Observations of Size-at-Age for Sockeye Salmon (*Oncorhynchus nerka*) Smolts from Great Central Lake, British Columbia (1971-2018)

Kim D. Hyatt, Howard W. Stiff and D. Paul Rankin

Biological Sciences Branch
Department of Fisheries and Oceans
Pacific Biological Station
Nanaimo, British Columbia V9R 5K6

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by

Kim D. Hyatt[1], Howard W. Stiff[1] and D. Paul Rankin[2]

[1] Salmon in Regional Ecosystems Program, and
[2] Retired, Science Branch, Department of Fisheries and Oceans
Pacific Biological Station, British Columbia, V9R 5K6

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ABSTRACT

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Personnel from the Salmon in Regional Ecosystems Program (SIRE-P) and its predecessors have conducted annual sampling of juvenile salmon (*Oncorhynchus nerka*) migrating seaward from Great Central Lake in most years between 1971 and 2018. Observations of biological traits of smolts (e.g. size at sea entry) help inform ongoing research into the likely origins of large variations in production exhibited by Sockeye Salmon populations in freshwater and marine ecosystems in Canada's Pacific region. For Great Central Lake, smolts were collected from a fyke net set on one to several dates during the spring migration period (April to early June) at the outlet of the lake (Robertson Creek). Individual fish from sample collections were processed and measured for fork length and weight, and scales were taken. Fish weight (wet weight in grams) and length (fork length in mm) were obtained from either fresh, frozen or preserved samples but all observations here are expressed as fresh measure equivalents. Summary statistics of size-at-age of Sockeye Salmon smolts are tabulated in this report by survey date and age. A consistent annual index of Great Central Lake Sockeye smolt size was identified for the predominant age 1 class of migrants, based on a subset of the sample observations collected between April 24^{th} (10^{th} percentile) and June 2^{nd} (90^{th} percentile) of each year. The all-year weighted averages for fork length and wet weights of age 1.0 Sockeye smolts exiting Great Central Lake were 7.2 cm and 3.2 grams respectively. The weighted averages for fork length and wet weights of age 2.0 Sockeye smolts were 8.8 cm and 5.8 grams respectively.

RÉSUMÉ

Hyatt, K. D., Stiff, H. W. and Rankin, D. P. 2019. Observations of Size-at-Age for Sockeye Salmon (*Oncorhynchus nerka*) Smolts from Great Central Lake, British Columbia (1971-2018). Can. Manu. Rep. Fish. Aquat. Sci. 3189: v + 100 p.

Les employés du Programme du saumon dans les écosystèmes régionaux et leurs prédécesseurs ont effectué des échantillonnages annuels de saumons juvéniles (*Oncorhynchus nerka*) qui dévalaient du lac Great Central la plupart des années entre 1971 et 2016. L’observation des caractéristiques biologiques des saumoneaux (p. ex. la taille à l’entrée en mer) aide à orienter les recherches en cours sur les origines probables des grandes variations de la production des populations de saumon rouge dans les écosystèmes d’eau douce et marins de la région du Pacifique du Canada. Dans le cas du lac Great Central, les saumoneaux ont été capturés à l’aide d’un verveux à une ou plusieurs dates durant la migration printanière (d’avril à début juin) à la sortie du lac (ruisseau Robertson). Les poissons individuels ont été traités; on a mesuré leur longueur à la fourche et leur poids, et prélevé des écailles. Le poids (poids humide en grammes) et la longueur (longueur à la fourche en mm) du poisson ont été obtenus à partir d’échantillons frais, congelés ou conservés, mais toutes les observations sont exprimées ici en équivalents de mesures fraîches. Des statistiques sommaires sur la taille selon l’âge des saumoneaux rouges sont présentées dans le présent rapport par date de relevé et par âge. Un indice annuel uniforme de la taille des saumoneaux rouges du lac Great Central a été établi pour la classe d’âge 1 prédominante des migrateurs, d’après un sous-ensemble des observations des échantillons recueillies entre le 24 avril (10e centile) et le 2 juin (90e centile) de chaque année. Les moyennes sur toute l’année pour la longueur à la fourche et le poids humide des saumoneaux rouges d’âge 1 quittant le lac Great Central étaient de 7,2 cm et 3,2 grammes respectivement. Les moyennes sur toute l’année pour la longueur à la fourche et le poids humide des saumoneaux rouges d’âge 2 étaient de 8,8 cm et de 5,8 grammes respectivement.

INTRODUCTION

The Salmon in Regional Ecosystems Program (SIRE-P), and its predecessors, have been involved in a series of short- to medium-term studies spanning a roughly forty-year interval focused on more than thirty Sockeye Salmon conservation units (CUs) in Canada's Pacific region. Funding of short-term studies has been received from a variety of federal, provincial and industry sources with interests in salmon enhancement (Hyatt et al. 1984, 2004, 2005a; Hyatt and Stockner 1985), stock assessment (Hyatt and Steer 1987; Hyatt et al. 1994, 2000; McCreight 1994; Hyatt and Rankin 1999), habitat and stock restoration (Johannes et al. 1999, 2002; Hyatt et al. 2003; Hyatt and Stockwell 2019), climate change (Hyatt et al. 2005b, 2015b, 2016, 2018a; Stiff et al. 2018) and food-web research (McQueen et al. 2007; Hyatt et al. 2005b, 2011, 2018). Although most of these programs, focused on individual Sockeye CUs, have been completed and terminated within less than five years, a few of these Sockeye CUs, associated with each of several distinctive freshwater and marine adaptive zones (Holtby and Ciruna 2007), have been subjects of sufficient interest to permit assembly of longer term (>25 years) data sets on life-stage specific biological traits and abundance. Multidecadal patterns of annual production variations exhibited as total returns of adults (i.e. catch plus escapement) by these CUs have been documented by Hyatt et al. (2005b, 2016a, 2018a) in DFO's State of the Pacific Ocean reports, but assembly and documentation of associated abundance and biological trait observations by life-stage (Hyatt et al. 2015b; Stiff et al. 2018), to make these data more widely available to the scientific community, remains a work in progress.

In this report we summarize observational data collected to assess biological traits (size and age) of Sockeye Salmon smolts sampled during spring seaward migrations from Great Central Lake from 1977-2018. Smolt catch and effort data are analyzed to derive a consistent, representative estimate of mean annual Great Central Lake Sockeye smolt size by age class. The time-series of annual length and weight estimates by age are extended back to 1971 by the inclusion of weighted mean annual estimates from prior studies (Robinson and Barraclough 1972a, 1972b, 1973, 1975a, 1975b, 1976).

This report includes:

(1) a general map of sampling locations;

(2) smolt catch and effort summary tables and plots;

(3) plots of length/weight regressions and frequency distributions; and

(4) plots and tables of observed and "best" estimates of smolt size by year and age.

The results reported here are derived from projects designed to deliver on a variety of objectives but now comprise a sufficiently long time series of obervations to have utility as a basis for analysis of lake carrying capacity (Hyatt et al. 2011) and identification of the factors operating to control salmon production variations in either freshwater (Hyatt and Rankin 1999) or marine ecosystems (Hyatt et al. 2015b).

STUDY AREA

Great Central Lake, located in central Vancouver Island (49°22'N x 125°15'W; elev. 82 m), is a moderately deep, oligotrophic waterbody (mean depth 212 m; max depth 270 m) with a surface area of approximately 5,100 hectares, draining a 35,000 hectare watershed (Hyatt et al. 2011, 2016; Rutherford et al. 1986; Stockner and Shortreed 1985). The lake drains from the northeast end via Stamp River and Robertson Creek, which joins Stamp River approximately 3 km downstream. The Stamp River ultimately joins the Sproat River to form the Somass River flowing into Alberni Inlet (Figure 1, Figure 2).

Where Robertson Creek flows into the Stamp River is the site of the Robertson Creek Hatchery (RCH), a salmon enhancement facility producing up to 7 million Chinook, 180,000 Coho, and 100,000 Steelhead smolts annually. Hatchery personnel also distribute fertilizing nutrients into Great Central Lake on an annual basis to indirectly stimulate juvenile Sockeye salmon production via phyto- and zooplankton growth. Great Central Lake fertilization efforts have occurred annually since 1970, with the exception of 1974, 1975 and 1976 (Hyatt et al. 2016b).

METHODS

Readers are encouraged to review Hyatt et al. (1984) and Rankin et al. (1994) for details regarding smolt sample acquisition and processing methods. However, the general methodology for the Great Central Lake system is outlined briefly here.

Smolt surveys were conducted during April through June. Survey timing was designed to encompass the period of peak smolt migrations (Rankin et al. 1994). Smolts captured during these surveys include: large numbers of Sockeye (*Oncorhynchus nerka*), smaller numbers of Coho (*O. kisutch*), Chinook (*O. tshawytsha*), and in some cases, Pink (*O. gorbuscha*) and Chum (*O. keta*) fry. The results presented here are limited to Sockeye smolts as samples of other species collected were not processed.

Most Sockeye salmon smolts leave Great Central Lake via Stamp River (the main outlet), but some also emigrate via Robertson Creek. Beginning in 1977[1], migrating smolts were captured in Robertson Creek via fyke-net (2 x 2 x 7 m length; Gjernes 1979) below the bridge adjacent to the coffer dam separating the creek from Great Central Lake (Rankin et al. 1994). On any given sampling date, the fyke-net was set one hour before sunset for a duration of 3 to 4 hours and checked at half-hour intervals as per the guidelines outlined in Hyatt et al. (1984). This period includes the time of peak diel smolt migration activity (Wood et al. 1993).

A sample size of 100-200 Sockeye smolts per sample night was recommended for each date sampled. If fewer than 100 smolts were caught during the first 4 hours of sampling, the net was left for the remainder of the night (about 6 hours) and retrieved in the morning. All fish captured and retained were classified by species and preserved with labels identifying system, date, start and stop time, set number, species counts, initials of collection crew and total number of collections obtained during each survey date.

As of 1990, biosamples have also been obtained from smolts retrieved via hand-operated dipnet from Glover Creek pond, an intake pool associated with the Robertson Creek hatchery facility. Dipnet samples often occurred on the same date as Robertson Creek fyke-net samples for data

[1] From 1971 - 1976, migrating smolts were captured at a weir in Robertson Creek (Robinson and Barraclough 1972a; 1976).

comparison. In recent years, dipnetting at this location has become the principal source of smolt samples.

Sampled fish were generally preserved in buffered 3.7% formaldehyde for at least five weeks prior to laboratory processing for species, length, weight and scales. Alternatively, fish were preserved in 70% ethyl alcohol, and, in some cases, frozen prior to chemical preservation. Subsequently, in the laboratory at the Pacific Biological Station (PBS), fish were identified to species, and Sockeye smolts were weighed to 0.01 g and measured to 1 mm.

PBS crews performed all sampling between 1977 and 2003, 2012, 2013 and 2015. Fyke-net sampling by PBS personnel was reduced in frequency to 0 – 2 sample dates per year as of 2003. PBS smolt samples were preserved and processed in the PBS laboratory using a metric measuring board and electronic balance to determine fork lengths and preserved weights. Preserved smolt weights were converted to standardized fresh weights (Rankin et al. 1994) and are reported as such here.

From 2006-2011, staff at the Robertson Creek Hatchery (RCH) managed the bulk of the smolt sampling program at the Glover Pond trap site, enabling more frequent size sampling, but no scale sampling was performed for age determination (Steven Emmonds, RCH Manager, pers. comm.). In 2016 and 2018, smolt samples were collected by Hupacasath First Nation (HFN) fisheries personnel, via dipnet from a fence trap in the Glover Creek pond. HFN samples were weighed and measured (and scale-sampled in 2016, though age data not currently available) at the Glover Pond trap site, and the fish were released alive (Murrell 2018).

Age of fish was determined from scale analysis in the PBS Aging Lab. Between 1977 and 1986, all fish captured and retained were scale-sampled for age analysis. After 1986, scale sampling was focused on fish in the overlapping size range of 75 – 90 mm, with few fish <70 mm or >90 mm in fork length scale-sampled. Age proportions from scale data by year, month and 5 mm length class were used to classify unaged fish to age class.[2]

Too few scales were examined (N < 25) for the years 2006 – 2009, 2011 – 2018 to assign scale-based ages to mixed-age samples of smolts. In the absence of scale age data for a given year, monthly length-frequency distributions were reviewed for evidence of bi-modality to identify likely forklength threshold values to distinguish age classes. These were used in conjunction with multi-year age proportions by forklength size class to assign a corresponding proportion of unaged fish in that size class to age.

Processed smolt data were compiled and analyzed using SAS® statistical software to tabulate summary statistics for fork length, preserved and standardized fresh weights, and smolt condition factor[3] by year, sample date and age class. Sample dates were converted to Julian day-of-year[4] for inter-annual comparisons. Univariate statistical procedures were used to detect and correct or exclude erroneous data from summary analyses. Analysis of variance and paired t-tests were

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[2] Unaged fish <70 mm or >100 mm were classified as Age 1 and Age 2, respectively, unless otherwise specified by field personnel in sample meta-data.

[3] Fulton fish condition factor (K) is an index of fish 'health' that relates fish weight to length, and is influenced by age of fish, sex, season, maturation stage, fullness of gut, type of food consumed, amount of fat reserve, and degree of muscular development (Fulton 1902; *in* Barnham and Baxter 1998). $K = 10^5 \times W / L^3$, where W = Standard weight (g) and L = forklength (cm). K generally ranges from 0.5 ("poor condition") to 2.0 ("good condition"), with K <= 1 for long, thin fish such as salmonid fry and smolts.

[4] For leap years, day-of-year was advanced by one day beginning in March to account for February 29th.

used to test for differences in size statistics between the two gear types and/or sampling locations for common sample dates.

Summary plots include:

(1) Weekly sample size, as an indicator of outmigration run-timing (ages pooled);

(2) Length and weight frequency distributions and regressions (by age class); and

(3) Trends in mean length (cm) and standardized fresh weight (g) over time (by age).[5]

The above analyses were used to identify a defensible and reproducible annual indicator of Great Central Lake Sockeye smolt size for covariation analyses (e.g. Hyatt et al. 2011).

Years for which Sockeye smolt size data were insufficient or unavailable (2004, 2005, 2014, 2017) were infilled with estimates based on linear regression analysis of smolt length as a function of standardized estimates ($\mu \sim 0, \sigma^2$) of annual smolt abundance estimates, winter fry size (forklength) and fry abundance estimates from representative acoustic trawl surveys (ATS) during the previous winter or fall[6], where available. Within- and between-year temporal effects were assessed by including terms for ocean entry year and week of fall/winter ATS sample date (shifted to increment from the previous July). Missing annual mean length for age 2 fish was estimated based on the all-year linear relation with mean age 1 forklength.

The annual mean length and weight time-series were extended through the inclusion of weighted mean forklength and standard weights for 1971 - 1976 (Robinson and Barraclough 1972a,b; 1973; 1975a,b; 1976).

Non-parametric test statistics were calculated over the resulting annual 48-year time-series for detection of trends (Mann-Kendall (MK)) and step changes in the mean ("regime shifts") (Kundzewicz and Robson 2000). Regime shift detection using sequential t-test analysis was applied after prewhitening using a target P = 0.05, cutoff length = 10 years, tuning constant = 2 and a subsample size = 6 years (STARS 6.2 software: Rodionov 2004).

RESULTS

The total annual number of Sockeye smolts sampled, with associated statistics of fork length and standardized weight are summarized in Table 1 by year and age, and tabulated by sample date and sample location in Appendix I. The location and annual frequency of sampling dates are listed in Table 2, indicating fyke-net sampling efforts in Robertson Creek, and dipnet or fence-trap sampling in Glover Creek. Sample meta-data, including (where available) total catch and total fish sampled by date, sample site, gear type, sampling agency and fish preservative type, are listed in Appendix VII[7]. Smolt biosample observations were not available for 2004, 2005, 2014, or 2017, and were limited to <100 fish in 2013 and 2015.

In some years, few (0 - 25) scale-based age observations were available to rigorously characterize age composition (2006 - 2009, 2011 - 2018). To obtain sufficient aged fish for mean

[5] For some figures, the Fulton fish condition factor (K) is multiplied by 10 for plotting purposes.
[6] Winter pre-smolt (fry) size and abundance estimates from Hyatt et al. (2016) and K. Hyatt, DFO Pacific Biological Station (unpub. data).
[7] Smolt data are available upon request. Contact Kim.Hyatt@dfo-mpo.gc.ca.

size estimation, unaged fish were assigned to age as described in METHODS. Most age assignments were to age 1 (95%); data changes are listed in Appendix VIII.

Figure 3 summarizes the annual range of dates sampled, with overlays of mean fork length and standard weight, by date and age class.

As an indicator of seasonal smolt catch and relative abundance, sample size (count of Sockeye smolts retained by age) and percent of total annual retained catch are charted by year and sample date in Appendix II. Within-year seasonal trends in mean length and weight at age are presented in Appendix III. The all-year trend in within-season smolt size at age is plotted for length and weight observations and fish condition in Figure 4.

Annual size-at-age frequency distributions for fork length, standard weight, and fish condition (K) are organized in Appendix IV. These indicators are graphically summarized across all years and sampling sites in Figure 5, and partitioned by sampling site in Figure 6. The annual absolute deviations from the multi-year average, displaying inter-annual differences in mean size and fish condition, is shown in Figure 7.

Statistical relations and corresponding regression and correlation coefficients for Sockeye length-weight relationships (by year and age) are summarized in Appendix V. The multi-year length-weight at age relationships are presented in Figure 8.

The multi-year seasonal distribution of smolt sample catch retained is plotted in Figure 9. Statistical quantiles of migration timing – based on Julian day-of-year – are compared in Table 3 for all available years versus "well-sampled" years where the number of sample dates exceed 3 dates. Median date of migration was day 130 across all years where at least 3 dates were sampled, indicating about 50% of Great Central migrants were tallied by May 10th, with 90% of migrants tallied between April 21st and June 6th (Figure 9).

The 1st and 99th day-of-year percentiles (day 114 - 153: April 24th to June 2nd) of the mid-80% of migration observations, representing ~80% of the smolt sample observations (Table 3, bottom), were used as cutoff dates to subset the sample data to obtain statistical measures associated with a consistent inter-annual indicator for Age 1 smolt size (Table 5). This rule was extended to include April 23rd to incorporate a portion of the sample data for 2013, in which sampling occurred only on April 16th and April 23rd (Figure 3; Appendix I).

Comparisons of data between sample sites for 37 common dates indicated a small but statistically-significant difference in forklength for 9 of 12 years where samples of 50 fish or more were obtained at both Robertson Creek (RC) via fyke-net and Glover Creek (GC) via dipnet. Sockeye fork lengths from Glover Creek samples ranged from 0 – 4 mm larger[8] than Robertson Creek samples, with an overall mean difference of +1.7 mm (Figure 10).

Linear calibrations were generated to provide site-specific forklength conversion coefficients, to account for possible size bias in the data for years where sampling was limited to one or the other site. The slope coefficient was tested for significant difference from 1, which would indicate a gradient in sizes between sites, and the intercept was tested for significant difference from 0, which would indicate an absolute difference in mean size between sites.

[8] With one sample date – 25-Apr-1990 – differing by 12 mm. Data from both sites on this date were excluded from further analyses.

- Equation 1: RC = 4.4 + 0.92 • GC
  (H_0: a = 0, P = 0.32; H_0: b = 1, P = 0.19; Figure 11, top)
- Equation 2: GC = 5.5 + 0.94 • RC
  (H_0: a = 0, P = 0.22; H_0: b = 1, P = 0.37; Figure 11, bottom)

Note that the hypothesis tests (H_0: a = 0 and b = 1) could not be rejected for either calibration model, indicating that, despite significant statistical differences in the mean, the coefficients indicate negligible differences between the sample data sets across all years. Thus, for the purposes of this report, the aggregated size data, pooled across sites, were deemed suitable for summary analyses.

Mean annual smolt fork length for age 1 fish (pooled across sample sites) was linearly correlated with pre-smolt (fry) length (r = 0.32, P = 0.08, N = 31; Figure 12), fry abundance (r = -0.37, P = 0.03, N = 34; Figure 13) and final smolt abundance (r = -0.40, P = 0.01, N = 36; Figure 14). However, mean annual smolt size for age 2 fish was not correlated with these factors nor their one-year prior lag values.

Step-wise selection retained only *pre-smolt length* as significant at the $\alpha = 0.05$ level for age 1 fish (Appendix VI) . However, an interaction term for pre-smolt forklength and estimated pre-smolt abundance was weakly significant (P = 0.08). Forcing *year* into the regression to account for annual temporal dependencies (autocorrelation) did not substantially change the explained variance ($r^2 \sim 0.3$). The model incorporating *year*, *pre-smolt fork length* and the interaction term between pre-smolt size and abundance ($r^2 = 0.32$, N = 28, P = 0.02; Appendix VI) was used to infill missing mean annual forklength for age 1 smolt size in 2004, 2005, and 2014 (Table 5). As pre-smolt data were not available for ocean entry year 2017, the simple linear relationship with smolt abundance (Figure 14) was used to estimate mean annual age 1 smolt length.

Estimated smolt lengths for 2004, 2005, 2014 and 2017 were converted to standard weight based on the multi-year length/weight relation for age 1 smolts (Figure 8).

No pre-smolt size or abundance variables were correlated with age 2 smolt size, thus missing age 2 mean annual smolt lengths (1980, 2004, 2005, 2014, 2017) were estimated based on the linear relationship with mean annual age 1 smolt length (r = 0.45, N = 36, P < 0.01; Figure 15).

Both length and weight time-series for age 1 and age 2 smolts were extended back to 1971 with the inclusion of smolt data obtained at a weir in Robertson Creek (Robinson and Barraclough 1972a,b; 1973; 1975a,b; 1976). As the raw data were not available for filtering, it should be noted that these data are not confined to the 80^{th} percentile of migration dates, but extend for a variable range of dates from early April into June and July depending on year.

Best estimates of mean annual Sockeye smolt size, concatenated to the weighted mean estimates from the 1971-1976 Robinson and Barraclough data (Table 5, Table 6), were plotted in Figure 16, by age. Predictive estimates for missing years 2004, 2005 and 2014 are represented by hollow squares in the length and weight time-series.

No linear parametric or non-parametric trends, autocorrelation, or regime changes were detected in age 1 mean annual fork length or standard weight estimates, though ranked-sum statistics indicated a step-change to lower weights between 1992 and 1994. Age 2 size data showed a weakly negative linear time trend (P < 0.10), but Mann-Kendall nonparametric trend statistics were not significant. However, both mean lengths and weights of age 2 fish were found to be statistically smaller after 1994.

DISCUSSION

Sampling Effort

Great Central Lake Sockeye smolts were sampled in all but three of the ocean entry years between 1977 – 2018, for an average 9.4 ± 6.5 dates across the months of April, May and June. Sampling frequency via fyke-net in Robertson Creek was highest during the late 1970s, when the frequency ranged from 9-24 dates per year. Sampling frequency was reduced in the 1980s, but reached 10 dates per year in the early 1990s. Dipnet sampling in Glover Creek commenced in 1990, and virtually replaced fyke net sampling from 2006 – 2011, and again as of 2016. During smolt year 2010, and 2012-2015, Great Central Sockeye were sampled two times or less. Only during the years 2012 and 2013 was sampling restricted to the period prior to the "peak migration period" (April 24th – June 3rd), and therefore potentially unrepresentative of the population. As scale sampling for age determination was largely restricted to PBS field programs, reductions in PBS-based sampling efforts after 2003 likely mean lower confidence in age composition for subsequent years.

Due to a minor positive bias in mean size (+1.7 mm, representing <3% of mean forklength) in samples dipnetted from Glover Creek versus fyke-net samples from Robertson Creek, it may be prudent for some analyses to apply a conversion factor to standardize the data by gear type. For example, applying a dipnet-to-fyke net conversion factor may be useful to adjust dipnet data from recent years into a fyke-net index for comparison with other fyke-net data (e.g. Sproat Lake and Henderson Lake Sockeye stocks). Alternatively, the fyke-to-dipnet conversion might be useful to render historical data (pre-1990) more comparable to recent data (2010-present), as dipnet data from Glover Pond have become the standard sampling method and data source. The Robertson Creek forklength index would be based on Robertson Creek length data where available, or the linear function of Glover Creek length data, using Equation 1 (Figure 11, top). The Glover Creek forklength index would be based on Glover Creek length data where available, or the linear function of Robertson Creek length data, using Equation 2 (Figure 11, bottom).

As the hypothesis tests for model coefficients (H_0: $a = 0$ and $b = 1$) were not rejected for either calibration model, indicating negligible practical differences between the sample data sets, pooled size data were used in all analyses in this report.

Smolt Migration

Tallying the frequency of sample dates (Julian day-of-year) across all ocean entry years, weighted by sample size, yields a coarse indicator of smolt migration abundance (assuming catch is proportional to abundance, and effort is roughly equivalent across dates)[9]. This indicator can be restricted to years where the number of sample dates exceeds a certain annual minimum (e.g. 3 sample dates). The resultant "smolt migration timing" statistics indicate that, over the range of well-sampled years, Great Central smolt migration peaks in May (median date: May 10th), with 90% of migrants tallied between April 21st and June 6th (Figure 9). Mean, median and variance

[9] This is due to the practice of retaining a maximum sample size of around two hundred individual fish for a given sample date. The actual catch on any date-specific sampling trip was often far higher than the maximum of two hundred fish retained. Consequently, the observations here will generally conceal the timing of peak migration which tends to occur over a much shorter period than suggested by the annual plots in Appendix II.

statistics did not vary significantly when included years were restricted to those with a minimum of 3, 4 or 5 sample dates (Table 3).

Migration timing varied between years, exhibiting – where sampling occurred weekly – mainly unimodal abundance patterns, with some possible exceptions (e.g. 1980, 1987, 1994, 2009, 2018), characterized by a pulse of smolts migrating in late-April, followed by another pulse in late May (Appendix I and Appendix II). Overall, age 1 fish ranged from 71 - 95% of migrants, and age 2 fish comprised 5 - 29% (Table 1). However, age 2's often contributed a higher proportion (up to 50%) of the early-to-mid-April pulse of migrants, while the migrants in May were predominantly composed of age 1 fish (>98 %).

Smolt Size and Condition

The mean length and standard weight of age 1 fish for all available years (1977-2018) were 7.2 + 0.8 cm and 3.2 + 1.4 g, respectively (N = 30,079; Table 1). Ninety-five percent of age 1 fish were less than 8.8 cm in fork length. Age 2 fish averaged slightly larger, at 8.8 + 1.8 cm and 5.8 + 1.9 g (N = 4,172).

Maximum length/weight of age 1's ranged from 9 - 12 cm / 6 - 9 g, resulting in a wide overlap in the age-specific size distributions which precludes a simple size-based assignment of unaged fish to age class. Laboratory personnel attempted to take this overlap into account, since 1987, by focusing scale collection for aging purposes on the upper end of age 1 fish sizes, between the lower 10th percentile of age 2's (75 mm) and the upper 5th percentile of age 1's (88 mm).

This may have been complicated by significant variation in mean smolt size between years. Ignoring years of limited sampling effort and/or small sample size (2003, 2012, 2013, 2015), age 1 fish averaged approximately 2 g – nearly one standard deviation below the all-year average weight – in 1983, 1995, 2001 (lowest), 2007 and 2018 (Figure 3 (top); Table 1). Large age 1 smolts, averaging > 4.5 g occurred in 1980, 1988, and 1992 (Figure 7, Appendix IV).

