Average total zooplankton production	0.81 µg L^{-1} d^{-1} dw
Average consumption by fish (by prey species)	*Daphnia* = 0.017 µg L^{-1} d^{-1} dw; *Bosmina* = 0.012, *Diacyclops* = 0.000; *Hespero.* = 0.177
Average consumption of zooplankton by fish	0.2058 µg L^{-1} d^{-1} dw
Percent prey biomass consumed (by species)	*Daphnia* = 1.25%; *Bosmina* = 0.74%, *Diacyclops* = 0.00%; *Hesperodiaptomus* = 1.86%
Percent of total prey biomass consumed	1.64 % d^{-1}
Percent prey production consumed (by species)	*Daphnia* = 276.2% d^{-1}; *Bosmina* = 6.3%, *Diacyclops* = 0.0%; *Hesperodiaptomus* = 29.3%
Percent of total prey production consumed	25.5% d^{-1}

Year 2022	
Simulation dates	27 June 2022 - 02 Nov 2022
Duration	130 days
Average age-0 density in simulation	1040 ha^{-1}
Age-0 density in the field	27 June 2022 = 999 ha^{-1}, 10 Aug = 1440 ha^{-1}, 28 Sept 2022 = 902 ha^{-1}, 03 Nov 2022 = 778 ha^{-1}
Average age-0 weight in simulation	2.2 g ww (simulation start weight = 0.3g, end weight = 4.3g)
Average age-1 density in simulation	98 ha^{-1}
Age-1 density in the field	27 June 2022 = 26 ha^{-1}, 10 Aug = 121 ha^{-1}, 28 Sept 2022 = 83 ha^{-1}, 03 Nov 2022 = 91 ha^{-1}
Average age-1 weight in simulation	9.0 g (simulation start weight = 4.3g, end weight = 14.5 g)
Average temperature at fish depth	10.7^{O}
Diet collection dates	27 June 2022, 26 Sept 2022, 03 Nov 2022
Average prey biomass in field (by species)	*Daphnia* = 0.7 µg L^{-1} dw; *Bosmina* = 2.6; *Diacyclops* = 0.0; *Hesperodiaptomus* = 15.3
Average total zooplankton biomass	20.04 µg L^{-1} dw
Average zooplankton production (by species)	*Daphnia* = 0..02 µg L^{-1} d^{-1} dw; *Bosmina* = 0.15, *Diacyclops* = 0.00; *Hesperodiaptomus* = 0.1.84
Average total zooplankton production	2.019 µg L^{-1} d^{-1} dw
Average consumption by fish (by prey species)	*Daphnia* = 0.005 µg L^{-1} d^{-1} dw; *Bosmina* = 0.019, *Diacyclops* = 0.000; *Hespero.* = 0.081
Average consumption of zooplankton by fish	0.1023 µg L^{-1} d^{-1} dw plus dipterans 0.006 and Leptodora 0.007 µg L^{-1} d^{-1} dw
Percent prey biomass consumed (by species)	*Daphnia* = 1.0%; *Bosmina* = 1.4%, *Diacyclops* = 0.00%; *Hesperodiaptomus* = 2.3%
Percent of total prey biomass consumed	1.2 % d^{-1}
Percent prey production consumed (by species)	*Daphnia* = 28.4% d^{-1}; *Bosmina* = 21.9%, *Diacyclops* = 0.0%; *Hesperodiaptomus* = 19.8%
Percent of total prey production consumed	5.07% d^{-1}

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