Fulton's fish condition factor (K) – which expresses the relationship between fish length and weight – may provide more insight into fish health and survival than either size factor alone. Mean fish condition for age 1 and age 2 fish was K=0.8 (Figure 5), which is likely typical for freshwater stages of juvenile salmonids. Fulton's K largely reflected inter-annual length and weight variation, with higher fish condition for most years between 1978-2000, followed by generally lower fish condition since 2001 (Figure 7, Table 1). Maximum age 1 fish condition occurred in 2010, where average-length fish were characterized by above-average weights, resulting in high condition factor K. In the following year, 2011, fish were characterized as the poorest condition in the time-series, apparently due to low weights associated with average-length fish. In 2010 and 2011[10], most length-weight data were acquired by RCH staff, therefore changes in methodology or equipment may be a factor in these deviations.

The length/weight curves for both age classes of Great Central Lake Sockeye are nearly identical despite the mean size differences: fresh standard weight (g) is approximately equivalent to 0.01 times the fork length (cm) cubed (Figure 8). Summary data in Table 5 reasonably replicate previous analyses for ocean entry years 2008-2012 (Hyatt et al. 2016b).

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[10] In 2011, PBS staff collected one sample on May 8th for which mean smolt weights of age 1 fish were approximately equivalent to the RCH samples (May 1 – May 10th), but the PBS mean lengths were ~1 cm smaller, resulting in a higher mean fish condition relative to the RCH samples (Appendix I - Glover).

Annual deviations in mean size for age 1.0 and age 2.0 smolts covary positively ($r = 0.45$, $P < 0.01$; Figure 15). This may suggest that they experience similar variations in foraging conditions and growth in Great Central Lake during the seasons prior to their exit as smolts.

Seasonal Trends in Smolt Size

Smolt size appeared to decrease – most notably for age 1 fish – as the season progressed ($P < 0.01$; Figure 4), as evidenced when sampling effort involved >3 dates (e.g. 1977-2002). This multi-year trend is driven, however, by a subset of years of strong within-season decline in the 1990s (e.g. 1989, 1991-1995, 1997-2000: $P < 0.001$; Appendix III), which may potentially mark an apparent shift from neutral or weakly positive changes in size in-season (perhaps related to spring growth) prior to 1989, to mainly negative trends in within-season fish size into the 2000s. High frequency (near-daily) sampling since 2006 supports this finding, at least for age 1 fish. Diminishing size at age over the season potentially signifies a tendency towards earlier seaward migration of larger smolts (Wood et al. 2003).

Best Estimates of Annual Smolt Size

Almost 40 years of data indicate that biosamples collected between late April and late May (weeks 16 - 20) are most representative of the size of fish of the dominant age 1 class. As overall mean, median and variance statistics did not vary significantly when years were restricted to those with a minimum of 3, 4 or 5 sample dates (Table 3), and within-year seasonal trends in size were generally weak for age 1 Sockeye (Appendix III), it may be surmised that one or more sample dates between late-April and late May are likely sufficient to characterize Great Central Sockeye smolt size, at least for the predominant age 1 class, provided it is based on a reasonable aggregate sample size (e.g. 50-100 fish).

As noted above, age 2 smolts make up a larger proportion of early season migrants (Table 1, Appendix III). To reduce the influence of unaged age 2's on the annual age 1 smolt size indicator, a later, narrower date-range based on the 10^{th} and 90^{th} percentiles (i.e. April 24^{th} to June 2^{nd} – encompassing the central 80% of migration observations) was used to subset the data to yield a consistent, representative estimate of annual Great Central Lake Sockeye smolt size (age 1), (Figure 16 (top); Table 5).

For years in which age 1 smolt size observations were insufficient or unavailable (2004, 2005, 2014, 2017), size estimates were provided based on statistical relationships with either winter fry length and abundance or final smolt abundance. Predicted values range within a standard deviation of the long-term mean length, but error terms are large (Figure 16, top). The inverse relationships between final age 1 smolt size and either abundance estimate (Figure 13, Figure 14) suggest a significant level of density dependence. However, abundance variables were evidently not as important as pre-smolt size for the years in which all three variables were available, and were not retained in the model determined by stepwise regression. Time of year of the fall/winter ATS samples did not appear to be an important factor.

Final age 2 smolt size was not correlated with these factors for the current or previous year. Best estimates for missing years (1980[11], 2004, 2005, 2014, 2017) were based on the all-year relationship for mean age 2 fork length as a function of mean age 1 fork length (Figure 15).

[11] Note that in 1980, no age 2 smolts were found in >400 sampled fish, therefore the predicted age 2 fork length is hypothetical, and the numbers of age 2 fish at the predicted size in that year were likely negligible.

Both length and weight time-series for age 1 and age 2 smolts were extended back to 1971 with the inclusion of weight mean smolt size data (Table 4) sampled in Robertson Creek (Robinson and Barraclough 1972a,b; 1973; 1975a,b; 1976). As the raw data for 1971-1976 were not available for filtering, these data are not confined to the 80th percentile of migration dates, but extend for a variable range of dates from early April into June and July depending on year. As the mean annual size data incorporated here were weighted by the sample sizes, and total sample sizes were large (average N > 5,000; Table 4), the values likely provide a reasonable estimate of smolt size. It might be noted that Great Central Lake was not fertilized for the years 1974-1976, which were associated with small age 1 fish in the Robinson and Barraclough dataset, though not outside the range of all year variation (Figure 16, top).

Best estimates of age 2 smolts were simply based on all available sample data (Figure 16 (bottom); Table 6), however these statistics should be used with caution due to low sample size in most years. Missing annual age 2 smolt sizes were not generated, as no significant statistical relationship was found based on pre-smolt size or abundance data.

Pre-1977 data from Robinson and Barraclough displayed marked increases in age 2 fish sizes in 1973 and 1974, which were >2 standard deviations larger than the all-year average. Age 1 fish also reflected a size increase in 1973, but not 1974. Smolt mean size for both age classes was lowest in 1975 in the pre-1977 time-series.

While time trends in the annual length and weight data were weak or non-existent for either age class[12], both ages showed statistical evidence of a decrease in size after 1992-1994, with or without inclusion of 1973 and 1974 data.

The resulting time-series of best estimates for age 1 (Table 5) and age 2 (Table 6) will provide a basis for further analysis and identification of the factors operating to control salmon production variations in freshwater (e.g. Hyatt and Rankin 1999; Hyatt et al. 2011) or marine ecosystems (e.g. Hyatt et al 2015b).

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Many individuals have been involved over the several decades of field sample acquisition, laboratory processing or data assembly on abundance and biological traits of juvenile Sockeye Salmon. The authors wish to thank, in alphabetical order, S. Baillie, K. Cooke, C. Cooper, B. Cousens, J. Candy, T. Cone, I. Cuthbert, S. Emmonds (and staff at the Robertson Creek Hatchery), R. Ferguson, T. Gjernes, B. Hanslit, M. Johannes, A. Keitla, J. Manzer, C. McConnell, I. Miki, S. Murdoch, G. Murrell (and staff at Hupacasath First Nation Fisheries), A. Phillips, J. Radziul, D. Rutherford, T. Shardlow, K. Simpson, G. Steer, R. Traber, P. Tschaplinski, V. Walker, and M. C. Wright for their efforts in supporting one or more phases of this work. T. Gjernes, in particular, counselled Dr. Hyatt in 1980 on the need for DFO Science to expand time series observations of abundance and biological traits of Sockeye Salmon populations and associated environmental conditions in areas outside of the Fraser basin as a source of information to improve our understanding of the role of factors, other than harvest, in driving annual variations in total returns of adult salmon.

[12] Age 2 size data showed a weak negative time trend ($P < 0.10$), largely driven by anomalously high lengths and weights in 1973 and 1974 (Figure 16).

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MAPS

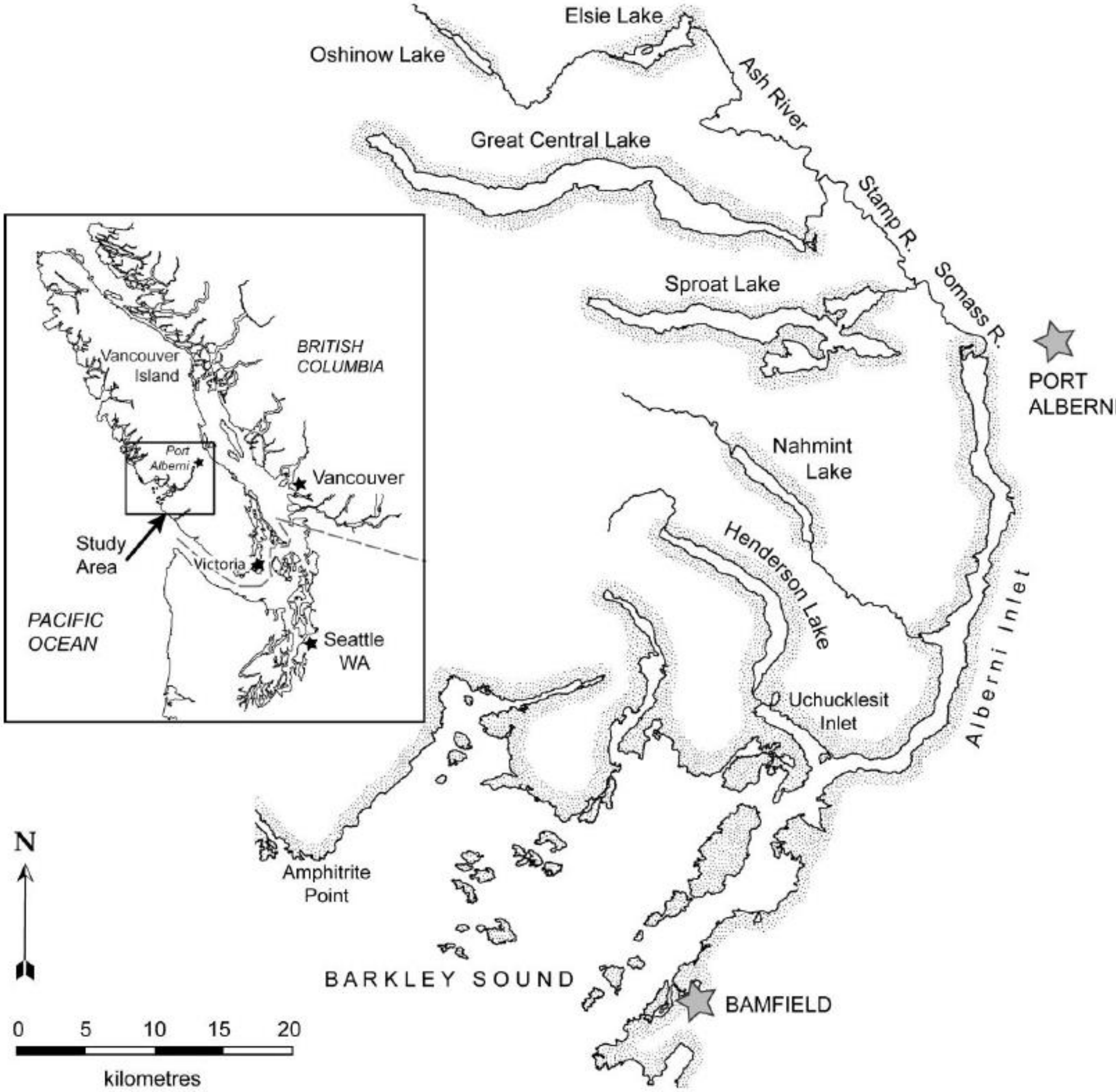


Figure 1. Location of Barkley Sound study lakes (including Great Central Lake) on the west coast of Vancouver Island, B.C.

Figure 2. Great Central Lake outlets – Stamp River and Robertson Creek via Boot Lagoon, with Robertson Creek and Glover Pond smolt sampling sites. Arrows show direction of flow and smolt outmigration.

FIGURES

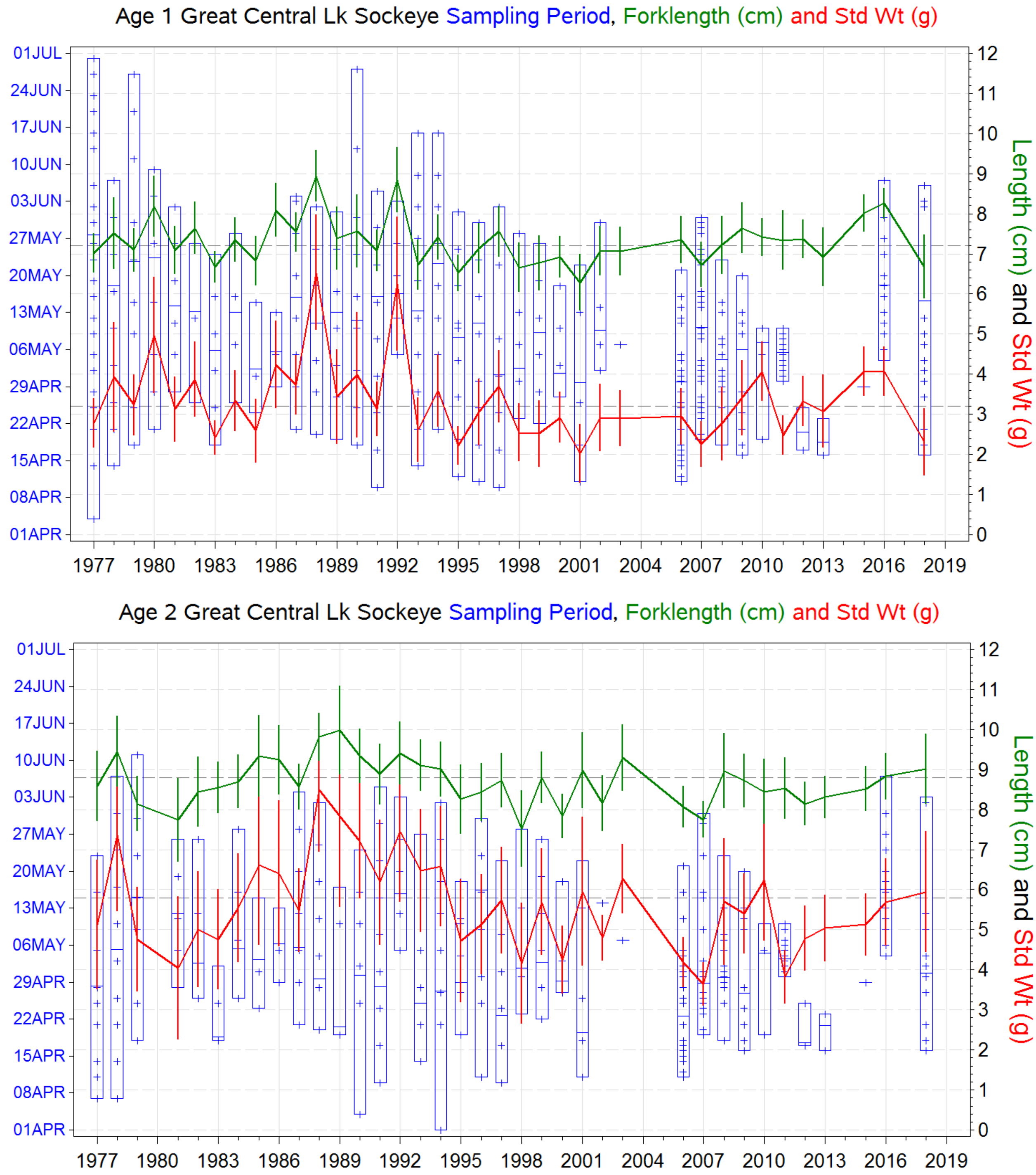


Figure 3. Great Central Lake Sockeye annual smolt sampling range (blue boxes; sample dates indicated by + symbol), mean fork length ±1 standard deviation (cm; green dashed line), mean standard fresh weight ±1 standard deviation (grams; red bars), and. Horizontal dashed lines: all-year mean length and weight. Top: Age 1; bottom: Age 2.

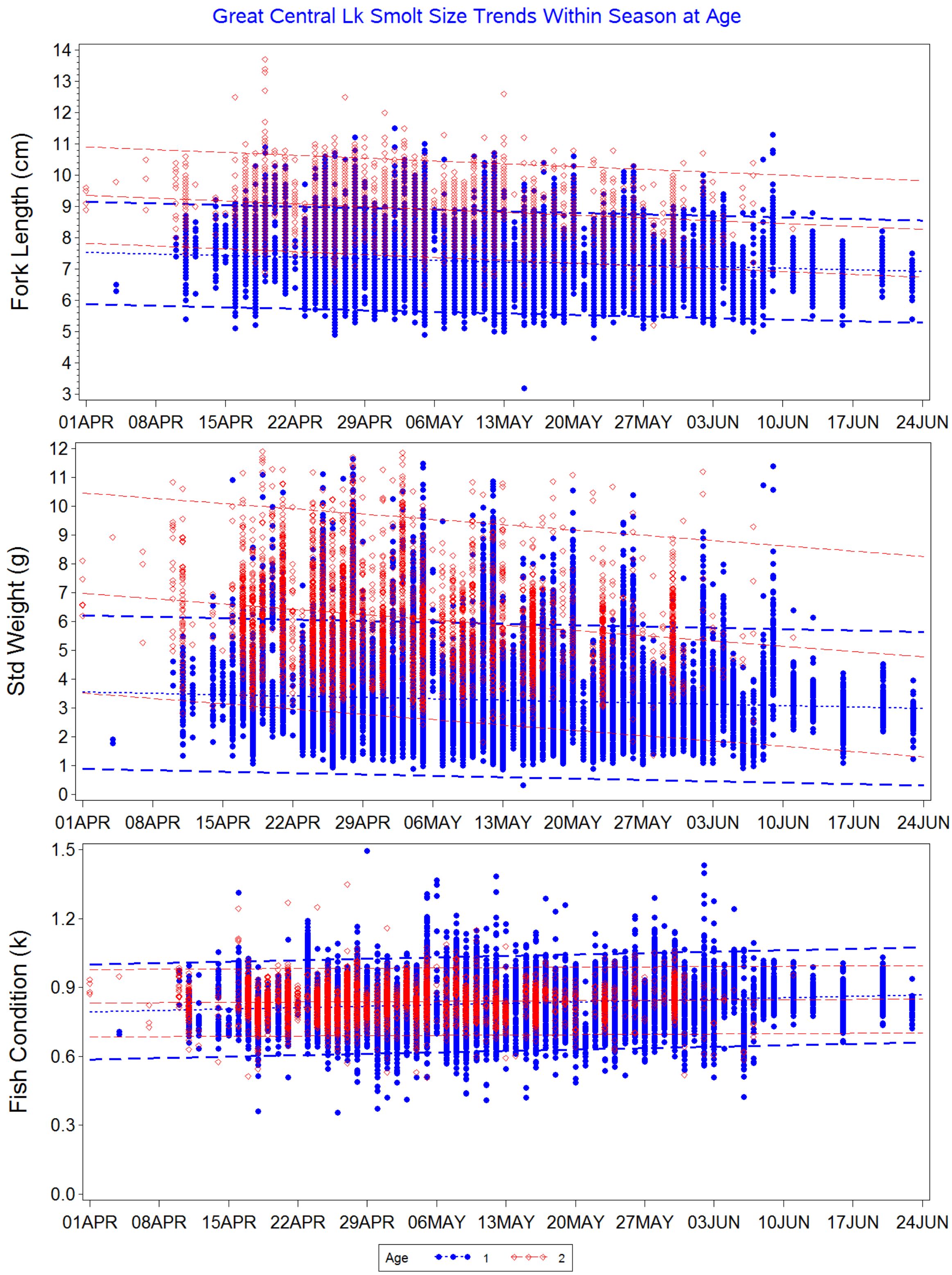
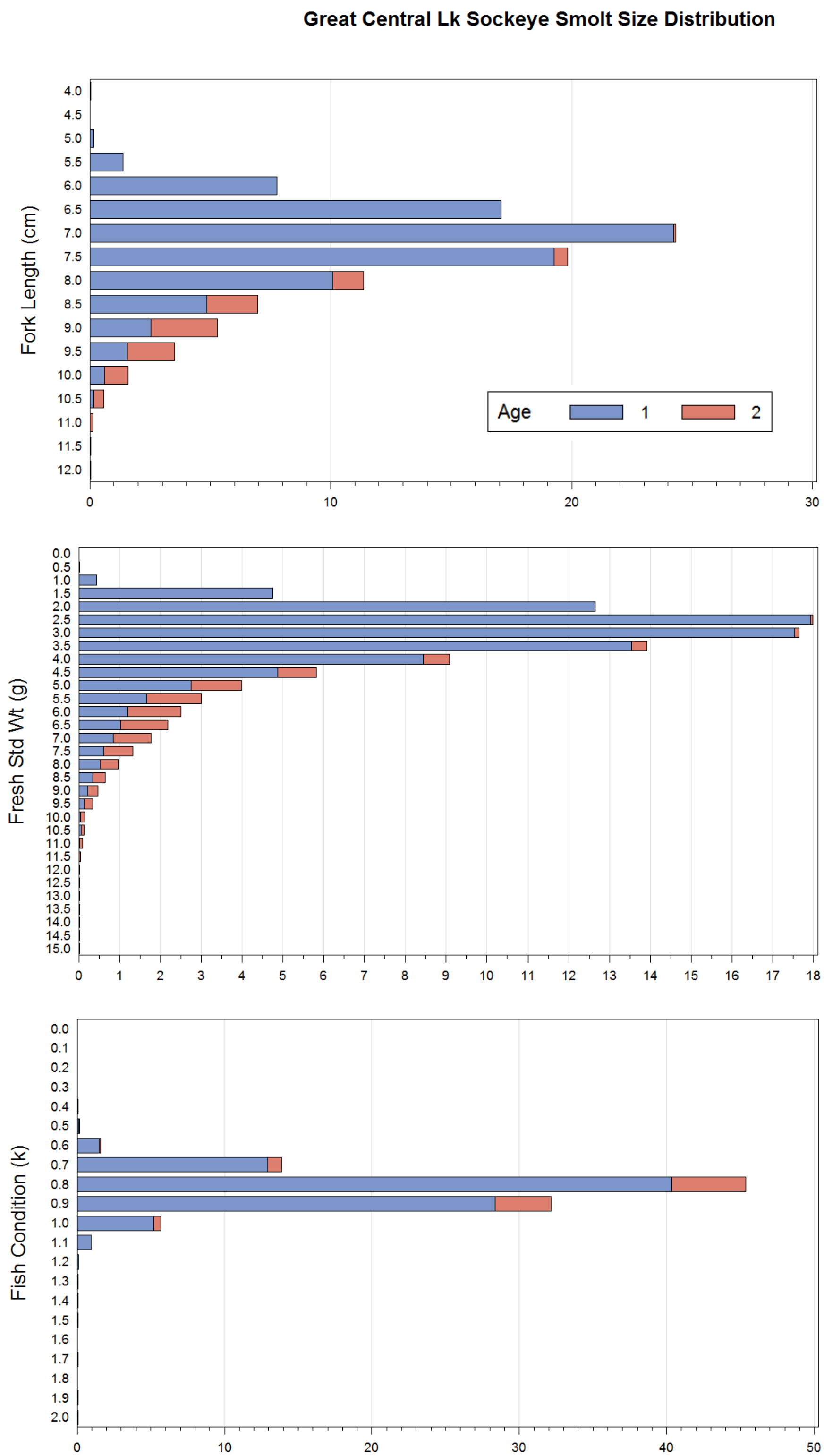


Figure 4. Trends in within-season smolt length (top), weight (middle), and in fish condition (bottom), by age class, all years and sample sites ($P < 0.05$; Adj. $r^2 < 0.04$; $N > 500$).



Fork Length (cm)	FREQ.	CUM. FREQ.	PCT.	CUM. PCT.
4.0	1	1	0.00	0.00
4.5	0	1	0.00	0.00
5.0	52	53	0.15	0.16
5.5	466	519	1.38	1.54
6.0	2614	3133	7.75	9.29
6.5	5759	8892	17.08	26.38
7.0	8194	17086	24.31	50.69
7.5	6682	23768	19.82	70.51
8.0	3834	27602	11.37	81.88
8.5	2349	29951	6.97	88.85
9.0	1790	31741	5.31	94.16
9.5	1184	32925	3.51	97.67
10.0	530	33455	1.57	99.24
10.5	197	33652	0.58	99.83
11.0	45	33697	0.13	99.96
11.5	10	33707	0.03	99.99
12.0	3	33710	0.01	100.00

Fresh Std Wt (g)	FREQ.	CUM. FREQ.	PCT.	CUM. PCT.
0.0	0	0	0.00	0.00
0.5	1	1	0.00	0.00
1.0	147	148	0.44	0.44
1.5	1590	1738	4.75	5.19
2.0	4234	5972	12.65	17.85
2.5	6014	11986	17.97	35.82
3.0	5903	17889	17.64	53.46
3.5	4657	22546	13.92	67.38
4.0	3041	25587	9.09	76.46
4.5	1949	27536	5.82	82.29
5.0	1333	28869	3.98	86.27
5.5	1006	29875	3.01	89.28
6.0	839	30714	2.51	91.78
6.5	729	31443	2.18	93.96
7.0	593	32036	1.77	95.74
7.5	443	32479	1.32	97.06
8.0	326	32805	0.97	98.03
8.5	215	33020	0.64	98.68
9.0	156	33176	0.47	99.14
9.5	118	33294	0.35	99.49
10.0	52	33346	0.16	99.65
10.5	44	33390	0.13	99.78
11.0	32	33422	0.10	99.88
11.5	16	33438	0.05	99.93
12.0	7	33445	0.02	99.95
12.5	5	33450	0.01	99.96
13.0	4	33454	0.01	99.97
13.5	5	33459	0.01	99.99
14.0	1	33460	0.00	99.99
14.5	2	33462	0.01	100.00
15.0	1	33463	0.00	100.00

Fish Condition (k)	FREQ.	CUM. FREQ.	PCT.	CUM. PCT.
0.0	0	0	0.00	0.00
0.1	0	0	0.00	0.00
0.2	0	0	0.00	0.00
0.3	0	0	0.00	0.00
0.4	10	10	0.03	0.03
0.5	53	63	0.16	0.19
0.6	530	593	1.58	1.77
0.7	4636	5229	13.85	15.63
0.8	15179	20408	45.36	60.99
0.9	10765	31173	32.17	93.16
1.0	1903	33076	5.69	98.85
1.1	324	33400	0.97	99.81
1.2	35	33435	0.10	99.92
1.3	15	33450	0.04	99.96
1.4	4	33454	0.01	99.98
1.5	4	33458	0.01	99.99
1.6	0	33458	0.00	99.99
1.7	1	33459	0.00	99.99
1.8	0	33459	0.00	99.99
1.9	1	33460	0.00	99.99
2.0	2	33462	0.01	100.00

Figure 5. Great Central Lake Sockeye smolt size distribution, all years, sites, and gears. Standard fork length (cm, top), standard fresh weight (g, middle), Fulford fish condition factor (K, bottom).

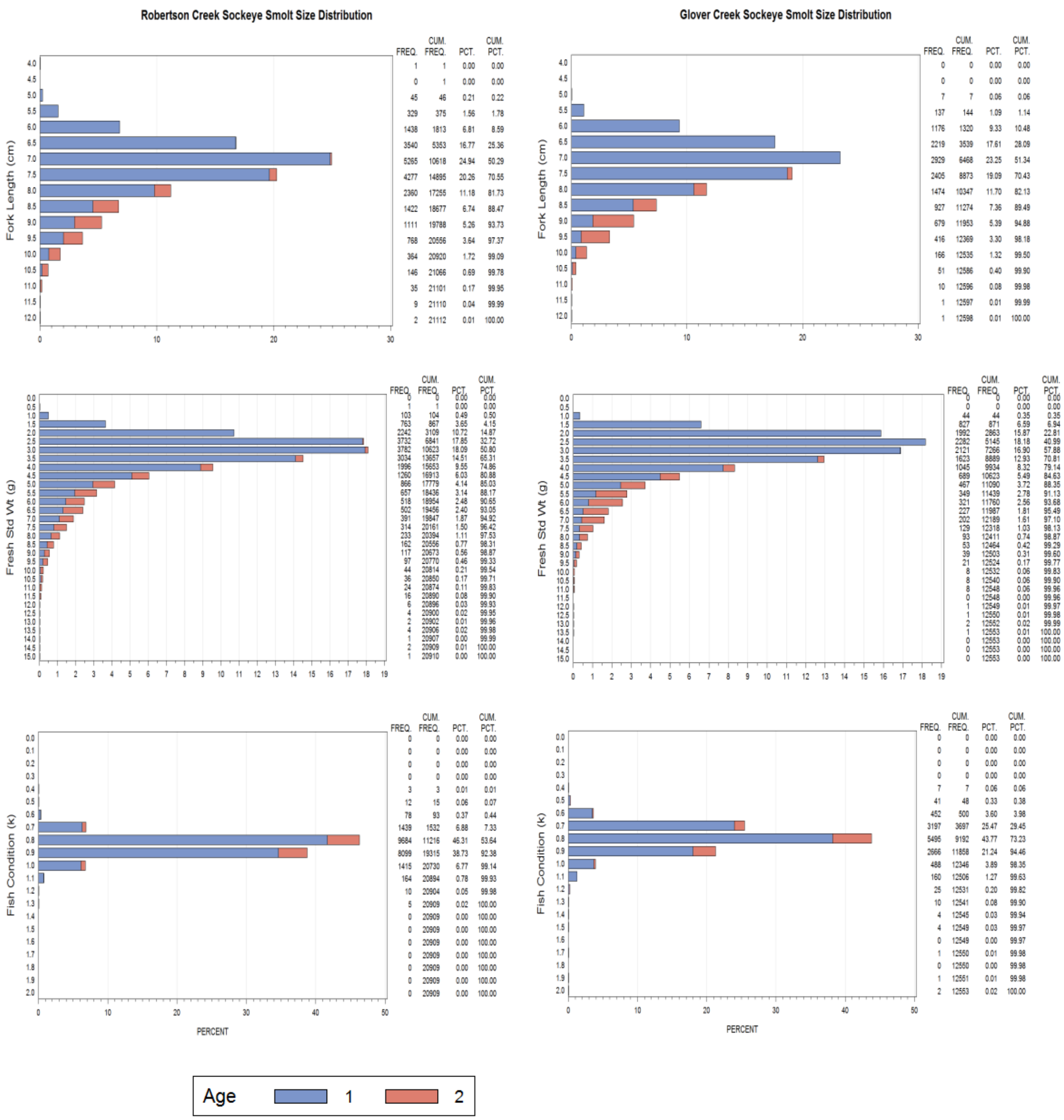


Figure 6. Great Central Lake Sockeye smolt size distribution by sample site (Robertson Creek, left; Glover Creek, right), all years. Standard fork length (cm, top), standard fresh weight (g, middle), Fulford fish condition factor (K, bottom).

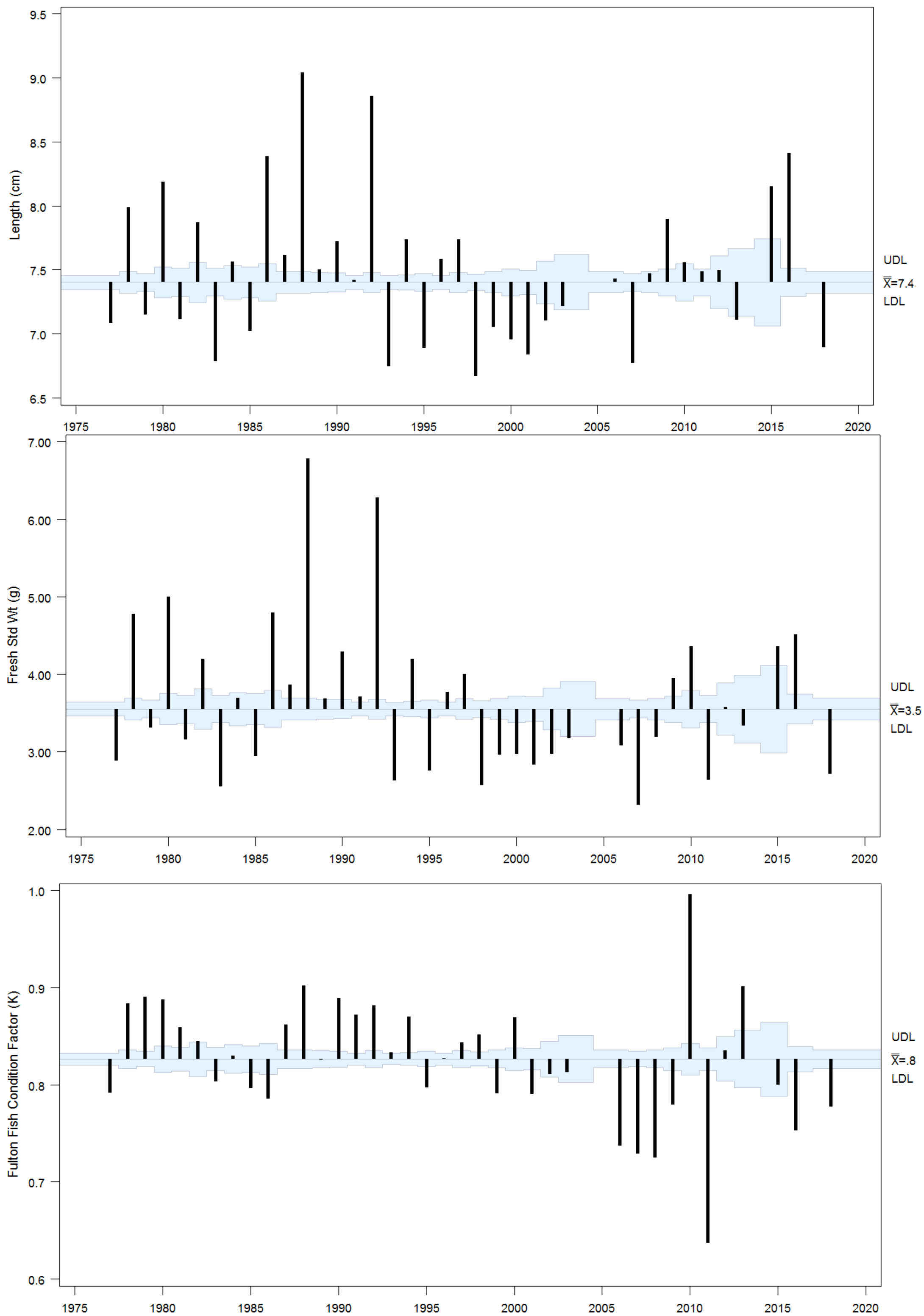
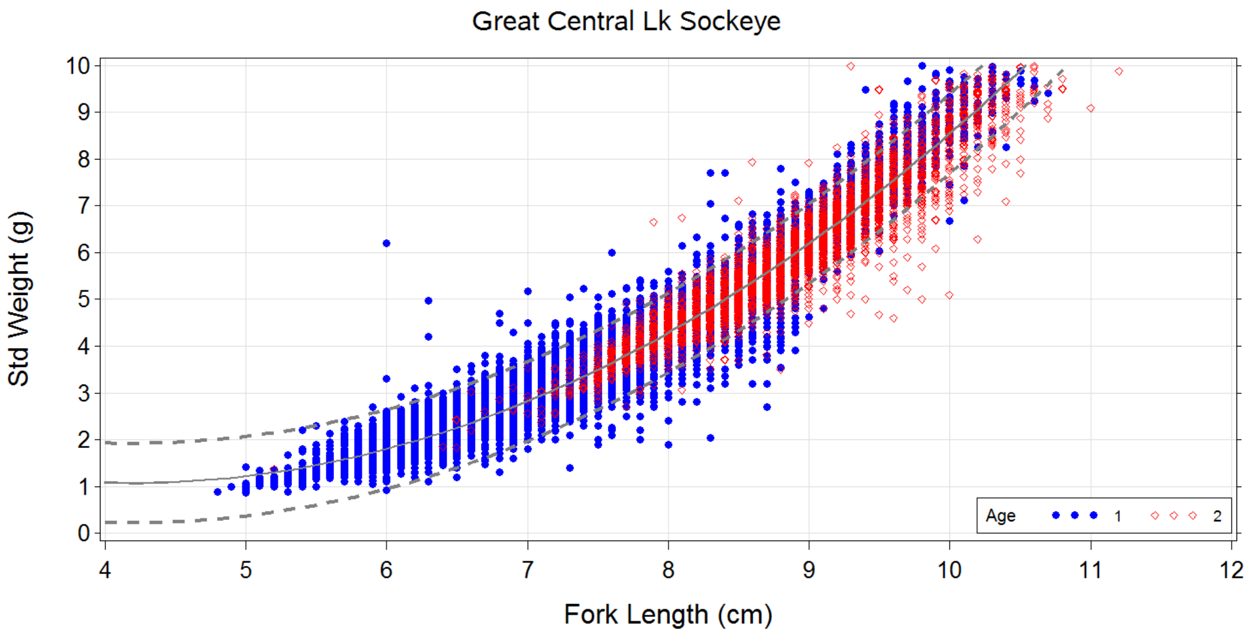


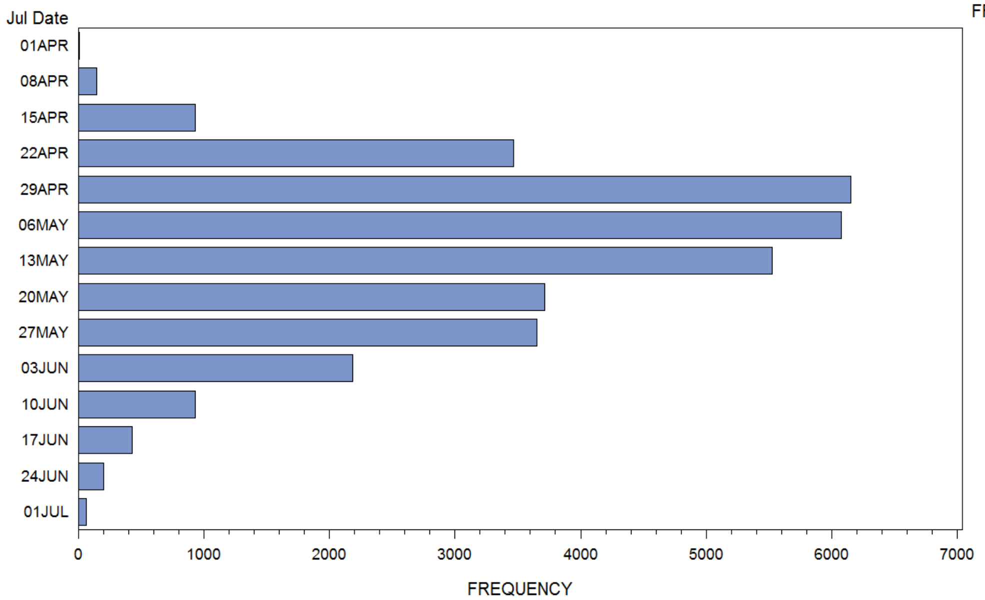
Figure 7. Absolute deviation of annual mean length (top), standard weight (middle), and fish condition factor (bottom) from the overall multi-year averages for Age 1 Great Central Lake Sockeye smolts.



Great Central Lk Smolt Length to Weight Power Relationship Statistics

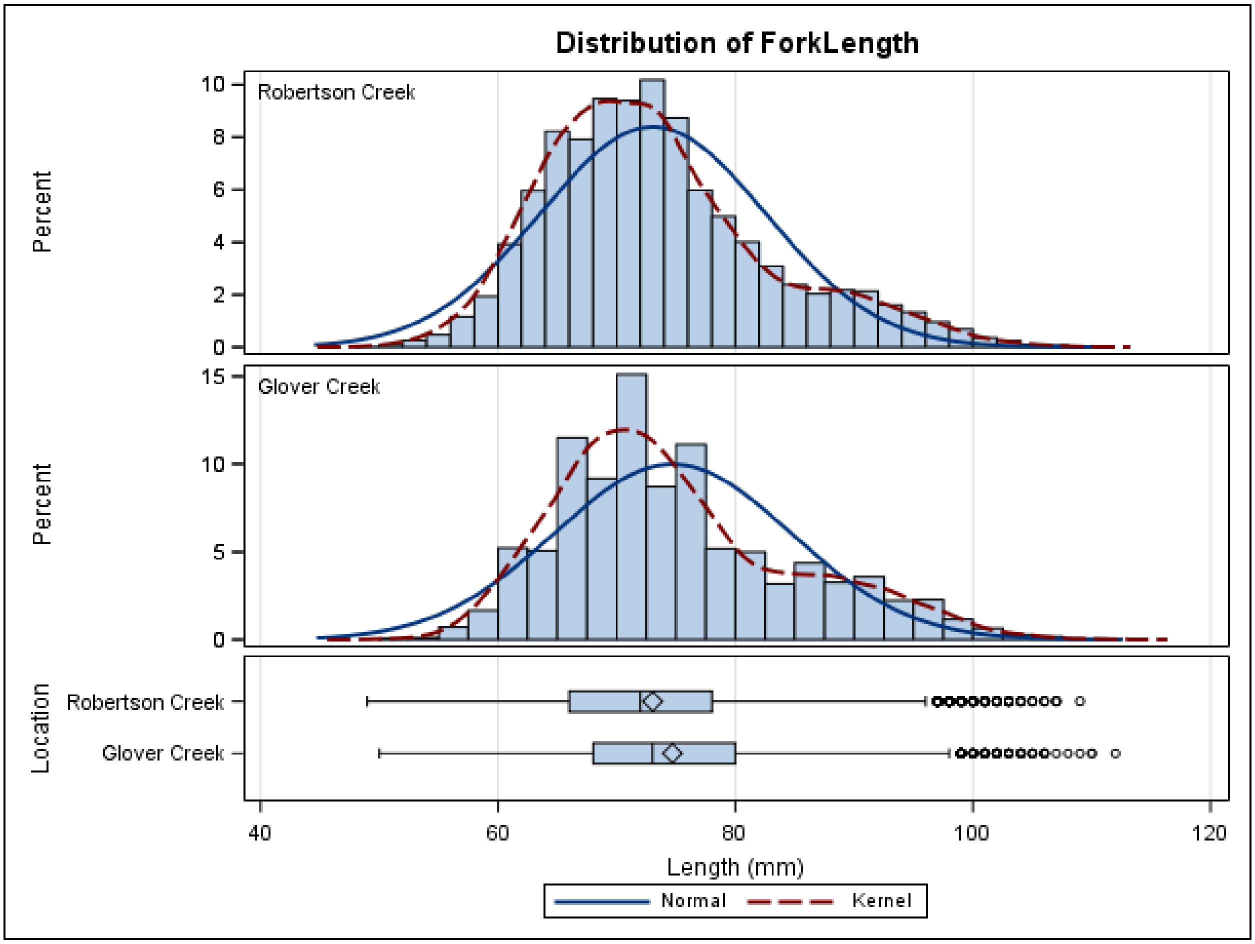
	Age							
	1				2			
	a	b	Rsq	N	a	b	Rsq	N
Stock								
Great Central Lk	0.0071	3.073	0.90	29788	0.0107	2.883	0.88	4061

Figure 8. Great Central Lake Sockeye smolt length/weight relationship, by age, all years.
Model: Std Weight (g) = a • Fork Length (cm) ^{b}



Jul Date	FREQ.	CUM. FREQ.	PCT.	CUM. PCT.
01APR	8	8	0.02	0.02
08APR	146	154	0.44	0.46
15APR	930	1084	2.78	3.24
22APR	3467	4551	10.35	13.59
29APR	6152	10703	18.37	31.96
06MAY	6073	16776	18.14	50.10
13MAY	5522	22298	16.49	66.59
20MAY	3711	26009	11.08	77.68
27MAY	3653	29662	10.91	88.59
03JUN	2187	31849	6.53	95.12
10JUN	934	32783	2.79	97.91
17JUN	430	33213	1.28	99.19
24JUN	205	33418	0.61	99.80
01JUL	66	33484	0.20	100.00

Figure 9. Great Central Lake Sockeye smolt “abundance distribution” (frequency of sample dates (Julian day of year), weighted by sample size), across all years where the minimum number of sample dates >= 3 with reasonable spread of dates (see table 3 and 4).



The TTEST Procedure

Variable: ForkLength (Length (mm))

Location	N	Mean	Std Dev	Std Err	Minimum	Maximum
Robertson Creek	7132	73.0208	9.5040	0.1125	49.0000	109.0
Glover Creek	6007	74.6592	9.9770	0.1287	50.0000	112.0
Diff (1-2)		-1.6385	9.7231	0.1703		

Location	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
Robertson Creek		73.0208	72.8001	73.2414	9.5040	9.3505	9.6626
Glover Creek		74.6592	74.4069	74.9116	9.9770	9.8018	10.1587
Diff (1-2)	Pooled	-1.6385	-1.9722	-1.3047	9.7231	9.6069	9.8421
Diff (1-2)	Satterthwaite	-1.6385	-1.9736	-1.3033			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	13137	-9.62	<.0001
Satterthwaite	Unequal	12530	-9.58	<.0001

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	6006	7131	1.10	<.0001

Figure 10. Great Central Lake Sockeye smolt forklength distribution by sample site and t-test statistics for common dates where both sites were sampled, 1990-2001. Mean length at Glover Creek averaged 1.6 mm larger across all common dates.

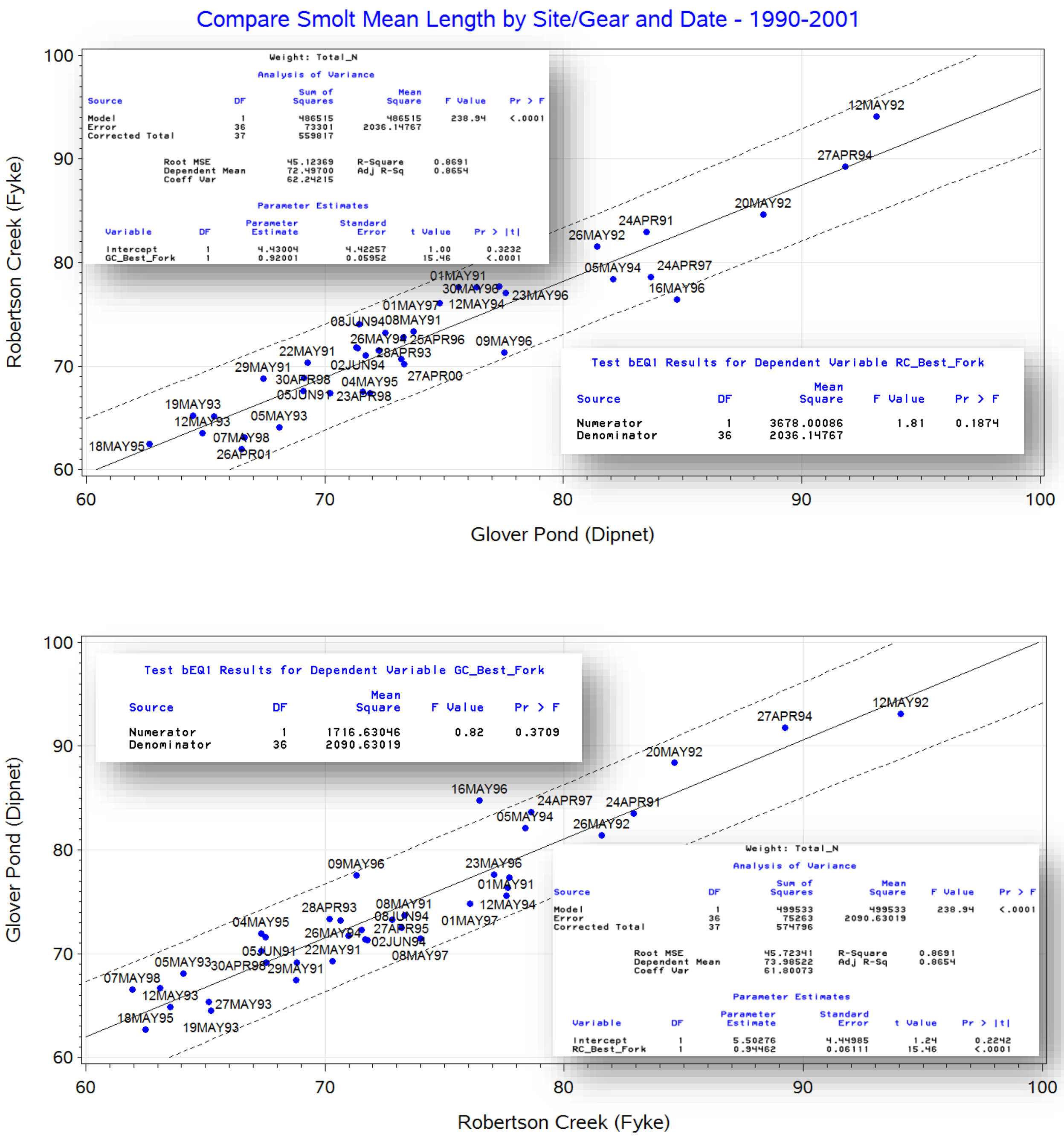


Figure 11. Correlation and calibration of Great Central Lake Sockeye smolt forklength between sample sites for common sampling dates 1990-2001. Mean length at Glover Creek averaged 1.66 mm larger across all dates.

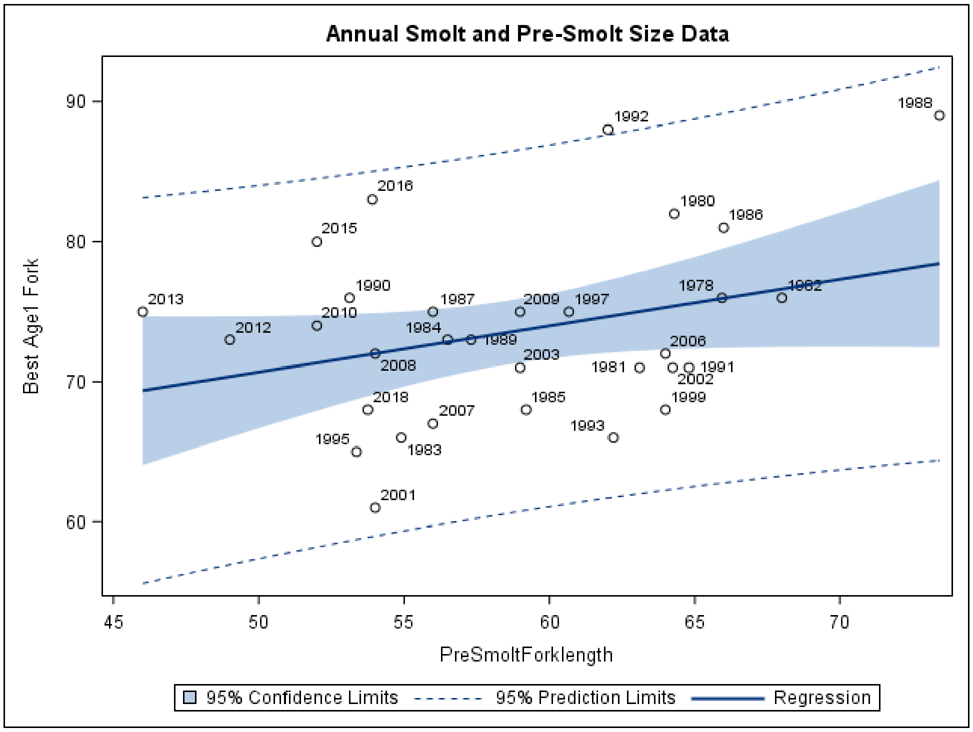


Figure 12. Simple linear relationship for age 1 fork length as a function of winter pre-smolt fork length, 1978-2018 (r = 0.32; P = 0.08; N = 31).

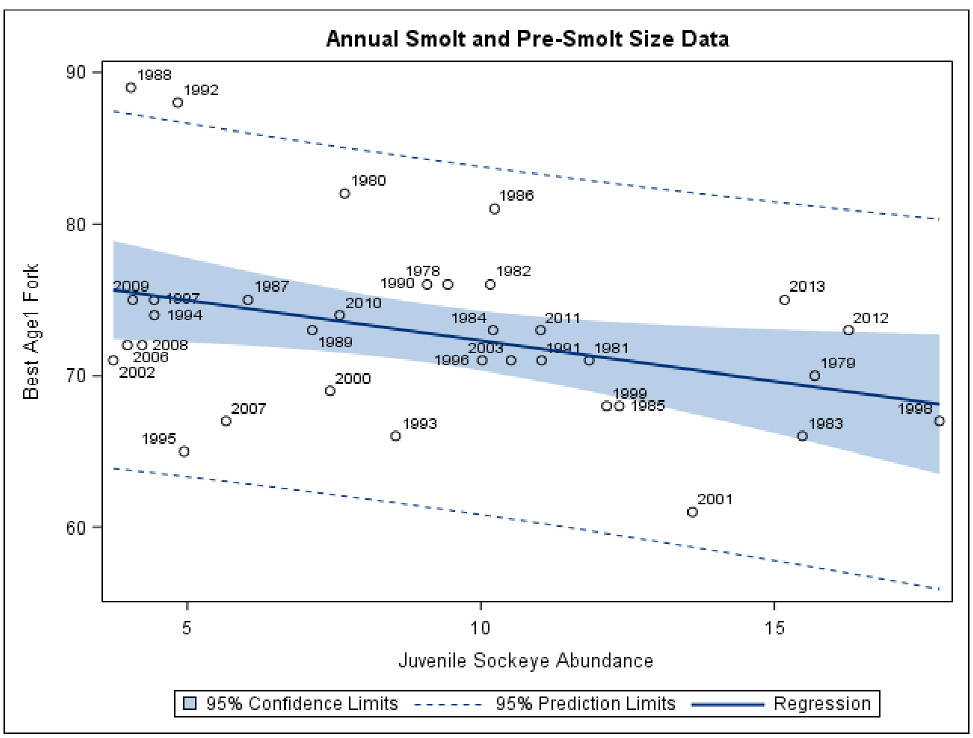


Figure 13. Simple linear relationship for age 1 fork length as a function of winter pre-smolt abundance, 1978-2014 (r = -0.37; P = 0.03; N = 34).

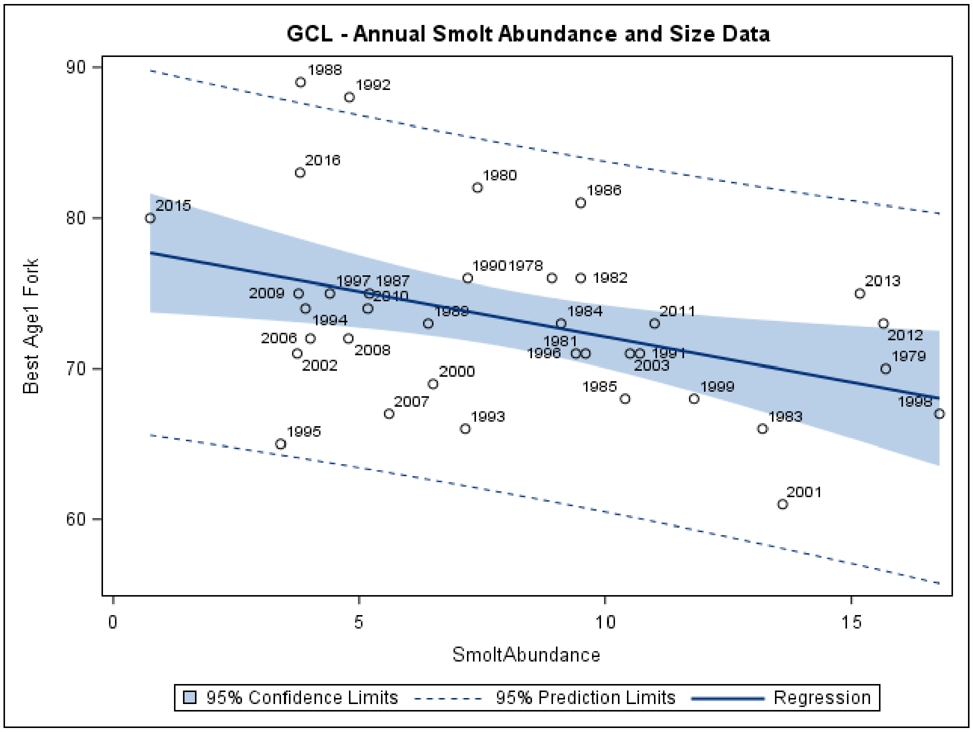


Figure 14. Simple linear relationship for age 1 fork length as a function of final smolt abundance estimate, 1978-2014 (a = 78.1; b = -0.601; r = -0.40; P = 0.01; N = 36).

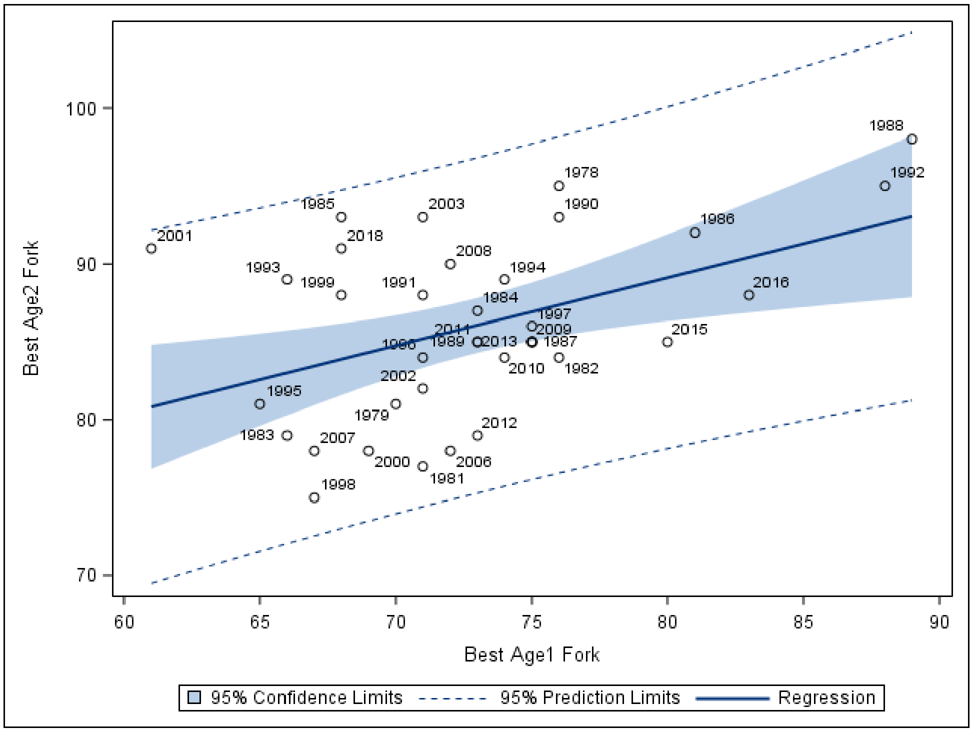
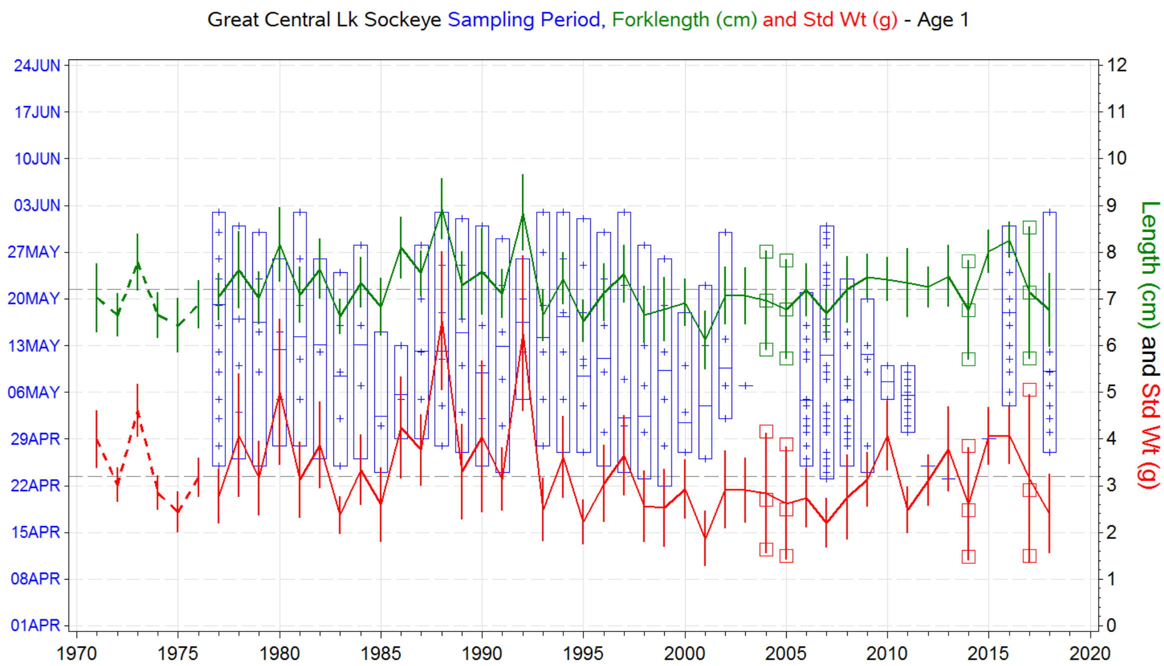


Figure 15. Relationship between age 1 and age 2 fork length, 1978-2018 (a = 54.2; b = 0.436 ; r = 0.45; P < 0.01; N = 36).



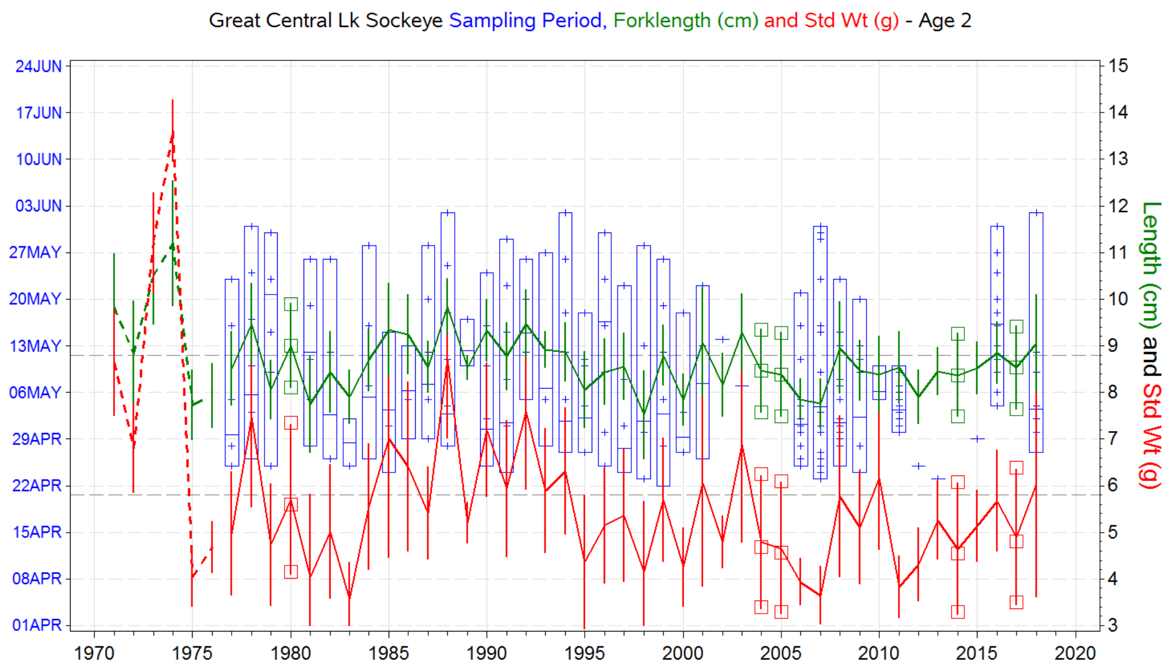


Figure 16. Best estimates of Great Central Lake Sockeye annual mean smolt size (solid lines) based on sampling effort (blue boxes) between April 23rd and June 3rd each year for age 1 smolts (top), with predictive estimates for ocean entry years 2004, 2005, 2014, and 2017 (empty squares). Age 2 (bottom) based on all available samples; smolt size for missing years estimated based on Figure 15. Dashed lines (1971-1976) from Robinson & Barraclough (1972a,b; 1973; 1975a,b; 1976).

TABLES

	Age																			
	1										2									
		Length (cm)				Fresh Std Wt (g)						Length (cm)				Fresh Std Wt (g)				
	N	AVG	P10	P95	MAX	AVG	P95	SD	K	Pct %	N	AVG	P10	P95	MAX	AVG	P95	SD	K	Pct %
Year																				
1977	2,217	7.0	6.4	7.8	9.4	2.8	3.8	0.6	0.79	96	97	8.6	7.3	10.0	10.6	5.1	8.0	1.6	0.78	4
1978	699	7.5	6.3	8.8	10.7	3.9	6.1	1.4	0.89	31	227	9.5	8.3	10.7	11.5	7.4	10.4	2.0	0.86	10
1979	1,274	7.1	6.4	7.9	9.2	3.2	4.5	0.7	0.89	95	71	8.1	7.4	9.4	9.5	4.8	7.5	1.3	0.87	5
1980	455	8.2	7.4	9.6	11.3	5.0	7.9	1.5	0.89	100										
1981	537	7.1	6.3	8.0	8.8	3.1	4.5	0.8	0.86	97	18	7.7	6.5	10.3	10.3	4.0	8.9	1.8	0.83	3
1982	190	7.6	6.7	8.6	9.1	3.9	5.4	0.9	0.86	71	77	8.4	7.1	9.9	10.7	5.0	7.6	1.4	0.82	29
1983	538	6.7	6.2	7.3	8.0	2.4	3.1	0.4	0.81	94	35	8.5	7.9	10.0	10.0	4.8	7.4	1.2	0.75	6
1984	330	7.3	6.6	8.2	9.7	3.3	4.6	0.7	0.83	84	63	8.7	7.8	9.8	9.9	5.5	7.9	1.3	0.83	16
1985	418	6.8	6.0	7.8	10.0	2.6	3.9	0.8	0.79	92	36	9.3	8.1	11.2	12.0	7.0	13.7	2.6	0.83	8
1986	238	8.1	7.2	9.1	10.0	4.2	6.1	1.1	0.78	74	82	9.2	8.1	10.6	11.2	6.4	9.5	1.8	0.79	26
1987	825	7.5	6.9	8.3	9.8	3.7	4.9	0.7	0.86	92	67	8.6	7.9	9.4	10.1	5.5	7.0	1.0	0.87	8
1988	777	8.9	8.1	10.0	11.2	6.6	9.3	1.5	0.90	88	97	9.8	9.0	10.8	10.9	8.6	11.4	1.6	0.90	11
1989	1,017	7.4	6.5	8.7	10.9	3.4	5.5	1.2	0.83	96	44	10.3	8.5	13.3	13.7	9.6	20.3	4.4	0.84	4
1990	1,085	7.6	6.7	9.5	11.5	4.0	7.7	1.6	0.89	91	110	9.3	8.6	10.4	10.9	7.2	9.4	1.4	0.88	9
1991	1,691	7.1	6.4	7.9	9.9	3.1	4.2	0.7	0.87	81	394	8.9	8.0	10.2	11.0	6.2	9.3	1.5	0.87	19
1992	1,052	8.8	7.8	10.0	11.0	6.3	8.9	1.7	0.88	98	24	9.4	8.3	10.6	10.8	7.5	9.9	1.8	0.88	2
1993	2,311	6.7	6.0	7.8	9.4	2.6	4.0	0.8	0.83	99	16	9.1	8.5	10.8	10.8	6.5	9.7	1.5	0.84	1
1994	1,510	7.4	6.8	8.3	10.5	3.6	5.1	0.9	0.87	80	382	9.0	8.2	10.1	10.6	6.6	9.2	1.5	0.89	20
1995	1,075	6.5	6.0	7.2	9.0	2.2	2.9	0.5	0.79	79	286	8.3	7.2	9.6	10.6	4.7	7.3	1.5	0.81	21
1996	1,382	7.1	6.4	8.1	9.4	3.1	4.5	0.8	0.82	66	726	8.4	7.4	9.4	10.4	5.1	7.1	1.2	0.84	34
1997	851	7.6	6.8	8.6	10.2	3.7	5.3	0.9	0.84	85	148	8.7	7.8	9.8	10.5	5.7	7.9	1.3	0.85	15
1998	1,520	6.7	6.0	7.6	10.5	2.6	3.6	0.8	0.85	99	16	7.5	6.6	9.6	9.6	4.2	8.8	1.5	0.95	1
1999	840	6.8	5.9	7.9	9.8	2.5	4.0	0.8	0.79	86	136	8.8	8.0	9.8	10.5	5.7	8.0	1.3	0.82	14
2000	590	6.9	6.3	7.8	8.6	2.9	4.1	0.6	0.87	96	24	7.8	7.3	8.5	9.6	4.2	5.1	0.8	0.88	4
2001	566	6.3	5.4	7.3	10.3	2.0	3.1	0.7	0.79	79	147	9.0	7.7	10.3	11.2	6.0	8.9	1.8	0.80	21
2002	239	7.1	6.3	8.1	8.6	2.9	4.4	0.8	0.81	97	7	8.2	7.4	9.4	9.4	4.8	5.5	0.6	0.89	3
2003	134	7.1	6.3	8.1	8.4	2.9	4.1	0.7	0.81	93	10	9.3	8.6	11.3	11.3	6.9	12.4	2.1	0.84	7
2006	853	7.4	6.6	8.2	9.1	2.9	4.1	0.7	0.73	89	107	8.1	7.5	8.7	9.7	4.2	5.1	0.6	0.80	11
2007	1,287	6.7	6.0	7.7	8.4	2.3	3.3	0.6	0.73	96	52	7.7	7.4	8.5	9.3	3.6	4.6	0.5	0.78	4
2008	827	7.2	6.5	8.6	10.0	2.8	4.7	0.9	0.72	86	139	9.0	7.5	10.3	11.2	5.7	8.4	1.6	0.78	14
2009	460	7.6	7.0	8.8	9.8	3.4	5.4	0.9	0.75	76	144	8.7	8.0	9.6	10.5	5.5	7.1	1.1	0.82	24
2010	271	7.4	6.9	8.2	9.3	4.1	5.3	0.7	0.99	87	42	8.4	7.5	9.5	9.8	6.2	8.7	1.5	1.03	13
2011	526	7.3	6.4	8.5	9.5	2.5	3.4	0.5	0.64	88	74	8.5	7.5	9.9	10.0	3.8	5.2	0.7	0.62	12
2012	132	7.4	6.7	8.1	8.7	3.3	4.3	0.6	0.83	83	27	8.1	7.5	9.1	9.1	4.8	6.0	0.8	0.88	17
2013	83	6.9	6.1	8.2	8.6	3.1	4.8	0.9	0.91	86	13	8.3	7.5	9.1	9.1	5.0	6.4	0.8	0.87	14
2015	41	8.0	7.3	8.7	8.8	4.1	5.0	0.6	0.79	72	16	8.5	7.9	9.5	9.5	5.1	6.6	0.8	0.83	28
2016	406	8.3	7.8	8.8	9.2	4.1	5.0	0.6	0.72	75	136	8.9	8.2	10.0	12.6	5.7	7.8	1.1	0.83	25
2018	832	6.7	5.9	8.3	9.8	2.3	4.0	0.8	0.76	91	82	9.1	7.9	10.5	12.5	6.5	10.9	3.0	0.84	9
All	30079	7.2	6.2	8.8	11.5	3.2	6.0	1.3	0.82	3E3	4,172	8.8	7.5	10.2	13.7	5.8	9.1	1.9	0.84	472

Table 1. Great Central Lake Sockeye annual smolt size statistics (standard fork length (cm), standard fresh weight (g)), by age, sites pooled.

	Sample Dates			
	Robertson Creek		Glover Creek	
	Count	%	Count	%
Year				
1977	24	100		
1978	12	100		
1979	9	100		
1980	7	100		
1981	6	100		
1982	3	100		
1983	6	100		
1984	4	100		
1985	3	100		
1986	3	100		
1987	8	100		
1988	7	100		
1989	7	100		
1990	9	82	2	18
1991	9	53	8	47
1992	5	63	3	38
1993	10	50	10	50
1994	10	56	8	44
1995	7	54	6	46
1996	8	53	7	47

	Sample Dates			
	Robertson Creek		Glover Creek	
	Count	%	Count	%
Year				
1997	7	64	4	36
1998	4	50	4	50
1999	6	86	1	14
2000	4	80	1	20
2001	5	71	2	29
2002	4	100		
2003	1	100		
2006			21	100
2007			27	100
2008			13	100
2009	1	11	8	89
2010	1	33	2	67
2011			11	100
2012	2	100		
2013	2	100		
2015	1	100		
2016			12	100
2018			13	100
ALL	195		163	

Table 2. Great Central Lake Sockeye annual smolt sampling frequency (dates per year), by sampling site.

Great Central Lk Smolt Abundance Density (Years 1977-2018)

Sample Dates (Day of Year, Weighted by #Fish)									
Min	Mean	Max	Std	P05	P10	Med	P90	P95	#Fish
91	131	189	15	111	114	129	152	157	33,718

Great Central Lk Smolt Abundance Density (Years Where #Dates >= 3)

Sample Dates (Day of Year, Weighted by #Fish)									
Min	Mean	Max	Std	P05	P10	Med	P90	P95	#Fish
91	132	189	15	111	114	130	153	157	32,949

Great Central Lk Smolt Abundance Density (Mid-90th Migration Percentile)

Sample Dates (Day of Year, Weighted by #Fish)									
Min	Mean	Max	Std	P05	P10	Med	P90	P95	#Fish
111	131	157	12	114	115	129	150	153	30,484

Great Central Lk Smolt Abundance Density (Mid-80th Migration Percentile)

Sample Dates (Day of Year, Weighted by #Fish)									
Min	Mean	Max	Std	P05	P10	Med	P90	P95	#Fish
114	130	152	11	115	117	129	146	149	27,507

Great Central Lk Smolt Abundance Density (Mid-80th Migration %ile Years Where #Dates >= 3)

Sample Dates (Day of Year, Weighted by #Fish)											
Min	Mean	Max	Std	P01	P05	P10	Med	P90	P95	P99	#Fish
114	131	153	11	114	115	117	130	148	150	153	28,331

Table 3. Great Central Lake Sockeye smolt "migration timing" statistics, including minimum, mean, maximum (Julian) day of year, standard deviation (days), and 5th, 10th, 50th (median), 90th and 95th percentiles, weighted by sample size. Top-to-bottom: (1) all available years; (2) all years where number of sample dates >= 3; (3) all years filtered for mid-90th and (4) mid-80th percentile of migration dates; (5) all years where sample dates >=3 and filtered for mid-80th percentile.
(Note: April 1st = 91; May 1st = 121; May 10th = 130; May 26th = 146; Jun 1st = 152)

	Age 1						Age 2					
	Fork Length (mm)			Preserved Weight (g)			Fork Length (mm)			Preserved Weight (g)		
Year	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
1971	7,503	70.2	7.4	3,674	3.54	0.62	458	98.2	11.5	367	8.84	1.15
1972	2,408	66.5	4.6	2,408	3.01	0.37	1,400	88.4	11.2	1,400	6.80	0.97
1973	4,516	77.8	6.1	4,516	4.61	0.57	402	104.8	10.6	402	11.25	1.09
1974	5,426	66.5	4.9	5,426	2.84	0.37	689	112.2	13.5	689	14.28	1.36
1975	5,197	64.3	5.9	5,197	2.43	0.44	496	77.3	7.5	496	4.04	0.65
1976	1,688	68.8	5.1	1,688	3.17	0.42	1,788	79.3	7.0	1,788	4.67	0.56
Avg	4,456	69.0		3,818	3.27		872	93.4		857	8.31	

Table 4. Sockeye size statistics for smolts emigrating from Great Central Lake via Robertson Creek (April – July), 1971 – 1976 (Source: Robinson and Barraclough 1972a,b; 1973; 1975a,b; 1976).

	Age								
	1								
	N	Length (cm)				Fresh Std Wt (g)			K
		AVG	P10	P95	MAX	AVG	P95	SD	
Year									
1971		7.0	6.3	7.8	7.8	4.0	4.6	0.6	
1972		6.7	6.2	7.1	7.1	3.0	3.4	0.4	
1973		7.8	7.2	8.4	8.4	4.6	5.2	0.6	
1974		6.7	6.2	7.1	7.1	2.8	3.2	0.4	
1975		6.4	5.8	7.0	7.0	2.4	2.9	0.4	
1976		6.9	6.4	7.4	7.4	3.2	3.6	0.4	
1977	1,548	7.0	6.4	7.8	8.8	2.8	3.7	0.6	0.78
1978	626	7.6	6.6	8.9	10.7	4.1	6.1	1.3	0.89
1979	889	7.0	6.3	7.9	9.2	3.2	4.5	0.8	0.90
1980	252	8.2	7.2	9.7	10.8	5.0	8.0	1.6	0.89
1981	537	7.1	6.3	8.0	8.8	3.1	4.5	0.8	0.86
1982	190	7.6	6.7	8.6	9.1	3.9	5.4	0.9	0.86
1983	471	6.6	6.2	7.2	7.9	2.4	3.1	0.4	0.81
1984	330	7.3	6.6	8.2	9.7	3.3	4.6	0.7	0.83
1985	418	6.8	6.0	7.8	10.0	2.6	3.9	0.8	0.79
1986	238	8.1	7.2	9.1	10.0	4.2	6.1	1.1	0.78
1987	515	7.5	6.9	8.3	9.8	3.8	4.9	0.7	0.86
1988	737	8.9	8.1	10.0	11.2	6.5	9.3	1.5	0.90

(Continued)

Table 5. Statistics associated with best estimates of Great Central Lake Sockeye annual (ocean entry year) Age 1 mean smolt size (standard fork length (cm), standard fresh weight (g)), based on sampling effort between April 24th and June 3rd each year. Note: Values for 1971-1976 from Robinson and Barraclough (1972; 1973; 1975; 1976). Values for 2004, 2005, 2014 and 2017 are estimated.

	Age								
	1								
	N	Length (cm)				Fresh Std Wt (g)			K
		AVG	P10	P95	MAX	AVG	P95	SD	
Year									
1989	945	7.3	6.5	8.5	9.9	3.3	5.2	1.0	0.83
1990	998	7.6	6.7	9.6	11.5	4.0	7.8	1.6	0.89
1991	1,435	7.1	6.4	7.9	9.9	3.1	4.2	0.7	0.86
1992	1,051	8.8	7.8	10.0	11.0	6.3	8.9	1.7	0.88
1993	2,003	6.6	6.0	7.6	9.2	2.5	3.7	0.7	0.83
1994	1,142	7.4	6.8	8.3	10.5	3.6	5.0	0.9	0.86
1995	1,073	6.5	6.0	7.2	9.0	2.2	2.8	0.5	0.79
1996	1,372	7.1	6.4	8.1	9.4	3.0	4.4	0.8	0.82
1997	805	7.5	6.8	8.5	10.2	3.6	5.1	0.8	0.84
1998	1,520	6.7	6.0	7.6	10.5	2.6	3.6	0.8	0.85
1999	840	6.8	5.9	7.9	9.8	2.5	4.0	0.8	0.79
2000	590	6.9	6.3	7.8	8.6	2.9	4.1	0.6	0.87
2001	424	6.1	5.3	7.1	8.0	1.9	2.9	0.6	0.79
2002	239	7.1	6.3	8.1	8.6	2.9	4.4	0.8	0.81
2003	134	7.1	6.3	8.1	8.4	2.9	4.1	0.7	0.81
2004	.	7.0	5.9	8.0	8.0	2.8	4.2	1.3	
2005		6.8	5.7	7.8	7.8	2.6	3.9	1.2	

(Continued)

Table 5, continued. Statistics associated with best estimates of Great Central Lake Sockeye annual (ocean entry year) Age 1 mean smolt size (standard fork length (cm), standard fresh weight (g)), based on sampling effort between April 24th and June 3rd each year. Note: Values for 1971-1976 from Robinson and Barraclough (1972; 1973; 1975; 1976). Values for 2004, 2005, 2014 and 2017 are estimated.

	Age								
	1								
	N	Length (cm)				Fresh Std Wt (g)			K
		AVG	P10	P95	MAX	AVG	P95	SD	
Year									
2006	613	7.2	6.5	8.1	9.1	2.7	3.7	0.6	0.72
2007	1,205	6.7	6.0	7.5	8.4	2.2	3.1	0.5	0.73
2008	793	7.2	6.4	8.6	10.0	2.7	4.6	0.9	0.72
2009	345	7.5	7.0	8.2	8.7	3.1	4.0	0.6	0.75
2010	269	7.4	6.9	8.2	9.3	4.1	5.3	0.7	0.99
2011	526	7.3	6.4	8.5	9.5	2.5	3.4	0.5	0.64
2012	56	7.3	6.7	8.0	8.1	3.1	4.2	0.5	0.81
2013	29	7.5	6.7	8.6	8.6	3.8	5.5	0.9	0.89
2014		6.8	5.7	7.8	7.8	2.6	3.9	1.2	
2015	41	8.0	7.3	8.7	8.8	4.1	5.0	0.6	0.79
2016	401	8.3	7.8	8.8	9.2	4.1	5.1	0.6	0.73
2017		7.1	5.7	8.5	8.5	3.1	5.0	1.8	
2018	628	6.8	5.9	8.3	9.8	2.4	4.1	0.8	0.76
All	26258	7.2	6.2	8.9	11.5	3.2	6.1	1.4	0.82

Table 5, continued. Statistics associated with best estimates of Great Central Lake Sockeye annual (ocean entry year) Age 1 mean smolt size (standard fork length (cm), standard fresh weight (g)), based on sampling effort between April 24th and June 3rd each year. Note: Values for 1971-1976 from Robinson and Barraclough (1972; 1973; 1975; 1976). Values for 2004, 2005, 2014 and 2017 are estimated.

	Age								
	2								
	N	Length (cm)				Fresh Std Wt (g)			K
		AVG	P10	P95	MAX	AVG	P95	SD	
Year									
1971		9.8	8.7	11.0	11.0	8.6	9.8	1.2	
1972		8.8	7.7	10.0	10.0	6.8	7.8	1.0	
1973		10.5	9.4	11.6	11.6	11.2	12.3	1.1	
1974		11.2	9.9	12.6	12.6	14.3	15.7	1.4	
1975		7.7	7.0	8.5	8.5	4.0	4.7	0.7	
1976		7.9	7.2	8.6	8.6	4.7	5.2	0.6	
1977	97	8.6	7.3	10.0	10.6	5.1	8.0	1.6	0.78
1978	227	9.5	8.3	10.7	11.5	7.4	10.4	2.0	0.86
1979	71	8.1	7.4	9.4	9.5	4.8	7.5	1.3	0.87
1980		9.0	8.1	9.9	9.9	5.7	7.3	1.6	
1981	18	7.7	6.5	10.3	10.3	4.0	8.9	1.8	0.83
1982	77	8.4	7.1	9.9	10.7	5.0	7.6	1.4	0.82
1983	35	8.5	7.9	10.0	10.0	4.8	7.4	1.2	0.75
1984	63	8.7	7.8	9.8	9.9	5.5	7.9	1.3	0.83
1985	36	9.3	8.1	11.2	12.0	7.0	13.7	2.6	0.83
1986	82	9.2	8.1	10.6	11.2	6.4	9.5	1.8	0.79
1987	67	8.6	7.9	9.4	10.1	5.5	7.0	1.0	0.87
1988	97	9.8	9.0	10.8	10.9	8.6	11.4	1.6	0.90

(Continued)

Table 6. Statistics associated with best estimates of Great Central Lake Sockeye annual (ocean entry year) Age 2 mean smolt size (standard fork length (cm), standard fresh weight (g)), based on all available sampling effort each year. Note: Note: Values for 1971-1976 from Robinson and Barraclough (1972; 1973; 1975; 1976). Missing values for 1980, 2004, 2005, 2014, and 2017 were estimated based on relationship with mean annual Age 1 smolt length.

	Age								
	2								
	N	Length (cm)				Fresh Std Wt (g)			K
		AVG	P10	P95	MAX	AVG	P95	SD	
Year									
1989	44	10.3	8.5	13.3	13.7	9.6	20.3	4.4	0.84
1990	110	9.3	8.6	10.4	10.9	7.2	9.4	1.4	0.88
1991	394	8.9	8.0	10.2	11.0	6.2	9.3	1.5	0.87
1992	24	9.4	8.3	10.6	10.8	7.5	9.9	1.8	0.88
1993	16	9.1	8.5	10.8	10.8	6.5	9.7	1.5	0.84
1994	382	9.0	8.2	10.1	10.6	6.6	9.2	1.5	0.89
1995	286	8.3	7.2	9.6	10.6	4.7	7.3	1.5	0.81
1996	726	8.4	7.4	9.4	10.4	5.1	7.1	1.2	0.84
1997	148	8.7	7.8	9.8	10.5	5.7	7.9	1.3	0.85
1998	16	7.5	6.6	9.6	9.6	4.2	8.8	1.5	0.95
1999	136	8.8	8.0	9.8	10.5	5.7	8.0	1.3	0.82
2000	24	7.8	7.3	8.5	9.6	4.2	5.1	0.8	0.88
2001	147	9.0	7.7	10.3	11.2	6.0	8.9	1.8	0.80
2002	7	8.2	7.4	9.4	9.4	4.8	5.5	0.6	0.89
2003	10	9.3	8.6	11.3	11.3	6.9	12.4	2.1	0.84
2004		8.5	7.6	9.4	9.4	4.8	6.3	1.4	
2005		8.4	7.5	9.3	9.3	4.7	6.1	1.4	

(Continued)

Table 6. Statistics associated with best estimates of Great Central Lake Sockeye annual (ocean entry year) Age 2 mean smolt size (standard fork length (cm), standard fresh weight (g)), based on all available sampling effort each year. Note: Note: Values for 1971-1976 from Robinson and Barraclough (1972; 1973; 1975; 1976). Missing values for 1980, 2004, 2005, 2014, and 2017 were estimated based on relationship with mean annual Age 1 smolt length.

	Age								
	2								
	N	Length (cm)				Fresh Std Wt (g)			K
		AVG	P10	P95	MAX	AVG	P95	SD	
Year									
2006	107	8.1	7.5	8.7	9.7	4.2	5.1	0.6	0.80
2007	52	7.7	7.4	8.5	9.3	3.6	4.6	0.5	0.78
2008	139	9.0	7.5	10.3	11.2	5.7	8.4	1.6	0.78
2009	144	8.7	8.0	9.6	10.5	5.5	7.1	1.1	0.82
2010	42	8.4	7.5	9.5	9.8	6.2	8.7	1.5	1.03
2011	74	8.5	7.5	9.9	10.0	3.8	5.2	0.7	0.62
2012	27	8.1	7.5	9.1	9.1	4.8	6.0	0.8	0.88
2013	13	8.3	7.5	9.1	9.1	5.0	6.4	0.8	0.87
2014		8.4	7.5	9.3	9.3	4.6	6.1	1.4	
2015	16	8.5	7.9	9.5	9.5	5.1	6.6	0.8	0.83
2016	136	8.9	8.2	10.0	12.6	5.7	7.8	1.1	0.83
2017		8.5	7.6	9.4	9.4	4.9	6.4	1.4	
2018	82	9.1	7.9	10.5	12.5	6.5	10.9	3.0	0.84
All	4,205	8.8	7.5	10.2	13.7	5.8	9.2	1.9	0.84

Table 6. Statistics associated with best estimates of Great Central Lake Sockeye annual (ocean entry year) Age 2 mean smolt size (standard fork length (cm), standard fresh weight (g)), based on all available sampling effort each year. Note: Note: Values for 1971-1976 from Robinson and Barraclough (1972; 1973; 1975; 1976). Missing values for 1980, 2004, 2005, 2014, and 2017 were estimated based on relationship with mean annual Age 1 smolt length.

APPENDIX I (Robertson Creek Sample Site)

Appendix I. Annual Sockeye smolt size statistics by sample site, age class, and sample date.

Great Central Lk
Robertson Creek

		Age 1									Age 2								
			Length (cm)			Fresh Std Wt (g)						Length (cm)			Fresh Std Wt (g)				
Year	Date	N	AVG	MAX	SE	AVG	MAX	SE	K	%	N	AVG	MAX	SE	AVG	MAX	SE	K	%
1977	04APR77	2	6.4	6.5	0.10	1.8	1.9	0.07	0.70	0									
	07APR77										2	10.2	10.5	0.30	8.2	8.4	0.22	0.78	0
	11APR77										2	9.5	10.6	1.10	7.2	10.6	3.44	0.76	0
	14APR77	1	7.1	7.1		2.6	2.6		0.74	0	1	8.1	8.1		3.1	3.1		0.58	0
	21APR77	1	9.4	9.4		7.4	7.4		0.89	0	4	9.2	10.5	0.62	6.5	10.3	1.66	0.76	0
	25APR77	53	8.0	8.8	0.07	4.1	5.6	0.11	0.78	2	60	9.0	10.1	0.05	5.7	8.0	0.11	0.79	3
	28APR77	2	6.5	7.0	0.55	2.2	2.8	0.61	0.78	0	1	8.1	8.1		3.8	3.8		0.71	0
	02MAY77	6	6.5	7.3	0.26	1.9	3.1	0.29	0.67	0									
	05MAY77	152	7.1	8.2	0.03	2.8	4.4	0.04	0.79	7	17	7.6	8.7	0.11	3.4	5.0	0.13	0.79	1
	09MAY77	190	6.9	7.9	0.03	2.5	3.6	0.03	0.76	8									
	12MAY77	60	6.7	7.6	0.05	2.5	3.4	0.05	0.81	3									

		Age 1									Age 2								
			Length (cm)			Fresh Std Wt (g)						Length (cm)			Fresh Std Wt (g)				
Year	Date	N	AVG	MAX	SE	AVG	MAX	SE	K	%	N	AVG	MAX	SE	AVG	MAX	SE	K	%
1977	16MAY77	183	6.8	8.0	0.03	2.5	4.0	0.04	0.76	8	6	7.4	7.7	0.10	3.1	3.9	0.21	0.78	0
	19MAY77	125	7.0	7.5	0.03	2.7	3.4	0.03	0.81	5									
	23MAY77	197	7.0	8.0	0.03	2.8	4.3	0.04	0.80	8	4	7.5	7.7	0.14	3.4	3.7	0.13	0.80	0
	26MAY77	228	7.2	8.2	0.03	2.8	4.4	0.03	0.76	10									
	30MAY77	222	7.3	8.4	0.02	3.1	4.6	0.03	0.77	10									
	02JUN77	130	6.7	7.9	0.03	2.6	4.0	0.04	0.84	6									
	06JUN77	46	6.7	7.6	0.07	2.1	3.4	0.09	0.69	2									
	13JUN77	203	7.0	8.0	0.03					9									
	16JUN77	207	7.0	7.9	0.03	2.7	4.2	0.04	0.78	9									
	20JUN77	70	6.9	7.8	0.04	2.9	3.8	0.04	0.87	3									

(Continued)

Great Central Lk
Robertson Creek

		Age																	
		1									2								
			Length (cm)			Fresh Std Wt (g)						Length (cm)			Fresh Std Wt (g)				
		N	AVG	MAX	SE	AVG	MAX	SE	K	%	N	AVG	MAX	SE	AVG	MAX	SE	K	%
Year	Date																		
1977	23JUN77	50	6.9	7.5	0.06	2.6	4.0	0.07	0.81	2									
	27JUN77	55	7.0	7.9	0.06	3.3	4.5	0.09	0.95	2									
	30JUN77	34	7.4	8.9	0.09	3.8	6.6	0.14	0.94	1									
	ALL	2,217	7.0	9.4	0.01	2.8	7.4	0.01	0.79	96	97	8.6	10.6	0.09	5.1	10.6	0.16	0.78	4
1978	Date																		
	04JUL77	20	7.3	8.1	0.09	3.7	4.9	0.15	0.93	2									
	08JUL77	6	7.7	8.1	0.12	4.0	4.2	0.09	0.88	1									
	07APR78										1	8.9	8.9		5.3	5.3		0.75	0
	14APR78	3	6.7	7.0	0.18	2.3	2.6	0.23	0.73	0	3	9.0	9.3	0.22	6.0	6.3	0.29	0.82	0
	21APR78	2	7.1	7.3	0.25	2.7	3.1	0.47	0.75	0	3	9.6	10.5	0.77	7.1	8.9	1.51	0.77	0
Year	Date																		
1978	26APR78	39	7.9	10.7	0.17	4.1	9.4	0.27	0.80	4	28	9.8	11.0	0.15	7.5	10.3	0.33	0.79	3
	03MAY78	65	8.2	10.5	0.12	5.2	10.5	0.23	0.89		125	9.7	11.5	0.07	8.1	12.6	0.16	0.89	
	10MAY78	32	7.5	10.6	0.19	3.5	9.7	0.30	0.78	3	35	9.4	10.6	0.12	6.7	9.5	0.28	0.80	3
	17MAY78	295	7.7	10.4	0.04	4.3	8.3	0.07	0.91		22	8.7	10.4	0.15	6.0	9.6	0.32	0.90	2
	24MAY78	118	7.4	8.6	0.05	3.8	6.0	0.07	0.91	11	3	9.3	10.8	0.75	7.1	10.7	1.80	0.85	0
	31MAY78	77	7.0	8.0	0.05	3.1	4.2	0.07	0.89	7	6	7.5	8.0	0.10	3.9	4.9	0.20	0.92	1
	07JUN78	42	6.0	7.5	0.08	1.9	4.0	0.09	0.86	4	1	7.2	7.2		2.6	2.6		0.68	0
	ALL	699	7.5	10.7	0.03	3.9	10.5	0.05	0.89	31	227	9.5	11.5	0.06	7.4	12.6	0.13	0.86	10
1979	Date																		
	18APR79	84	7.5	9.1	0.06	3.4	5.6	0.08	0.80	6	13	8.5	9.5	0.23	4.8	7.5	0.37	0.78	1
1979	25APR79	94	7.3	8.7	0.05	3.3	5.3	0.07	0.82	7	6	8.5	9.1	0.18	5.1	6.2	0.27	0.83	0
	09MAY79	196	7.1	8.7	0.04	3.3	5.7	0.05	0.91	15	5	8.4	9.4	0.25	5.2	7.0	0.49	0.86	0
	15MAY79	214	6.8	9.2	0.03	2.8	7.5	0.04	0.90	16	11	7.9	9.3	0.25	4.5	7.1	0.43	0.88	1
	23MAY79	197	6.8	8.2	0.03	2.7	5.2	0.05	0.87	15	7	7.9	9.4	0.28	4.3	8.5	0.73	0.83	1
	30MAY79	188	7.3	8.4	0.04	3.7	6.7	0.05	0.95	14	28	8.0	9.5	0.10	4.8	8.3	0.23	0.92	2
	11JUN79	101	7.3	8.8	0.04	3.4	6.4	0.06	0.89	8	1	8.3	8.3		5.5	5.5		0.96	0
	20JUN79	100	7.2	8.2	0.03	3.2	4.5	0.05	0.87	7									
	27JUN79	100	7.2	8.2	0.03	3.5	5.4	0.06	0.94	7									
	ALL	1,274	7.1	9.2	0.01	3.2	7.5	0.02	0.89	95	71	8.1	9.5	0.08	4.8	8.5	0.15	0.87	5
1980	21APR80	3	7.8	9.5	0.91	4.2	7.1	1.46	0.82	1									
	28APR80	8	7.8	10.2	0.56	4.7	9.7	1.10	0.88	2									
	05MAY80	100	8.3	10.8	0.10	5.1	10.8	0.20	0.86	22									
	15MAY80	100	8.1	9.7	0.05	4.8	8.2	0.10	0.91	22									
	26MAY80	44	8.2	10.0	0.06	5.2	9.6	0.14	0.93	10									
	04JUN80	100	8.1	9.4	0.05	4.9	8.0	0.10	0.89	22									
	09JUN80	100	8.3	11.3	0.08	5.1	12.9	0.17	0.87	22									
	ALL	455	8.2	11.3	0.03	5.0	12.9	0.07	0.89	100									
1981	Date																		
	28APR81	99	6.6	7.9	0.05	2.4	3.9	0.05	0.81	18	1	7.1	7.1		3.0	3.0		0.84	0

(Continued)

Great Central Lk
Robertson Creek

		Age																	
		1									2								
			Length (cm)			Fresh Std Wt (g)						Length (cm)			Fresh Std Wt (g)				
		N	AVG	MAX	SE	AVG	MAX	SE	K	%	N	AVG	MAX	SE	AVG	MAX	SE	K	%
Year	Date																		
1981	05MAY81	80	7.1	8.1	0.06	3.1	4.5	0.07	0.85	14	5	7.4	8.2	0.30	3.5	4.2	0.36	0.84	1
	11MAY81	78	7.3	8.8	0.06	3.3	5.7	0.09	0.83	14	7	8.0	10.3	0.46	4.4	8.9	0.86	0.81	1
	19MAY81	131	7.1	8.7	0.05	3.3	5.6	0.06	0.89	24	2	8.0	9.0	1.00	4.9	6.8	1.94	0.90	0
	26MAY81	113	7.1	8.3	0.05	3.3	5.3	0.07	0.89	20	3	7.8	9.2	0.81	3.9	5.5	1.07	0.78	1
	02JUN81	36	7.6	8.8	0.10	3.9	5.6	0.15	0.87	6									
	ALL	537	7.1	8.8	0.03	3.1	5.7	0.03	0.86	97	18	7.7	10.3	0.24	4.0	8.9	0.42	0.83	3
1982	Date																		
	26APR82	64	8.0	9.1	0.08	4.1	5.9	0.12	0.80	24	54	8.5	10.1	0.10	5.1	7.6	0.18	0.80	20
	12MAY82	37	7.7	8.5	0.08	3.8	4.9	0.11	0.80	14	13	8.3	10.7	0.32	4.8	8.9	0.52	0.81	5
	26MAY82	89	7.4	8.7	0.06	3.8	6.3	0.10	0.92	33	10	8.0	9.7	0.29	4.9	8.2	0.51	0.93	4
1982		190	7.6	9.1	0.05	3.9	6.3	0.07	0.86	71	77	8.4	10.7	0.10	5.0	8.9	0.16	0.82	29
1983	Date																		
	18APR83	67	7.0	8.0	0.04	2.7	4.1	0.05	0.79	12	33	8.6	10.0	0.11	4.8	8.4	0.21	0.75	6
	25APR83	99	6.7	7.8	0.04	2.5	4.1	0.04	0.82	17	1	8.3	8.3		4.1	4.1		0.72	0
	02MAY83	99	6.6	7.9	0.04	2.4	3.3	0.03	0.81	17	1	7.5	7.5		3.0	3.0		0.72	0
	09MAY83	99	6.6	7.2	0.03	2.3	3.0	0.03	0.81	17									
	16MAY83	100	6.6	7.6	0.04	2.3	3.3	0.04	0.80	17									
	24MAY83	74	6.6	7.4	0.04	2.4	3.3	0.05	0.81	13									
	ALL	538	6.7	8.0	0.02	2.4	4.1	0.02	0.81	94	35	8.5	10.0	0.11	4.8	8.4	0.21	0.75	6
1984	26APR84	76	7.5	9.7	0.07	3.5	7.1	0.10	0.81	19	24	8.7	9.9	0.14	5.4	7.9	0.28	0.81	6
	07MAY84	66	7.5	8.7	0.06	3.6	5.2	0.08	0.85	17	27	8.8	9.8	0.12	5.8	8.7	0.25	0.85	7
	16MAY84	92	7.5	8.5	0.04	3.5	5.4	0.06	0.82	23	8	8.6	9.9	0.27	5.4	8.9	0.58	0.83	2
	28MAY84	96	7.0	8.1	0.05	2.9	4.6	0.06	0.84	24	4	8.7	9.7	0.34	5.6	7.6	0.68	0.85	1
	ALL	330	7.3	9.7	0.03	3.3	7.1	0.04	0.83	84	63	8.7	9.9	0.08	5.5	8.9	0.17	0.83	16
1985	Date																		
	24APR85	192	7.0	10.0	0.04	2.8	8.2	0.05	0.79	42	2	8.5	8.6	0.15	4.7	4.9	0.17	0.78	0
	01MAY85	89	7.0	9.0	0.07	2.8	6.1	0.10	0.80	20	27	9.5	12.0	0.20	7.4	14.1	0.52	0.84	6
	15MAY85	137	6.5	8.1	0.05	2.2	4.3	0.05	0.79	30	7	9.1	10.4	0.30	6.3	9.4	0.66	0.83	2
	ALL	418	6.8	10.0	0.03	2.6	8.2	0.04	0.79	92	36	9.3	12.0	0.17	7.0	14.1	0.43	0.83	8
1986	29APR86	76	8.2	9.7	0.08	4.3	7.1	0.13	0.77	24	26	9.5	11.2	0.17	6.9	10.9	0.37	0.79	8
	05MAY86	87	8.0	10.0	0.07	4.1	8.5	0.12	0.79	27	24	9.0	10.5	0.16	5.9	10.0	0.35	0.80	8
	13MAY86	75	8.1	9.5	0.06	4.3	6.9	0.11	0.78	23	32	9.3	11.0	0.15	6.4	10.7	0.31	0.78	10
	ALL	238	8.1	10.0	0.04	4.2	8.5	0.07	0.78	74	82	9.2	11.2	0.09	6.4	10.9	0.20	0.79	26
1987	Date																		
	21APR87	88	7.8	8.9	0.04	4.0	5.8	0.06	0.85	10	14	8.8	10.1	0.15	5.9	9.0	0.31	0.88	2
	29APR87	135	7.8	9.8	0.04	4.1	8.8	0.07	0.86	15	18	8.9	9.5	0.10	6.1	7.0	0.19	0.84	2
	05MAY87	98	7.6	8.5	0.04	3.7	5.1	0.06	0.86	11	3	8.3	8.5	0.12	4.9	5.4	0.28	0.85	0
	12MAY87	90	7.6	8.7	0.05	4.0	6.2	0.07	0.90	10	11	8.4	9.6	0.17	5.1	7.8	0.33	0.86	1
	20MAY87	94	7.4	8.4	0.05	3.6	5.2	0.07	0.87	11	8	8.5	9.2	0.20	5.3	6.8	0.37	0.86	1

(Continued)

Great Central Lk
Robertson Creek

		Age																	
		1									2								
		N	Length (cm)			Fresh Std Wt (g)			K	%	N	Length (cm)			Fresh Std Wt (g)			K	%
			AVG	MAX	SE	AVG	MAX	SE				AVG	MAX	SE	AVG	MAX	SE		
Year	Date																		
1987	28MAY87	105	7.3	8.4	0.04	3.4	5.3	0.06	0.85	12	2	7.9	8.1	0.20	4.5	4.7	0.22	0.91	0
	03JUN87	118	7.5	8.6	0.05	3.6	5.6	0.07	0.85	13									
	04JUN87	104	7.4	8.4	0.04	3.5	5.2	0.06	0.86	12	4	8.2	8.7	0.19	4.8	5.6	0.35	0.88	0
	ALL	832	7.5	9.8	0.02	3.7	8.8	0.03	0.86	93	60	8.6	10.1	0.07	5.6	9.0	0.14	0.86	7
1988	Date																		
	20APR88	40	9.2	10.3	0.07	7.0	10.0	0.17	0.88	5	24	9.7	10.8	0.11	8.3	11.3	0.30	0.89	3
	28APR88	145	9.5	11.2	0.04	8.1	12.5	0.12	0.93	16	49	9.9	10.9	0.08	9.1	12.3	0.23	0.93	6
	04MAY88	141	8.9	10.0	0.04	6.3	8.9	0.08	0.88	16	11	9.6	10.6	0.17	7.9	10.5	0.44	0.88	1
	11MAY88	174	8.9	10.4	0.04	6.3	10.0	0.09	0.88	20	3	9.6	9.9	0.18	7.5	8.0	0.41	0.83	0
	18MAY88	110	8.6	9.9	0.06	5.7	8.9	0.11	0.89	12	6	9.6	10.8	0.31	7.6	10.9	0.81	0.85	1
1988	25MAY88	90	8.6	10.1	0.07	6.0	9.4	0.14	0.92	10	2	9.3	9.6	0.35	6.8	6.9	0.02	0.87	0
	02JUN88	77	8.6	10.0	0.07	6.1	9.1	0.14	0.94	9	2	10.7	10.7	0.00	10.8	11.2	0.39	0.88	0
	ALL	777	8.9	11.2	0.02	6.6	12.5	0.05	0.90	88	97	9.8	10.9	0.06	8.6	12.3	0.17	0.90	11
1989	Date																		
	19APR89	72	8.5	10.9	0.09	5.2	11.1	0.18	0.82	7	41	10.4	13.7	0.22	10.0	21.8	0.68	0.84	4
	27APR89	165	7.8	9.4	0.05	4.1	7.1	0.08	0.83	16									
	03MAY89	130	7.5	9.6	0.05	3.5	7.4	0.08	0.82	12									
	10MAY89	166	7.4	8.8	0.04	3.3	5.9	0.06	0.81	16	2	8.7	8.8	0.15	5.3	5.7	0.40	0.82	0
	17MAY89	117	7.4	8.9	0.06	3.5	6.2	0.09	0.85	11	1	8.3	8.3		5.0	5.0		0.88	0
	25MAY89	167	7.1	9.9	0.06	3.0	7.9	0.08	0.80	16									
1989	01JUN89	200	6.8	8.9	0.03	2.7	5.2	0.04	0.84	19									
	ALL	1,017	7.4	10.9	0.02	3.4	11.1	0.04	0.83	96	44	10.3	13.7	0.21	9.6	21.8	0.66	0.84	4
1990	Date																		
	04APR90										1	9.8	9.8		8.9	8.9		0.95	0
	18APR90	5	7.6	9.7	0.58	4.1	8.2	1.09	0.87	0									
	25APR90	171	8.1	10.6	0.07	5.0	11.1	0.13	0.92	21	28	9.2	10.0	0.09	7.2	9.4	0.20	0.91	
	10MAY90	187	7.3	8.9	0.03	3.5	6.7	0.04	0.88	16	12	8.8	10.0	0.17	5.9	8.7	0.38	0.86	1
	16MAY90	193	7.1	9.5	0.03	3.3	8.0	0.04	0.92	16	7	8.6	9.2	0.18	5.7	6.7	0.33	0.89	1
	24MAY90	167	6.9	8.2	0.03	3.0	5.8	0.04	0.91	14	4	8.6	9.3	0.36	6.0	8.1	0.78	0.95	0
	31MAY90	27	6.9	8.0	0.09	3.1	5.2	0.14	0.91	2									
1990	13JUN90	76	7.2	8.8	0.05	3.3	6.1	0.07	0.86	6									
	28JUN90	6	7.5	7.9	0.16	4.0	4.6	0.21	0.97	1									
	ALL	832	7.3	10.6	0.02	3.6	11.1	0.04	0.90	76	52	9.0	10.0	0.08	6.6	9.4	0.18	0.90	2
1991	Date																		
	10APR91	1	8.0	8.0		4.2	4.2		0.82	0	11	9.7	10.4	0.20	8.2	10.9	0.53	0.88	1
	17APR91	11	7.6	8.7	0.17	4.0	5.8	0.26	0.90	1	38	9.0	10.5	0.11	6.5	10.2	0.23	0.88	4
	24APR91	61	7.6	9.9	0.07	3.7	7.9	0.12	0.82	7	56	9.1	10.9	0.11	6.3	10.1	0.22	0.84	5
	01MAY91	143	7.4	8.6	0.04	3.3	5.2	0.05	0.82		57	8.7	10.1	0.09	5.6	9.1	0.17	0.85	5
	08MAY91	164	7.1	8.9	0.04	3.3	6.5	0.05	0.93		36	8.5	9.7	0.09	5.9	8.3	0.19	0.95	2
	15MAY91	10	6.6	7.4	0.13	2.7	3.6	0.15	0.92	2									

(Continued)

Great Central Lk
Robertson Creek

		Age																	
		1									2								
			Length (cm)			Fresh Std Wt (g)						Length (cm)			Fresh Std Wt (g)				
		N	AVG	MAX	SE	AVG	MAX	SE	K	%	N	AVG	MAX	SE	AVG	MAX	SE	K	%
Year	Date																		
1991	22MAY91	183	7.0	8.0	0.03	2.9	4.4	0.04	0.84	14	6	8.4	8.7	0.09	4.8	5.2	0.11	0.83	
	29MAY91	196	6.8	7.9	0.03	2.7	4.4	0.04	0.84	15	4	8.3	9.1	0.27	5.0	6.3	0.45	0.86	0
	05JUN91	140	6.9	7.8	0.03	3.1	4.5	0.05	0.95	12	1	8.1	8.1		4.7	4.7		0.89	0
	ALL	909	7.1	9.9	0.02	3.1	7.9	0.02	0.87	50	209	8.8	10.9	0.05	6.1	10.9	0.11	0.87	18
1992	Date																		
	05MAY92	194	9.4	11.0	0.04	7.3	11.5	0.09	0.88	18	6	9.7	10.6	0.19	8.2	9.9	0.43	0.89	1
	12MAY92	196	9.4	10.7	0.04	7.5	10.9	0.08	0.90	29	4	9.9	10.1	0.07	8.5	8.9	0.27	0.87	
	20MAY92	135	8.5	10.0	0.05	5.5	9.2	0.10	0.90	25	2	8.5	8.7	0.20	5.3	5.3	0.04	0.86	
	26MAY92	186	8.2	10.3	0.05	4.8	10.4	0.09	0.87	26									
	03JUN92	1	8.1	8.1		4.7	4.7		0.87	0	1	7.9	7.9		4.4	4.4		0.89	0
1992		712	8.9	11.0	0.03	6.4	11.5	0.06	0.89	98	13	9.4	10.6	0.21	7.5	9.9	0.46	0.88	1
1993	Date																		
	14APR93	2	7.4	7.7	0.35	3.9	4.3	0.42	0.97	1									
	21APR93	81	7.6	9.1	0.06	3.7	6.5	0.10	0.84	8	2	9.4	10.8	1.45	6.7	9.7	3.07	0.75	0
	28APR93	199	7.0	8.5	0.04	2.8	5.0	0.05	0.81	17	1	8.9	8.9		5.1	5.1		0.73	0
	05MAY93	222	6.4	7.7	0.03	2.2	4.4	0.03	0.84	16									
	12MAY93	200	6.4	7.3	0.03	2.2	3.6	0.03	0.83	15									
	19MAY93	187	6.5	7.9	0.04	2.3	3.9	0.04	0.81	13									
	27MAY93	162	6.5	7.6	0.04	2.3	3.9	0.04	0.83	12	1	8.7	8.7		6.2	6.2		0.95	0
	02JUN93	200	6.6	7.7	0.03	2.4	3.9	0.04	0.82	13									
1993	08JUN93	44	6.7	7.5	0.06	2.7	3.9	0.08	0.89	4									
	16JUN93	19	6.6	7.5	0.08	2.5	3.9	0.10	0.87	1									
	ALL	1,316	6.6	9.1	0.02	2.5	6.5	0.02	0.83	99	4	9.1	10.8	0.61	6.2	9.7	1.30	0.79	1
1994	Date																		
	01APR94										5	9.2	9.6	0.15	7.0	8.1	0.35	0.90	0
	21APR94	29	8.8	10.3	0.14	6.1	10.5	0.30	0.87	2	131	9.3	10.6	0.06	7.1	11.3	0.14	0.88	7
	27APR94	17	8.4	9.5	0.13	5.4	7.5	0.22	0.90	1	83	9.0	10.3	0.05	6.8	9.7	0.12	0.91	7
	05MAY94	168	7.7	9.7	0.04	4.3	8.0	0.06	0.92	12	32	8.4	9.3	0.09	5.5	7.4	0.18	0.93	
	12MAY94	189	7.7	9.2	0.03	3.8	7.0	0.04	0.83	16	10	8.9	10.3	0.29	5.9	9.1	0.59	0.82	1
	18MAY94	193	7.1	9.3	0.03	3.2	6.9	0.04	0.86	12	3	8.7	10.3	0.83	6.2	9.7	1.79	0.88	0
1994	26MAY94	71	7.1	8.1	0.06	3.1	4.6	0.07	0.85	7	2	9.4	10.3	0.95	7.3	9.8	2.44	0.86	
	02JUN94	117	7.2	8.3	0.04	3.1	4.5	0.05	0.84	12									
	08JUN94	181	7.3	10.5	0.03	3.5	10.7	0.06	0.88	17									
	16JUN94	31	7.0	7.5	0.04	3.2	3.8	0.05	0.91	2									
	ALL	996	7.4	10.5	0.02	3.7	10.7	0.03	0.87	80	266	9.1	10.6	0.04	6.8	11.3	0.09	0.89	15
1995	Date																		
	12APR95	1	6.2	6.2		2.0	2.0		0.83	0									
	19APR95	1	7.2	7.2		3.1	3.1		0.83	0	14	8.9	9.5	0.16	5.8	7.5	0.35	0.81	5
	27APR95	151	6.8	9.0	0.04	2.6	6.2	0.05	0.80		42	8.4	9.7	0.09	4.9	7.7	0.17	0.81	5
	04MAY95	177	6.6	7.4	0.03	2.3	3.4	0.03	0.81		23	8.0	9.0	0.10	4.3	6.2	0.19	0.82	4

(Continued)

Great Central Lk
Robertson Creek

		Age																	
		1									2								
			Length (cm)			Fresh Std Wt (g)						Length (cm)			Fresh Std Wt (g)				
		N	AVG	MAX	SE	AVG	MAX	SE	K	%	N	AVG	MAX	SE	AVG	MAX	SE	K	%
Year	Date																		
1995	11MAY95	48	6.3	7.3	0.05	2.1	3.1	0.05	0.81	4	4	8.7	9.3	0.22	5.5	6.6	0.38	0.83	0
	18MAY95	53	6.1	7.0	0.05	1.9	2.9	0.04	0.80	18	2	9.7	10.3	0.60	8.3	10.3	1.98	0.89	0
	25MAY95	6	6.3	6.8	0.20	1.9	2.4	0.15	0.78	0									
	ALL	437	6.6	9.0	0.02	2.3	6.2	0.03	0.80	22	85	8.4	10.3	0.07	5.0	10.3	0.14	0.82	15
1996	Date																		
	11APR96	2	7.4	7.4	0.05	3.2	3.5	0.26	0.80	0	1	7.5	7.5		3.7	3.7		0.89	
	18APR96	6	8.0	8.5	0.15	4.6	5.6	0.25	0.90	0									
	25APR96	98	7.2	8.1	0.05	3.3	4.8	0.06	0.86	9	9	8.1	9.0	0.17	4.7	6.6	0.33	0.88	1
	30APR96	191	7.1	8.2	0.03	2.9	4.5	0.04	0.83	18	9	8.0	8.9	0.16	4.4	6.4	0.32	0.87	1
	09MAY96	173	6.9	8.3	0.04	2.9	5.1	0.05	0.87	13	27	8.4	9.5	0.11	5.3	7.7	0.22	0.87	
1996	16MAY96	125	7.0	8.5	0.06	2.9	5.1	0.08	0.81	8	75	8.6	9.8	0.06	5.4	7.6	0.12	0.83	11
	23MAY96	139	7.3	9.4	0.05	3.2	6.5	0.07	0.80		61	8.6	10.0	0.07	5.4	8.1	0.14	0.83	5
	30MAY96	139	7.4	9.0	0.05	3.5	6.0	0.08	0.87	11	61	8.7	9.7	0.07	5.8	8.4	0.13	0.88	6
	ALL	873	7.1	9.4	0.02	3.1	6.5	0.03	0.84	60	243	8.6	10.0	0.04	5.4	8.4	0.07	0.85	24
1997	Date																		
	10APR97	3	7.6	7.8	0.12	4.2	4.6	0.25	0.95	0	5	8.7	9.1	0.24	6.5	7.4	0.52	0.97	1
	17APR97	14	7.7	9.0	0.16	4.2	5.7	0.19	0.92	4	10	8.7	9.8	0.16	6.0	6.9	0.22	0.90	
	24APR97	154	7.8	9.1	0.04	3.9	6.1	0.05	0.82	26	16	8.5	9.2	0.13	5.1	6.5	0.22	0.83	
	01MAY97	77	7.5	8.7	0.06	3.9	6.1	0.08	0.91	24	6	8.6	9.1	0.19	5.6	7.0	0.47	0.88	2
	08MAY97	135	7.4	8.8	0.04	3.2	5.4	0.05	0.80	28	3	8.9	9.2	0.15	6.4	7.8	0.71	0.89	1
1997	22MAY97	16	7.6	8.6	0.17	3.9	5.3	0.26	0.87	2	2	10.0	10.5	0.50	9.3	10.5	1.13	0.93	0
	02JUN97	11	6.4	6.9	0.12	2.3	2.9	0.11	0.88	1									
	ALL	410	7.6	9.1	0.03	3.7	6.1	0.04	0.84	86	42	8.7	10.5	0.09	5.8	10.5	0.20	0.88	3
1998	Date																		
	23APR98	217	6.7	8.2	0.03	2.9	4.7	0.04	0.96	30	6	8.0	8.5	0.14	4.5	5.1	0.21	0.87	0
	30APR98	274	6.7	8.4	0.03	2.5	5.2	0.03	0.82	35	1	8.4	8.4		5.6	5.6		0.95	0
	07MAY98	86	6.2	10.5	0.07	2.3	13.2	0.16	0.92	11									
	28MAY98	79	6.0	7.3	0.03	2.2	4.0	0.04	1.04	5	2	5.9	6.6	0.70	2.2	3.0	0.83	1.01	0
	ALL	656	6.6	10.5	0.02	2.6	13.2	0.03	0.90	82	9	7.6	8.5	0.35	4.1	5.6	0.43	0.91	1
1999	22APR99	7	7.4	7.9	0.21	3.3	4.1	0.28	0.82	1	32	8.8	10.5	0.12	5.8	10.0	0.26	0.84	3
	28APR99	154	7.1	8.5	0.05	3.0	5.2	0.07	0.79	16	46	8.9	10.2	0.07	5.8	9.1	0.16	0.82	5
	05MAY99	189	6.5	9.8	0.05	2.2	8.5	0.06	0.78	19	1	8.9	8.9		5.8	5.8		0.83	0
	12MAY99	192	6.7	8.5	0.04	2.4	5.2	0.05	0.79	36	8	8.6	9.5	0.19	5.3	7.3	0.36	0.83	
	19MAY99	129	6.7	8.7	0.06	2.6	5.5	0.08	0.80	13	17	9.0	10.3	0.16	6.2	9.3	0.38	0.83	2
	26MAY99	19	6.2	7.0	0.09	2.0	2.9	0.09	0.83	2	5	8.8	9.3	0.21	6.0	6.7	0.30	0.88	1
	ALL	690	6.7	9.8	0.03	2.5	8.5	0.03	0.79	87	109	8.9	10.5	0.06	5.9	10.0	0.12	0.83	10
2000	Date																		
	27APR00	181	7.0	8.3	0.03	3.1	4.9	0.04	0.88	52	6	8.2	9.6	0.31	4.8	7.4	0.55	0.86	2
	03MAY00	200	6.8	8.0	0.02	2.7	4.8	0.03	0.88	33									

(Continued)

Great Central Lk
Robertson Creek

		Age																	
		1									2								
			Length (cm)			Fresh Std Wt (g)						Length (cm)			Fresh Std Wt (g)				
		N	AVG	MAX	SE	AVG	MAX	SE	K	%	N	AVG	MAX	SE	AVG	MAX	SE	K	%
Year	Date																		
2000	10MAY00	18	6.6	8.1	0.15	2.5	4.6	0.19	0.86	3									
	18MAY00	60	6.5	7.4	0.05	2.4	3.7	0.06	0.87	10									
	ALL	459	6.8	8.3	0.02	2.8	4.9	0.03	0.88	98	6	8.2	9.6	0.31	4.8	7.4	0.55	0.86	2
2001	Date																		
	11APR01	17	6.8	7.6	0.14	2.6	3.4	0.15	0.82	3	19	9.3	10.4	0.16	6.9	9.6	0.35	0.83	6
	18APR01	133	6.8	10.3	0.06	2.6	8.6	0.08	0.78	19	67	9.0	10.7	0.10	6.0	9.6	0.20	0.79	9
	26APR01	193	6.2	7.4	0.04	2.0	3.3	0.04	0.79	36	7	8.5	9.5	0.23	4.8	6.5	0.39	0.76	
	13MAY01	118	5.8	8.0	0.05	1.5	3.9	0.05	0.77	17	12	9.6	11.2	0.24	7.0	10.8	0.55	0.76	2
	22MAY01	55	6.1	7.4	0.09	1.9	3.7	0.08	0.83	8	2	9.4	10.4	0.95	7.5	10.2	2.67	0.85	0
	ALL	516	6.3	10.3	0.03	2.0	8.6	0.03	0.79	81	107	9.1	11.2	0.08	6.2	10.8	0.17	0.79	17
2002	02MAY02	54	7.0	8.2	0.09	2.5	4.1	0.09	0.72	22									
	07MAY02	85	6.9	8.6	0.07	2.6	4.3	0.07	0.78	35									
	14MAY02	94	7.4	8.5	0.05	3.6	5.5	0.08	0.90	38	1	9.4	9.4		5.0	5.0		0.60	0
	30MAY02	12	6.8	7.3	0.11	2.3	3.0	0.13	0.70	5									
	ALL	245	7.1	8.6	0.04	3.0	5.5	0.05	0.81	100	1	9.4	9.4		5.0	5.0		0.60	0
2003	Date																		
	07MAY03	134	7.1	8.4	0.05	2.9	4.5	0.06	0.81	93	10	9.3	11.3	0.26	6.9	12.4	0.66	0.84	7
	ALL	134	7.1	8.4	0.05	2.9	4.5	0.06	0.81	93	10	9.3	11.3	0.26	6.9	12.4	0.66	0.84	7
2009	Date																		
	16APR09	17	8.3	9.1	0.11	5.1	6.8	0.19	0.88	3	10	9.0	9.6	0.12	6.3	7.2	0.22	0.85	2
2009		17	8.3	9.1	0.11	5.1	6.8	0.19	0.88	3	10	9.0	9.6	0.12	6.3	7.2	0.22	0.85	2
2010	Date																		
	19APR10										6	8.5	9.5	0.39	5.9	8.1	0.74	0.93	2
	ALL										6	8.5	9.5	0.39	5.9	8.1	0.74	0.93	2
2012	Date																		
	17APR12	88	7.5	8.4	0.05	3.6	5.2	0.07	0.85	55	13	8.6	9.1	0.08	5.4	6.9	0.17	0.83	8
	25APR12	57	7.3	8.1	0.06	3.1	4.3	0.07	0.81	36	1	8.3	8.3		4.9	4.9		0.85	1
	ALL	145	7.4	8.4	0.04	3.4	5.2	0.05	0.84	91	14	8.6	9.1	0.08	5.3	6.9	0.16	0.83	9
2013	Date																		
	16APR13	57	6.7	8.0	0.08	2.8	5.0	0.10	0.92	59	1	8.4	8.4		4.8	4.8		0.81	1
2013	23APR13	29	7.4	8.2	0.11	3.7	4.8	0.14	0.89	30	9	8.6	9.1	0.09	5.6	6.4	0.16	0.86	9
	ALL	86	6.9	8.2	0.08	3.1	5.0	0.09	0.91	90	10	8.6	9.1	0.09	5.5	6.4	0.16	0.85	10
2015	Date																		
	29APR15	49	8.0	8.6	0.06	4.1	5.1	0.08	0.80	86	8	9.0	9.5	0.10	5.8	6.6	0.22	0.78	14
	ALL	49	8.0	8.6	0.06	4.1	5.1	0.08	0.80	86	8	9.0	9.5	0.10	5.8	6.6	0.22	0.78	14

APPENDIX I (Glover Creek Sample Site)

Great Central Lk
Glover Creek

		Age																	
		1									2								
			Length (cm)			Fresh Std Wt (g)						Length (cm)			Fresh Std Wt (g)				
		N	AVG	MAX	SE	AVG	MAX	SE	K	%	N	AVG	MAX	SE	AVG	MAX	SE	K	%
Year	Date																		
1990	25APR90	76	9.3	10.5	0.08	7.0	10.6	0.18	0.86		35	9.8	10.9	0.09	8.1	10.6	0.20	0.86	5
	02MAY90	177	8.0	11.5	0.07	4.5	12.8	0.13	0.85	15	23	9.4	10.8	0.12	7.2	10.9	0.29	0.85	2
	ALL	253	8.4	11.5	0.06	5.2	12.8	0.13	0.85	15	58	9.6	10.9	0.07	7.7	10.9	0.17	0.85	7
1991	Date																		
	17APR91	2	7.8	8.5	0.70	4.2	5.3	1.10	0.86		40	9.4	11.0	0.10	7.2	11.2	0.23	0.87	
	24APR91	76	7.7	8.6	0.05	3.8	5.2	0.07	0.83		58	9.3	11.0	0.09	6.8	11.2	0.21	0.84	
	01MAY91	148	7.2	8.1	0.04	3.3	5.0	0.05	0.87	14	52	8.5	9.8	0.08	5.5	8.0	0.15	0.89	
	08MAY91	184	7.3	8.3	0.03	3.1	4.7	0.04	0.81	17	16	8.5	9.6	0.13	5.2	7.2	0.23	0.85	
	15MAY91	42	6.9	7.8	0.06	3.0	4.3	0.08	0.90		14	8.6	9.9	0.17	5.6	8.7	0.38	0.88	1
	22MAY91	115	6.9	7.8	0.04	3.1	4.9	0.05	0.92		1	7.8	7.8		4.2	4.2		0.88	0
	29MAY91	113	6.7	7.9	0.04	2.8	4.8	0.05	0.93		4	8.4	8.8	0.19	5.4	5.8	0.21	0.94	
1991	05JUN91	102	6.9	7.8	0.05	3.1	4.9	0.06	0.93										
	ALL	782	7.1	8.6	0.02	3.2	5.3	0.02	0.88	31	185	8.9	11.0	0.05	6.2	11.2	0.11	0.87	1
1992	Date																		
	12MAY92	112	9.3	10.6	0.05	7.0	10.8	0.12	0.87		3	9.9	10.4	0.26	8.4	9.5	0.55	0.86	1
	20MAY92	130	8.8	10.6	0.05	6.1	10.6	0.12	0.88		3	9.3	10.8	0.74	7.5	11.1	1.80	0.89	0
	26MAY92	98	8.1	10.1	0.07	4.7	8.5	0.13	0.87		5	9.0	9.9	0.31	6.7	9.1	0.76	0.89	0
	ALL	340	8.8	10.6	0.04	6.0	10.8	0.09	0.87		11	9.4	10.8	0.25	7.4	11.1	0.59	0.88	2
1993	Date																		
	14APR93	24	7.8	9.2	0.14	4.3	6.9	0.22	0.90		2	9.0	9.2	0.20	6.4	7.0	0.54	0.88	0
	21APR93	95	7.5	9.4	0.06	3.8	7.4	0.10	0.88		7	9.2	9.6	0.13	6.9	7.9	0.36	0.88	
1993	28APR93	199	7.3	9.2	0.04	3.2	6.7	0.06	0.81		1	9.0	9.0		5.8	5.8		0.80	
	05MAY93	152	6.8	8.0	0.03	2.7	4.7	0.05	0.86		2	9.0	9.5	0.50	6.1	7.9	1.76	0.81	0
	12MAY93	144	6.5	8.0	0.04	2.3	4.8	0.05	0.84										
	19MAY93	121	6.4	7.7	0.04	2.2	3.7	0.05	0.80										
	27MAY93	108	6.5	8.3	0.05	2.4	4.7	0.06	0.82										
	02JUN93	109	6.7	7.7	0.04	2.5	3.8	0.05	0.84										
	08JUN93	41	6.4	7.1	0.07	2.4	3.3	0.08	0.90										
	16JUN93	2	6.1	6.3	0.20	2.0	2.3	0.30	0.89										
	ALL	995	6.8	9.4	0.02	2.8	7.4	0.03	0.84		12	9.1	9.6	0.10	6.6	7.9	0.33	0.86	0
1994	27APR94	6	8.9	10.5	0.35	6.5	11.0	0.93	0.90		47	9.2	10.4	0.07	7.0	10.6	0.19	0.88	
	05MAY94	60	7.9	8.9	0.06	4.3	6.3	0.10	0.88		47	8.6	9.8	0.08	5.7	8.1	0.15	0.87	4
	12MAY94	107	7.6	8.7	0.04	3.7	5.8	0.06	0.86		7	8.7	9.3	0.18	5.6	7.3	0.41	0.83	
	18MAY94	42	7.3	9.0	0.07	3.4	6.2	0.10	0.87		2	8.1	8.8	0.70	4.7	6.0	1.30	0.86	
	26MAY94	55	7.2	8.2	0.06	3.3	4.7	0.08	0.86		1	8.4	8.4		5.3	5.3		0.90	0
	02JUN94	111	7.1	8.2	0.04	3.1	4.6	0.05	0.85		1	7.7	7.7		3.7	3.7		0.81	0
	08JUN94	137	7.3	8.2	0.04	3.4	5.4	0.05	0.87										
	16JUN94	1	6.8	6.8		2.8	2.8		0.89										
	ALL	519	7.4	10.5	0.02	3.5	11.0	0.04	0.86		105	8.9	10.4	0.06	6.2	10.6	0.13	0.87	4

(Continued)

Great Central Lk
Glover Creek

		Age																	
		1									2								
			Length (cm)			Fresh Std Wt (g)						Length (cm)			Fresh Std Wt (g)				
		N	AVG	MAX	SE	AVG	MAX	SE	K	%	N	AVG	MAX	SE	AVG	MAX	SE	K	%
Year	Date																		
1995	19APR95	2	7.5	7.6	0.15	3.4	3.4	0.09	0.81		54	9.0	9.9	0.08	6.0	7.9	0.15	0.82	
	27APR95	151	7.0	8.4	0.03	2.7	4.7	0.04	0.79	23	21	8.4	9.7	0.13	4.8	7.7	0.25	0.79	
	04MAY95	133	6.8	7.7	0.03	2.4	3.7	0.03	0.76	23	33	8.7	10.4	0.11	5.3	8.6	0.20	0.79	
	10MAY95	132	6.4	7.3	0.03	2.1	3.3	0.03	0.79	10	15	8.9	10.6	0.21	5.9	10.5	0.50	0.82	1
	18MAY95	187	6.3	8.8	0.03	2.0	5.4	0.03	0.79										
	01JUN95	78	6.3	6.8	0.03	2.0	2.7	0.03	0.81	6									
	ALL	683	6.6	8.8	0.02	2.2	5.4	0.02	0.79	62	123	8.8	10.6	0.06	5.6	10.5	0.12	0.81	1
1996	Date																		
	11APR96	5	7.5	8.2	0.34	4.1	5.5	0.57	0.93		1	7.8	7.8		4.3	4.3		0.91	0
	25APR96	93	7.2	8.5	0.06	3.2	5.1	0.08	0.84		15	8.0	8.7	0.10	4.5	5.6	0.16	0.86	
1996	30APR96	194	7.1	8.1	0.03	2.9	4.2	0.04	0.78		6	8.0	8.8	0.19	4.4	5.9	0.37	0.84	
	09MAY96	108	7.1	8.8	0.06	2.9	5.5	0.08	0.79		76	8.6	9.8	0.07	5.3	7.4	0.12	0.81	5
	16MAY96	43	7.6	8.7	0.08	3.7	5.8	0.11	0.82		157	8.7	10.4	0.04	5.5	8.6	0.08	0.82	
	23MAY96	91	7.3	9.1	0.08	3.2	5.8	0.11	0.80	11	39	8.9	10.1	0.09	5.7	8.0	0.17	0.80	
	30MAY96	98	7.0	8.5	0.05	2.9	4.8	0.07	0.83		66	8.8	10.0	0.07	5.9	8.9	0.14	0.85	
	ALL	632	7.2	9.1	0.02	3.1	5.8	0.03	0.81	11	360	8.7	10.4	0.03	5.5	8.9	0.06	0.82	5
1997	Date																		
	17APR97	30	8.4	9.5	0.10	5.0	7.2	0.18	0.85		48	9.0	10.0	0.07	6.3	8.6	0.15	0.84	6
	24APR97	105	8.2	10.2	0.05	4.6	8.5	0.09	0.83		32	8.9	10.3	0.11	5.9	9.1	0.23	0.82	5
	01MAY97	165	7.4	8.7	0.04	3.4	5.4	0.05	0.83		15	8.3	9.0	0.12	4.7	6.2	0.20	0.83	
1997	08MAY97	149	7.1	8.3	0.04	3.2	5.0	0.05	0.88		3	8.1	8.8	0.35	4.8	6.3	0.75	0.89	
	ALL	449	7.6	10.2	0.03	3.7	8.5	0.05	0.85		98	8.8	10.3	0.06	5.9	9.1	0.12	0.83	11
1998	Date																		
	23APR98	243	7.0	9.7	0.04	3.1	7.2	0.05	0.88										
	30APR98	271	6.9	9.1	0.03	2.7	5.9	0.04	0.79										
	07MAY98	85	6.7	8.6	0.05	2.2	4.3	0.05	0.75										
	13MAY98	271	6.3	7.5	0.02	2.0	3.4	0.02	0.80	18	1	9.6	9.6		8.8	8.8		0.99	0
	ALL	870	6.7	9.7	0.02	2.5	7.2	0.03	0.81	18	1	9.6	9.6		8.8	8.8		0.99	0
1999	Date																		
	12MAY99	161	7.0	8.5	0.05	2.6	5.0	0.06	0.76		16	9.0	10.2	0.15	5.8	7.8	0.28	0.78	2
1999		161	7.0	8.5	0.05	2.6	5.0	0.06	0.76		16	9.0	10.2	0.15	5.8	7.8	0.28	0.78	2
2000	Date																		
	27APR00	140	7.3	8.6	0.04	3.3	5.3	0.06	0.84		9	8.0	8.5	0.11	4.3	5.1	0.18	0.84	
	ALL	140	7.3	8.6	0.04	3.3	5.3	0.06	0.84		9	8.0	8.5	0.11	4.3	5.1	0.18	0.84	
2001	Date																		
	11APR01	3	6.4	7.2	0.40	2.2	3.1	0.46	0.82		23	9.1	10.0	0.16	6.2	8.9	0.34	0.81	
	26APR01	62	6.5	7.5	0.06	2.3	3.6	0.07	0.80		2	10.6	11.2	0.60	8.5	9.9	1.38	0.71	1
	ALL	65	6.5	7.5	0.06	2.3	3.6	0.07	0.80		25	9.2	11.2	0.17	6.4	9.9	0.35	0.80	1
2006	Date																		
	11APR06	49	8.0	8.7	0.07	4.0	5.1	0.09	0.76	5	1	9.1	9.1		5.4	5.4		0.72	0

(Continued)

Great Central Lk
Glover Creek

		Age																	
		1									2								
			Length (cm)			Fresh Std Wt (g)						Length (cm)			Fresh Std Wt (g)				
		N	AVG	MAX	SE	AVG	MAX	SE	K	%	N	AVG	MAX	SE	AVG	MAX	SE	K	%
Year	Date																		
2006	12APR06	18	8.0	8.5	0.08	3.7	4.7	0.13	0.74	2	2	9.3	9.7	0.35	5.5	5.9	0.35	0.68	0
	14APR06	20	7.9	8.7	0.08	3.7	5.0	0.14	0.74	2									
	15APR06	19	8.0	8.7	0.09	3.7	4.6	0.13	0.73	2	1	8.8	8.8		5.0	5.0		0.73	0
	16APR06	20	7.6	8.3	0.12	3.4	4.2	0.15	0.75	2									
	17APR06	19	7.8	8.5	0.08	3.4	4.5	0.12	0.71	2	1	8.8	8.8		3.5	3.5		0.51	0
	18APR06	49	7.8	8.5	0.05	3.7	4.8	0.07	0.76	5	1	9.5	9.5		6.4	6.4		0.75	0
	21APR06	100	7.7	8.7	0.04	3.5	5.0	0.05	0.76	10									
	25APR06	50	7.5	8.6	0.08	3.1	4.8	0.11	0.73	5									
	26APR06	50	7.0	8.1	0.07	3.0	4.6	0.10	0.87	5									
	28APR06	50	7.5	8.5	0.06	3.0	4.3	0.08	0.71	5									
2006	30APR06	100	7.5	8.7	0.05	3.1	5.0	0.07	0.73	10									
	01MAY06	50	7.5	8.6	0.08	3.0	4.7	0.10	0.70	5									
	02MAY06	50	7.2	8.5	0.07	2.7	4.3	0.09	0.71	5									
	04MAY06	50	7.2	8.3	0.08	2.9	4.6	0.09	0.74	5									
	05MAY06	50	7.2	8.0	0.06	2.7	3.9	0.07	0.73	5									
	11MAY06	100	7.2	8.1	0.04	2.7	4.0	0.05	0.73	10									
	12MAY06	19	7.3	8.0	0.10	2.8	3.7	0.12	0.70	2	1	9.1	9.1		6.1	6.1		0.81	0
	14MAY06	20	6.9	7.6	0.09	2.4	3.1	0.09	0.73	2									
	16MAY06	20	6.8	8.5	0.13	2.3	4.5	0.15	0.73	2									
	21MAY06	50	6.8	8.3	0.09	2.2	3.9	0.09	0.68	5									
2006		953	7.4	8.7	0.02	3.1	5.1	0.02	0.74	99	7	9.1	9.7	0.13	5.4	6.4	0.36	0.70	1
2007	Date																		
	19APR07	50	7.6	8.2	0.05	3.3	4.3	0.06	0.75	4									
	20APR07	50	7.4	8.0	0.05	3.0	3.9	0.07	0.73	4									
	23APR07	48	7.0	8.1	0.06	2.6	4.0	0.07	0.76	4	2	8.4	8.5	0.05	4.4	4.6	0.20	0.73	0
	24APR07	49	7.2	8.0	0.05	2.7	3.7	0.06	0.73	4	1	8.6	8.6		4.7	4.7		0.74	0
	25APR07	49	7.0	8.0	0.06	2.6	3.9	0.07	0.73	4	1	8.3	8.3		3.7	3.7		0.65	0
	26APR07	48	7.3	8.0	0.05	2.7	3.7	0.06	0.71	4	2	8.8	9.3	0.45	4.7	5.7	1.00	0.67	0
	27APR07	47	7.2	7.9	0.06	2.7	3.4	0.07	0.72	4	3	8.5	8.5	0.03	4.3	4.3	0.03	0.70	0
	30APR07	50	6.8	7.8	0.06	2.3	3.1	0.06	0.70	4									
2007	01MAY07	50	7.1	8.2	0.06	2.5	3.8	0.08	0.69	4									
	02MAY07	50	6.6	7.8	0.06	2.0	3.4	0.06	0.69	4									
	03MAY07	50	6.7	7.8	0.06	2.2	3.4	0.07	0.70	4									
	04MAY07	50	6.8	8.0	0.07	2.2	3.9	0.08	0.69	4									
	08MAY07	50	6.6	7.7	0.06	1.9	3.3	0.07	0.67	4									
	09MAY07	50	6.7	8.0	0.07	2.3	4.2	0.08	0.74	4									
	10MAY07	50	6.6	8.2	0.08	2.1	3.9	0.09	0.71	4									
	14MAY07	50	6.6	8.2	0.07	2.1	3.5	0.06	0.73	4									
	15MAY07	50	6.4	7.4	0.06	2.0	3.6	0.07	0.75	4									
	16MAY07	50	6.5	8.0	0.08	2.1	4.3	0.08	0.77	4									

(Continued)

Great Central Lk
Glover Creek

		Age																	
		1									2								
			Length (cm)			Fresh Std Wt (g)						Length (cm)			Fresh Std Wt (g)				
		N	AVG	MAX	SE	AVG	MAX	SE	K	%	N	AVG	MAX	SE	AVG	MAX	SE	K	%
Year	Date																		
2007	17MAY07	50	6.5	8.0	0.07	2.1	3.6	0.07	0.73	4									
	22MAY07	50	6.2	7.5	0.05	1.8	3.1	0.05	0.73	4									
	23MAY07	39	6.3	7.3	0.06	1.9	3.1	0.06	0.73	3									
	24MAY07	50	6.4	7.5	0.07	2.0	3.1	0.07	0.74	4									
	25MAY07	50	6.5	7.9	0.07	2.0	3.5	0.07	0.74	4									
	28MAY07	50	6.5	7.6	0.06	2.1	3.4	0.07	0.76	4									
	29MAY07	50	6.6	7.5	0.06	2.2	3.5	0.06	0.78	4									
	30MAY07	50	6.7	7.6	0.06	2.2	3.8	0.07	0.75	4									
	31MAY07	50	6.6	7.5	0.05	2.2	3.4	0.06	0.75	4									
	ALL	1,330	6.8	8.2	0.02	2.3	4.3	0.02	0.73	99	9	8.5	9.3	0.10	4.4	5.7	0.20	0.70	1
2008	18APR08	35	7.6	8.6	0.12	3.2	5.0	0.17	0.70	4	15	9.2	10.0	0.09	5.8	7.7	0.21	0.74	2
	25APR08	73	7.3	8.7	0.06	2.8	4.8	0.08	0.73	8	25	9.5	10.1	0.07	6.7	8.6	0.16	0.77	3
	28APR08	86	7.4	8.7	0.07	2.9	4.9	0.08	0.71	9	14	9.6	11.0	0.15	6.4	9.1	0.30	0.72	1
	29APR08	40	7.1	8.7	0.10	3.0	5.2	0.14	0.79	4	10	9.3	9.8	0.08	6.4	7.7	0.17	0.78	1
	30APR08	88	7.0	8.7	0.07	2.6	5.0	0.08	0.74	9	12	9.6	10.4	0.17	6.7	8.9	0.35	0.76	1
	01MAY08	43	7.0	8.4	0.10	2.4	4.1	0.11	0.68	4	7	9.5	10.2	0.19	6.0	7.5	0.42	0.69	1
	02MAY08	47	7.0	8.0	0.06	2.5	3.6	0.07	0.72	5	3	9.5	9.8	0.24	6.0	6.4	0.23	0.71	0
	05MAY08	86	7.2	8.6	0.06	2.7	4.6	0.08	0.72	9	14	9.4	10.5	0.13	6.3	8.6	0.25	0.75	1
	07MAY08	89	7.2	8.5	0.06	2.7	4.6	0.07	0.71	9	11	9.4	10.3	0.12	6.4	8.4	0.26	0.76	1
	08MAY08	89	7.2	8.2	0.06	2.8	4.4	0.07	0.73	9	11	9.6	10.1	0.11	6.8	7.9	0.27	0.77	1
2008	13MAY08	47	7.1	8.1	0.06	2.6	3.7	0.07	0.72	5	3	9.6	10.6	0.50	7.1	9.2	1.07	0.78	0
	15MAY08	98	7.1	8.4	0.05	2.6	4.4	0.05	0.71	10	2	10.2	11.2	1.00	8.7	12.1	3.40	0.77	0
	23MAY08	18	6.9	8.0	0.12	2.4	3.8	0.13	0.72	2									
	ALL	839	7.2	8.7	0.02	2.7	5.2	0.02	0.72	87	127	9.5	11.2	0.04	6.4	12.1	0.10	0.75	13
2009	Date																		
	18APR09	34	7.6	8.6	0.12	3.2	5.0	0.17	0.70	6	15	9.2	10.0	0.09	5.8	7.7	0.21	0.74	2
	21APR09	54	8.1	8.7	0.05	4.2	5.5	0.09	0.78	9	46	9.2	10.0	0.04	6.1	7.5	0.10	0.78	8
	24APR09	37	8.0	8.7	0.07	4.1	5.5	0.13	0.80	6	13	9.2	9.5	0.07	6.0	6.7	0.17	0.77	2
	28APR09	45	8.1	8.7	0.06	4.4	5.9	0.12	0.81	7	5	9.3	9.5	0.10	6.6	7.2	0.23	0.81	1
	09MAY09	37	7.5	8.2	0.06	3.4	4.2	0.09	0.79	6	1	8.9	8.9		5.0	5.0		0.71	0
2009	11MAY09	99	7.5	8.7	0.04	3.4	36.3	0.34	0.81	16	1	9.5	9.5		6.5	6.5		0.76	0
	13MAY09	89	7.3	8.5	0.05	3.0	4.6	0.06	0.76	15	1	10.5	10.5		12.5	12.5		1.08	0
	20MAY09	99	7.5	8.5	0.05	3.2	4.7	0.07	0.75	16	1	8.8	8.8		4.9	4.9		0.72	0
	ALL	494	7.6	8.7	0.02	3.5	36.3	0.08	0.78	82	83	9.2	10.5	0.04	6.1	12.5	0.11	0.77	14
2010	Date																		
	05MAY10	141	7.5	8.9	0.04	4.3	6.2	0.05	1.03	45	20	8.6	9.7	0.14	6.2	8.5	0.26	0.95	6
	10MAY10	139	7.4	9.3	0.03	3.9	8.3	0.06	0.97	44	7	9.3	9.8	0.18	8.2	10.8	0.61	1.03	2
	ALL	280	7.4	9.3	0.03	4.1	8.3	0.04	1.00	89	27	8.8	9.8	0.13	6.7	10.8	0.30	0.97	9

(Continued)

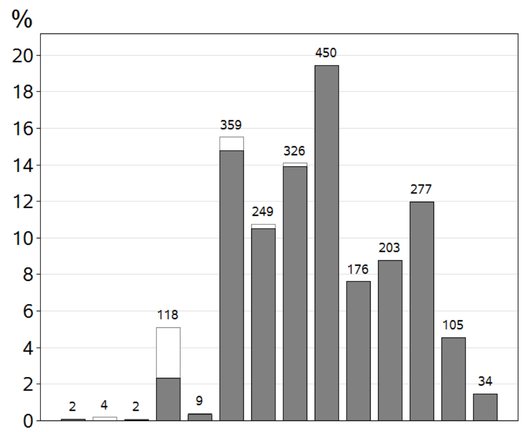
Great Central Lk
Glover Creek

		Age																	
		1									2								
			Length (cm)			Fresh Std Wt (g)						Length (cm)			Fresh Std Wt (g)				
		N	AVG	MAX	SE	AVG	MAX	SE	K	%	N	AVG	MAX	SE	AVG	MAX	SE	K	%
Year	Date																		
2011	30APR11	37	7.7	8.6	0.07	2.7	3.5	0.07	0.58	6	13	8.5	9.4	0.14	3.6	4.7	0.15	0.59	2
	01MAY11	36	7.6	9.1	0.10	2.6	4.5	0.10	0.59	6	14	8.8	9.9	0.14	4.1	5.4	0.16	0.59	2
	02MAY11	42	7.7	8.7	0.09	2.7	3.5	0.08	0.59	7	8	9.1	9.9	0.21	4.3	5.2	0.26	0.58	1
	03MAY11	42	7.8	8.8	0.07	2.5	3.4	0.07	0.54	7	8	9.0	10.0	0.29	3.8	4.8	0.22	0.52	1
	04MAY11	39	6.7	7.2	0.04	2.3	2.9	0.04	0.78	6	11	7.7	9.0	0.16	3.5	5.5	0.23	0.76	2
	05MAY11	45	7.6	9.5	0.10	2.3	3.5	0.07	0.53	8	4	8.8	9.5	0.32	4.1	5.0	0.34	0.61	1
	06MAY11	47	7.6	9.1	0.10	2.5	4.0	0.08	0.57	8	2	7.4	7.8	0.40	3.3	3.6	0.30	0.82	0
	07MAY11	45	7.7	9.3	0.09	2.6	4.8	0.09	0.56	7	5	8.7	9.0	0.13	3.7	4.1	0.10	0.57	1
	08MAY11	102	6.5	7.6	0.04	2.4	3.7	0.04	0.89	17									
	09MAY11	48	7.6	8.5	0.08	2.2	3.1	0.06	0.49	8	2	9.0	10.0	1.00	4.1	4.5	0.40	0.59	0
	10MAY11	43	7.5	9.0	0.07	2.5	3.4	0.06	0.59	7	7	8.2	9.5	0.30	3.6	4.1	0.21	0.66	1
2011		526	7.3	9.5	0.03	2.5	4.8	0.02	0.64	88	74	8.5	10.0	0.09	3.8	5.5	0.08	0.62	12
2016	Date																		
	04MAY16	14	8.4	8.8	0.08	4.8	5.9	0.17	0.80	3	8	8.6	8.9	0.08	5.7	6.8	0.21	0.90	1
	06MAY16	29	8.4	8.8	0.05	4.6	5.7	0.09	0.79	5	18	8.6	9.5	0.10	6.3	8.5	0.27	0.99	3
	09MAY16	30	8.2	9.1	0.07	4.1	5.2	0.09	0.74	6	22	8.5	9.1	0.07	5.4	6.8	0.13	0.87	4
	11MAY16	57	8.4	9.0	0.05	4.6	5.3	0.12	0.77	11	1	11.2	11.2		10.4	10.4		0.74	0
	13MAY16	20	8.3	8.9	0.09	4.4	5.3	0.16	0.77	4	3	10.7	12.6	0.98	5.7	5.7		0.71	1
	16MAY16	20	8.2	8.9	0.07	4.2	4.8	0.11	0.74	4	12	8.9	9.5	0.09	5.4	6.9	0.21	0.76	2
	18MAY16	39	8.2	8.6	0.05	4.1	5.1	0.09	0.74	7	19	8.7	9.5	0.12	5.4	7.1	0.20	0.81	4
	20MAY16	37	8.3	9.2	0.06	3.9	5.0	0.09	0.68	7	15	9.3	10.3	0.15	6.0	7.8	0.29	0.75	3
2016	24MAY16	83	8.2	9.1	0.04	3.8	4.8	0.06	0.70	15	16	8.9	9.9	0.14	5.6	7.4	0.23	0.80	3
	27MAY16	42	8.2	8.9	0.06	3.9	4.7	0.07	0.70	8	11	8.9	9.6	0.12	5.4	8.2	0.31	0.77	2
	31MAY16	30	8.2	9.2	0.08	3.8	5.0	0.11	0.68	6	9	8.8	10.4	0.26	5.6	9.5	0.57	0.81	2
	07JUN16	5	8.3	8.8	0.17	3.5	3.9	0.10	0.63	1	2	9.5	10.0	0.45	6.5	7.4	0.90	0.74	0
	ALL	406	8.3	9.2	0.02	4.1	5.9	0.03	0.72	75	136	8.9	12.6	0.06	5.7	10.4	0.09	0.83	25
2018	Date																		
	16APR18	1	6.0	6.0						0	10	9.5	12.5	0.45	10.3	21.5	1.55	1.18	1
	18APR18	3	7.9	8.6	0.35	3.8	5.2	0.72	0.74	0	2	9.4	9.5	0.05	6.5	6.8	0.30	0.77	0
	21APR18	4	8.3	8.8	0.29	4.1	4.9	0.41	0.71	0	12	8.8	10.0	0.17	5.4	7.0	0.25	0.78	1
	27APR18	21	7.5	9.5	0.25	3.3	6.0	0.31	0.73	2	10	10.1	12.5	0.32	8.3	20.7	1.39	0.78	1
2018	30APR18	88	7.1	8.7	0.08	2.7	5.4	0.10	0.74	10	12	8.9	10.4	0.24	5.5	7.8	0.41	0.78	1
	02MAY18	87	6.9	8.8	0.08	2.5	5.1	0.09	0.75	10	13	8.5	9.6	0.20	5.1	7.0	0.34	0.82	1
	04MAY18	92	7.0	9.8	0.08	2.6	5.2	0.09	0.72	10	8	9.4	10.4	0.23	6.1	8.8	0.46	0.72	1
	07MAY18	100	6.6	7.8	0.05	2.1	3.0	0.04	0.70	11									
	09MAY18	94	6.5	8.7	0.07	2.1	4.5	0.07	0.76	10	4	8.3	9.0	0.29	5.0	5.9	0.46	0.88	0
	12MAY18	51	6.6	8.7	0.09	2.4	4.2	0.09	0.84	6	5	8.7	10.5	0.71	5.6	8.0	0.76	0.88	1
	02JUN18	95	6.4	9.6	0.07	2.2	5.4	0.08	0.84	10	2	9.6	9.8	0.20	6.9	7.5	0.55	0.79	0
	03JUN18	96	6.3	7.7	0.05	2.0	3.7	0.06	0.80	11	4	9.3	9.8	0.21	6.2	7.3	0.37	0.79	0
	06JUN18	100	6.4	9.6	0.07	2.0	5.5	0.07	0.73	11									
	ALL	832	6.7	9.8	0.03	2.3	6.0	0.03	0.76	91	82	9.1	12.5	0.11	6.5	21.5	0.33	0.84	9

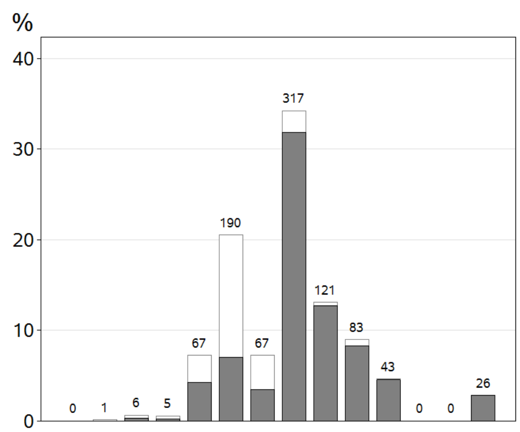
APPENDIX II – Seasonal Sample Size

Appendix II. Smolt sample size (number of fish) and percent of total retained catch, by year, sample date, and age, sample sites combined.

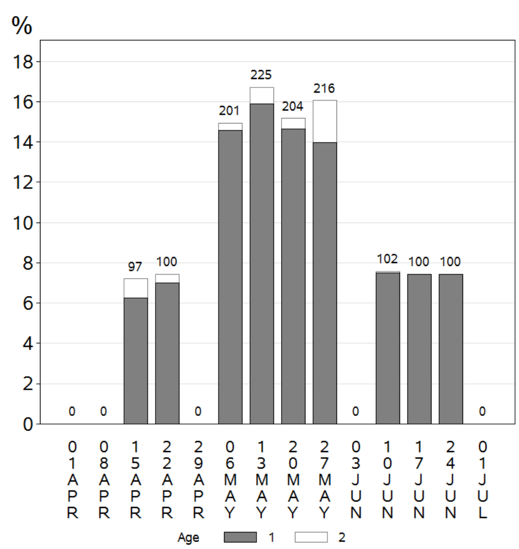
1977 Great Central Lk Sample Size by Week



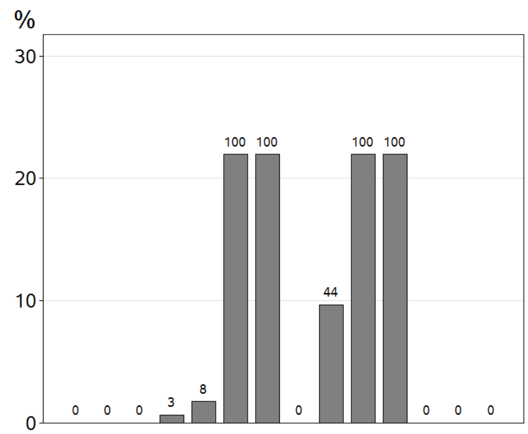
1978 Great Central Lk Sample Size by Week



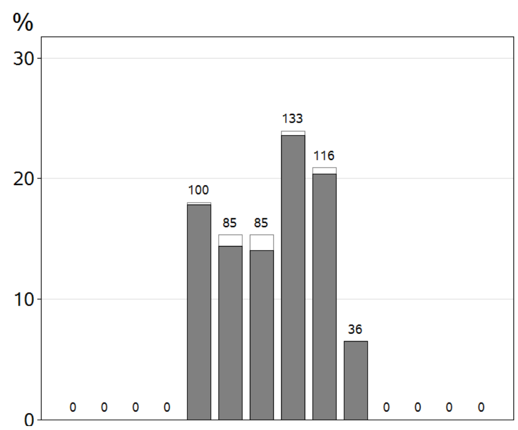
1979 Great Central Lk Sample Size by Week



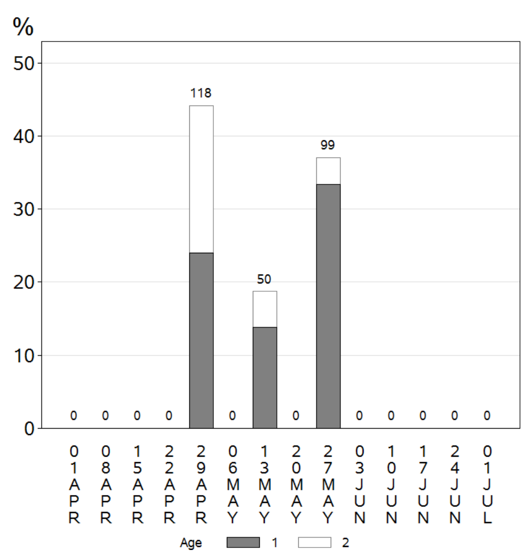
1980 Great Central Lk Sample Size by Week



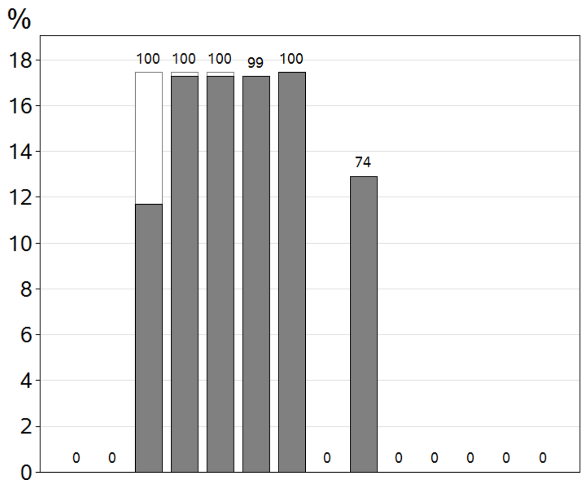
1981 Great Central Lk Sample Size by Week



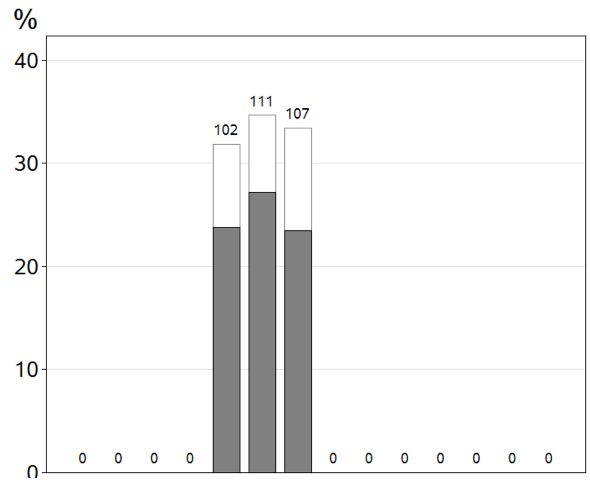
1982 Great Central Lk Sample Size by Week



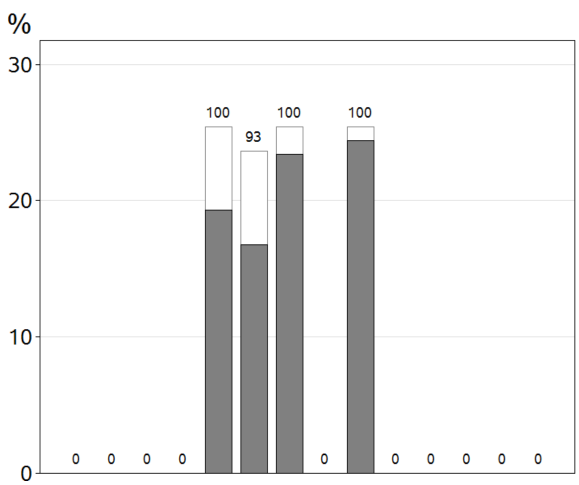
1983 Great Central Lk Sample Size by Week



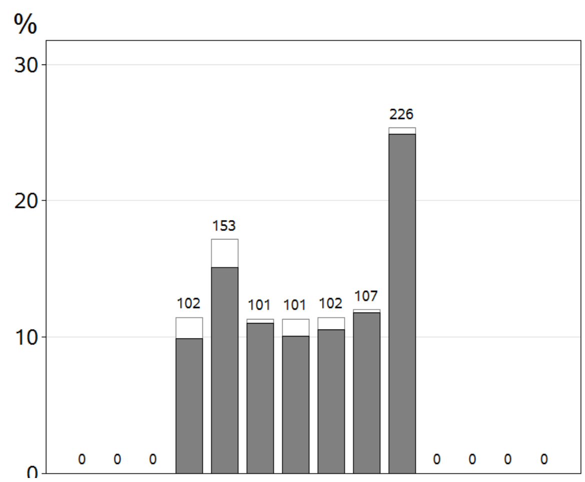
1986 Great Central Lk Sample Size by Week



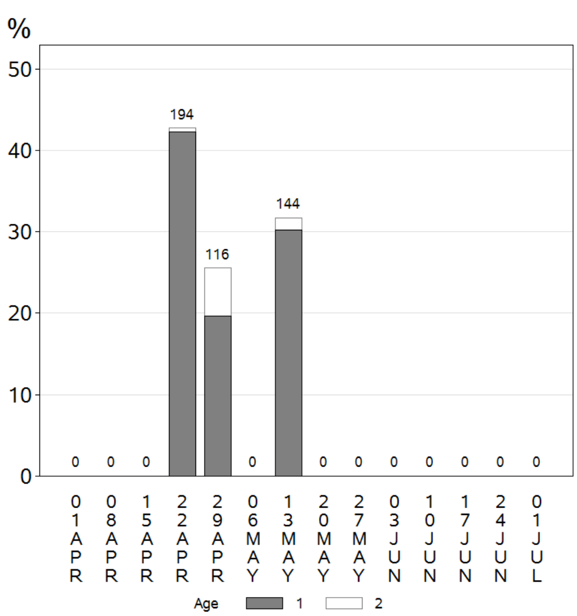
1984 Great Central Lk Sample Size by Week



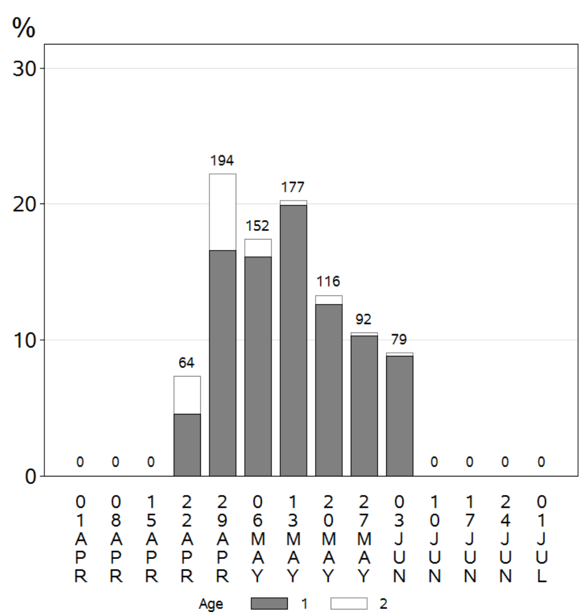
1987 Great Central Lk Sample Size by Week



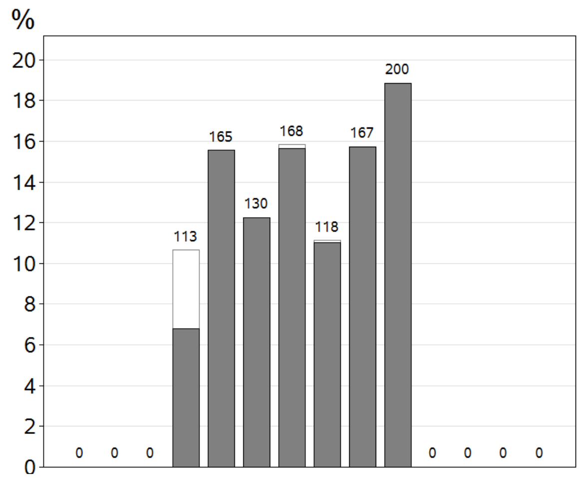
1985 Great Central Lk Sample Size by Week



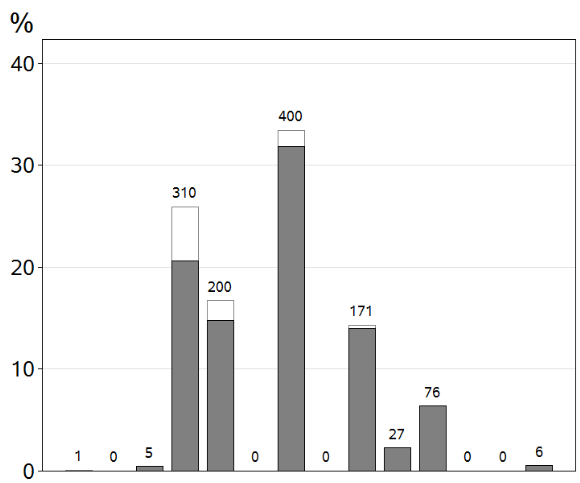
1988 Great Central Lk Sample Size by Week



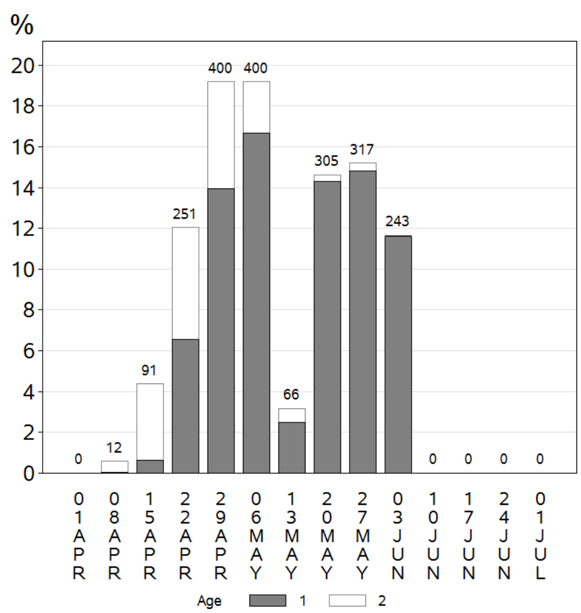
1989 Great Central Lk Sample Size by Week



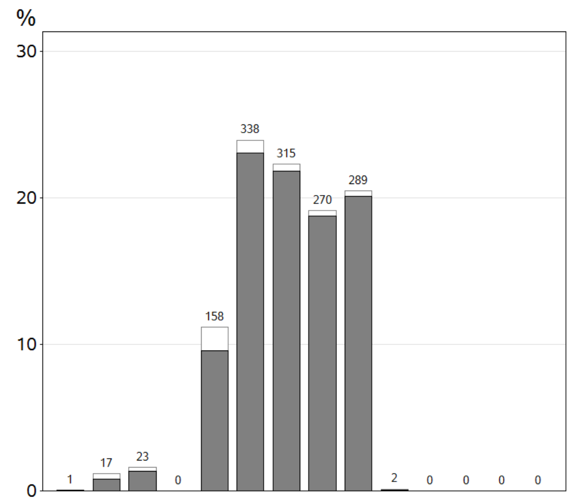
1990 Great Central Lk Sample Size by Week



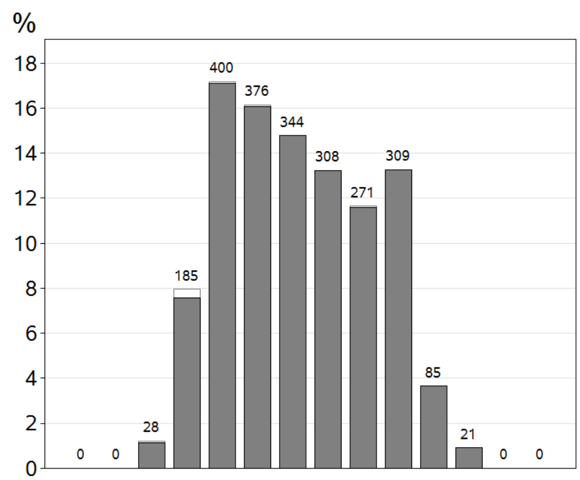
1991 Great Central Lk Sample Size by Week



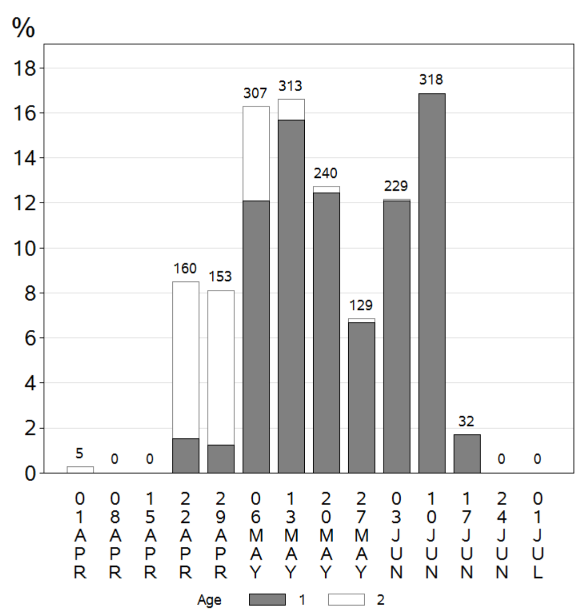
1992 Great Central Lk Sample Size by Week



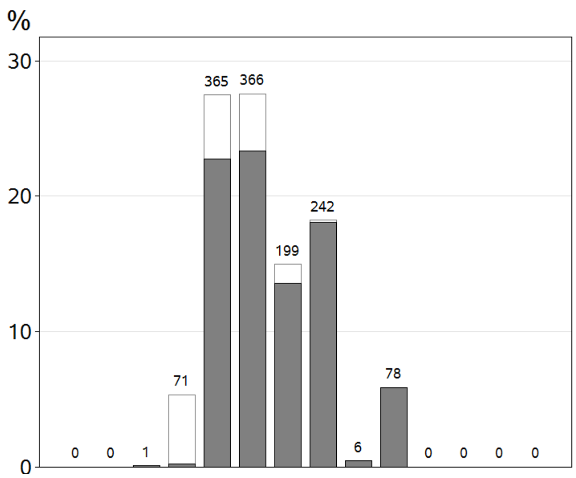
1993 Great Central Lk Sample Size by Week



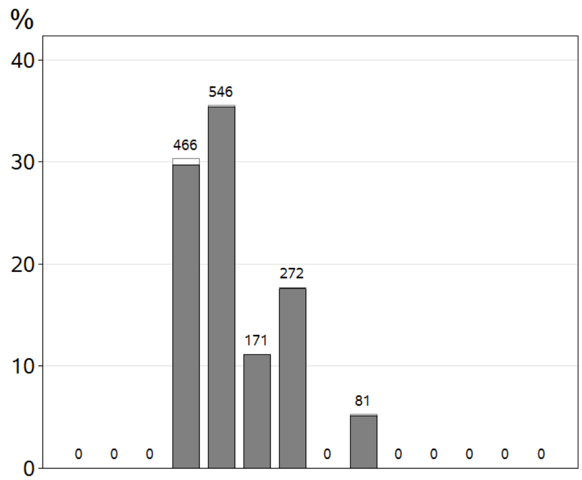
1994 Great Central Lk Sample Size by Week



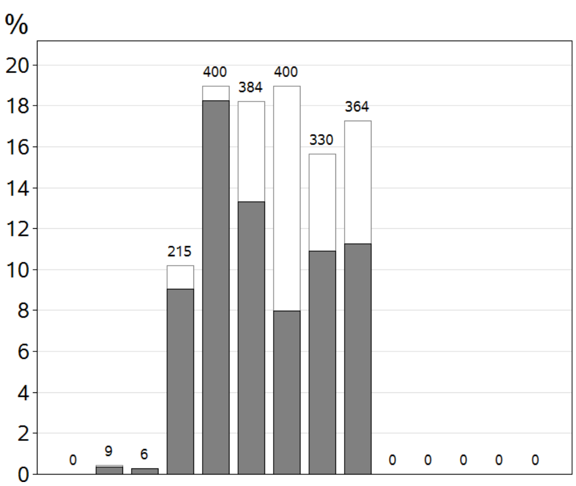
1995 Great Central Lk Sample Size by Week



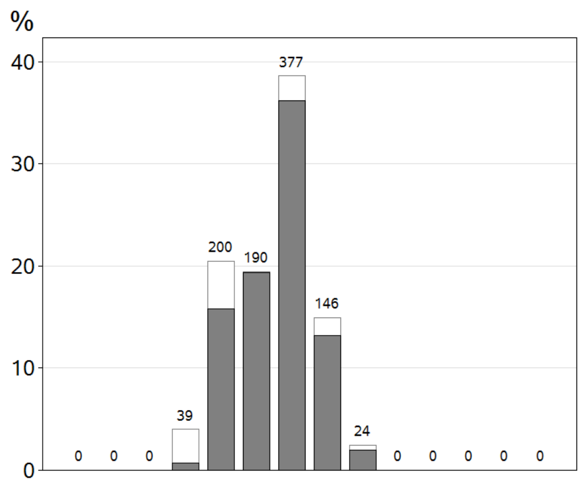
1998 Great Central Lk Sample Size by Week



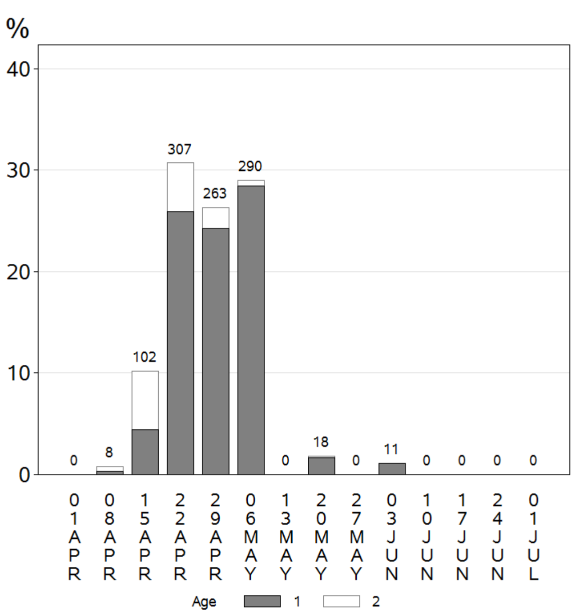
1996 Great Central Lk Sample Size by Week



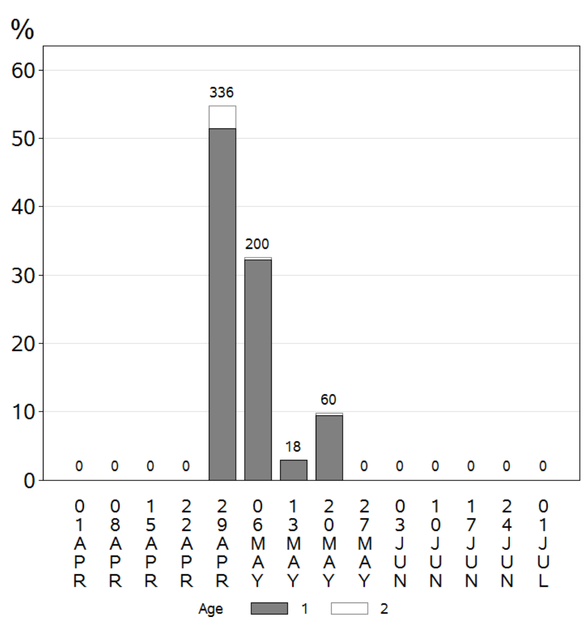
1999 Great Central Lk Sample Size by Week



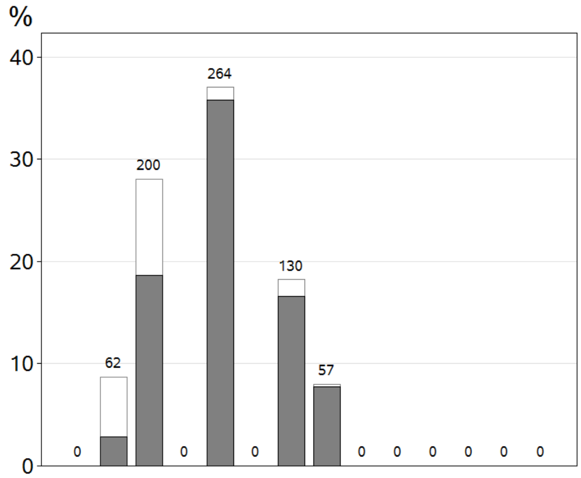
1997 Great Central Lk Sample Size by Week



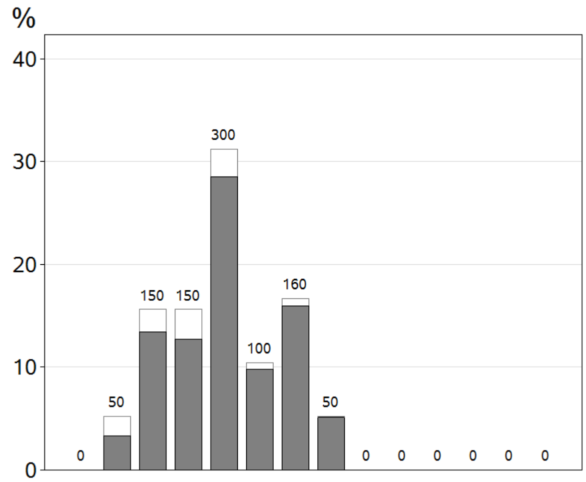
2000 Great Central Lk Sample Size by Week



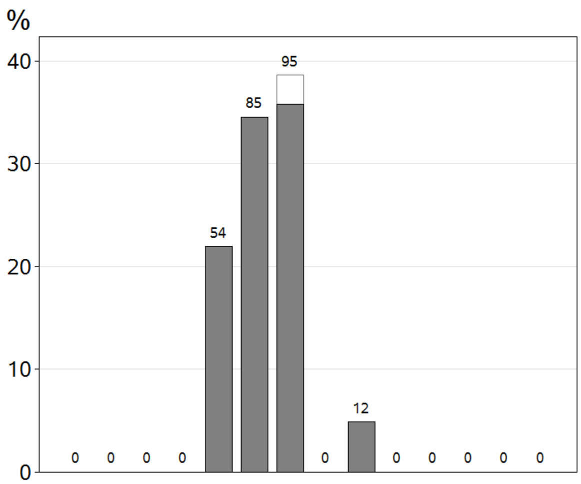
2001 Great Central Lk Sample Size by Week



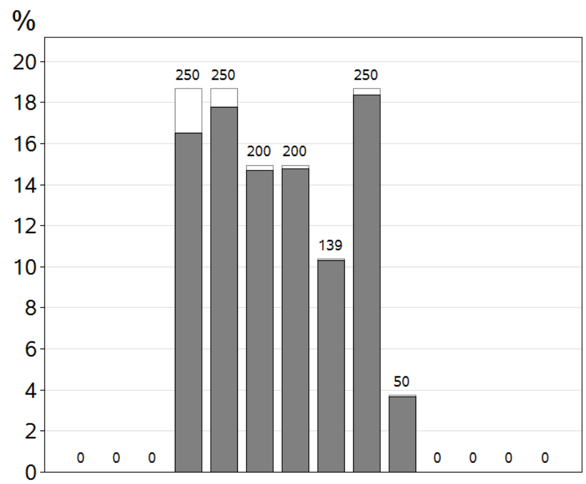
2006 Great Central Lk Sample Size by Week



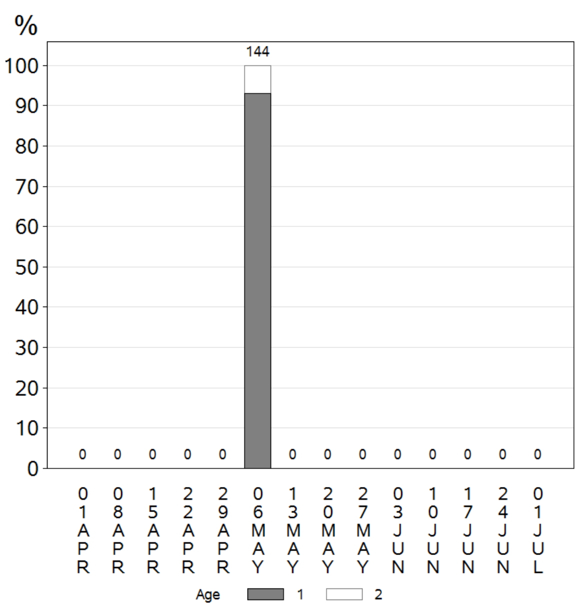
2002 Great Central Lk Sample Size by Week



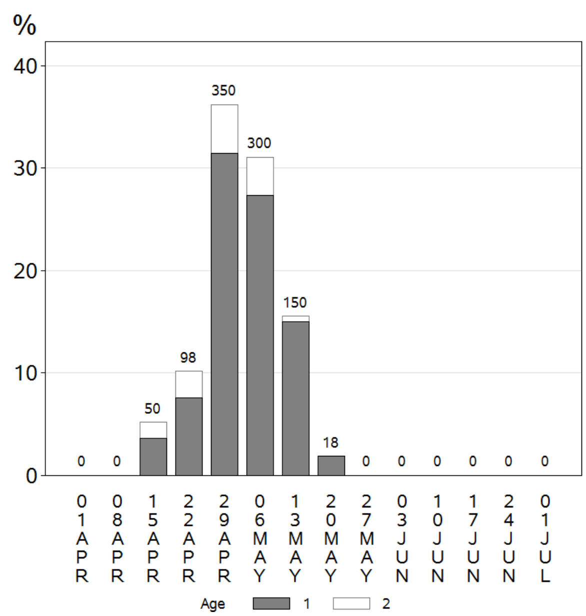
2007 Great Central Lk Sample Size by Week

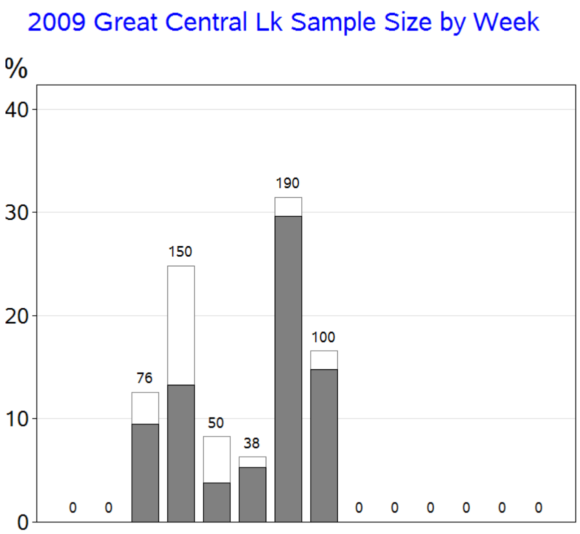


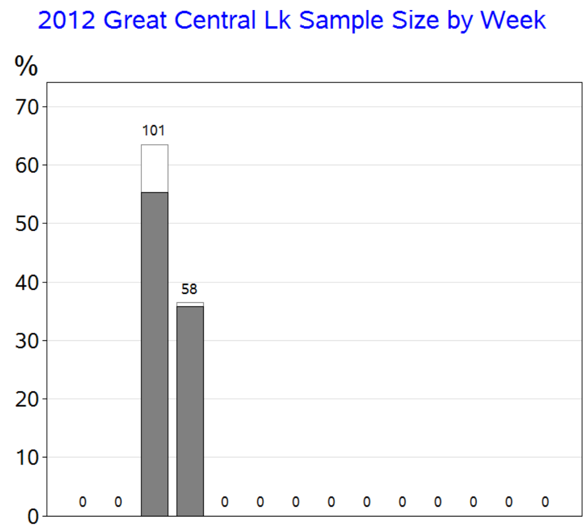
2003 Great Central Lk Sample Size by Week

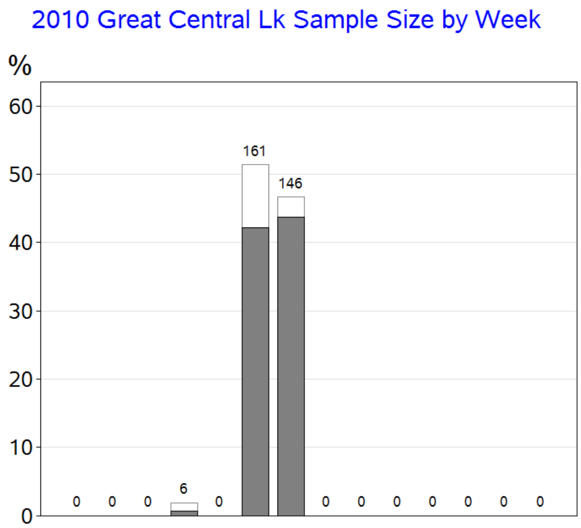


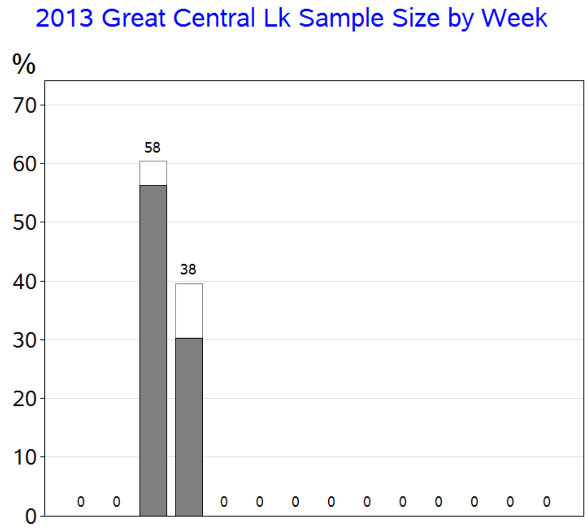
2008 Great Central Lk Sample Size by Week

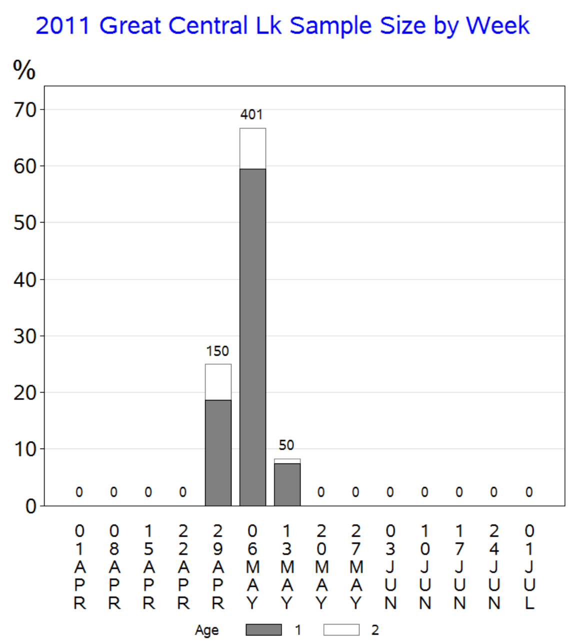


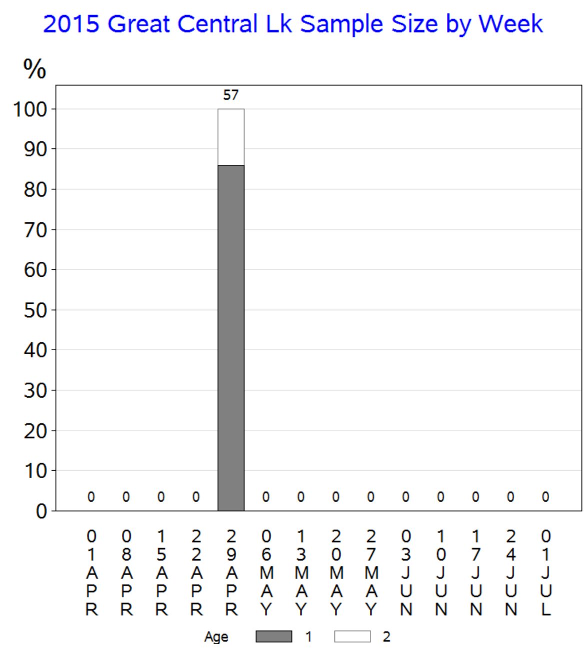

2009 Great Central Lk Sample Size by Week
%
0
0
76
150
50
38
190
100
0
0
0
0
0
0


2012 Great Central Lk Sample Size by Week
%
0
0
101
58
0
0
0
0
0
0
0
0
0
0

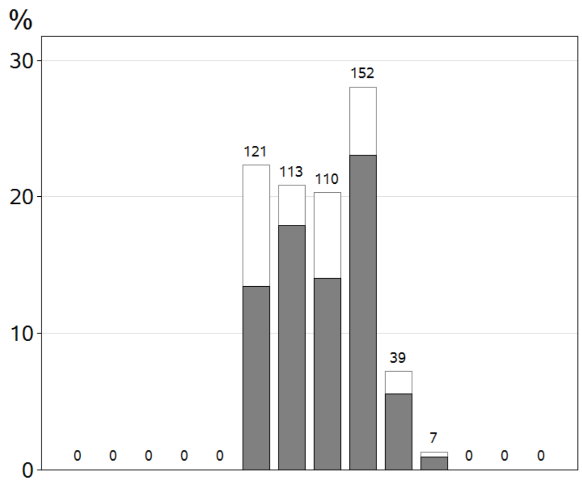

2010 Great Central Lk Sample Size by Week
%
0
0
0
6
0
161
146
0
0
0
0
0
0
0


2013 Great Central Lk Sample Size by Week
%
0
0
58
38
0
0
0
0
0
0
0
0
0
0

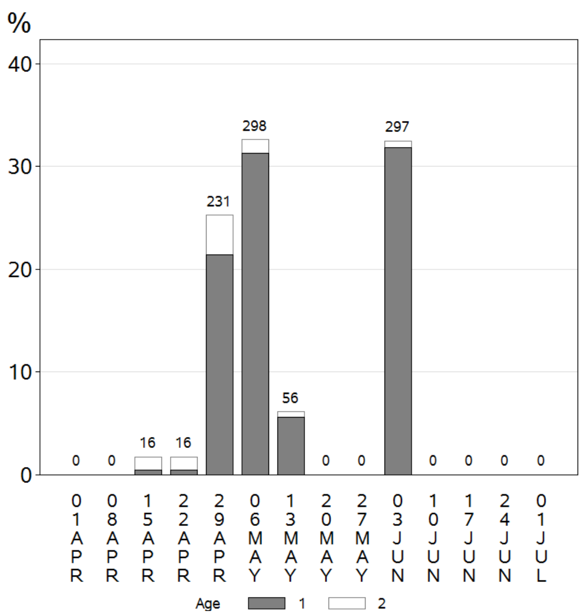

2011 Great Central Lk Sample Size by Week
%
0
0
0
0
150
401
50
0
0
0
0
0
0
0
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN 01JUL
Age 1 2


2015 Great Central Lk Sample Size by Week
%
0
0
0
0
57
0
0
0
0
0
0
0
0
0
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN 01JUL
Age 1 2

2016 Great Central Lk Sample Size by Week

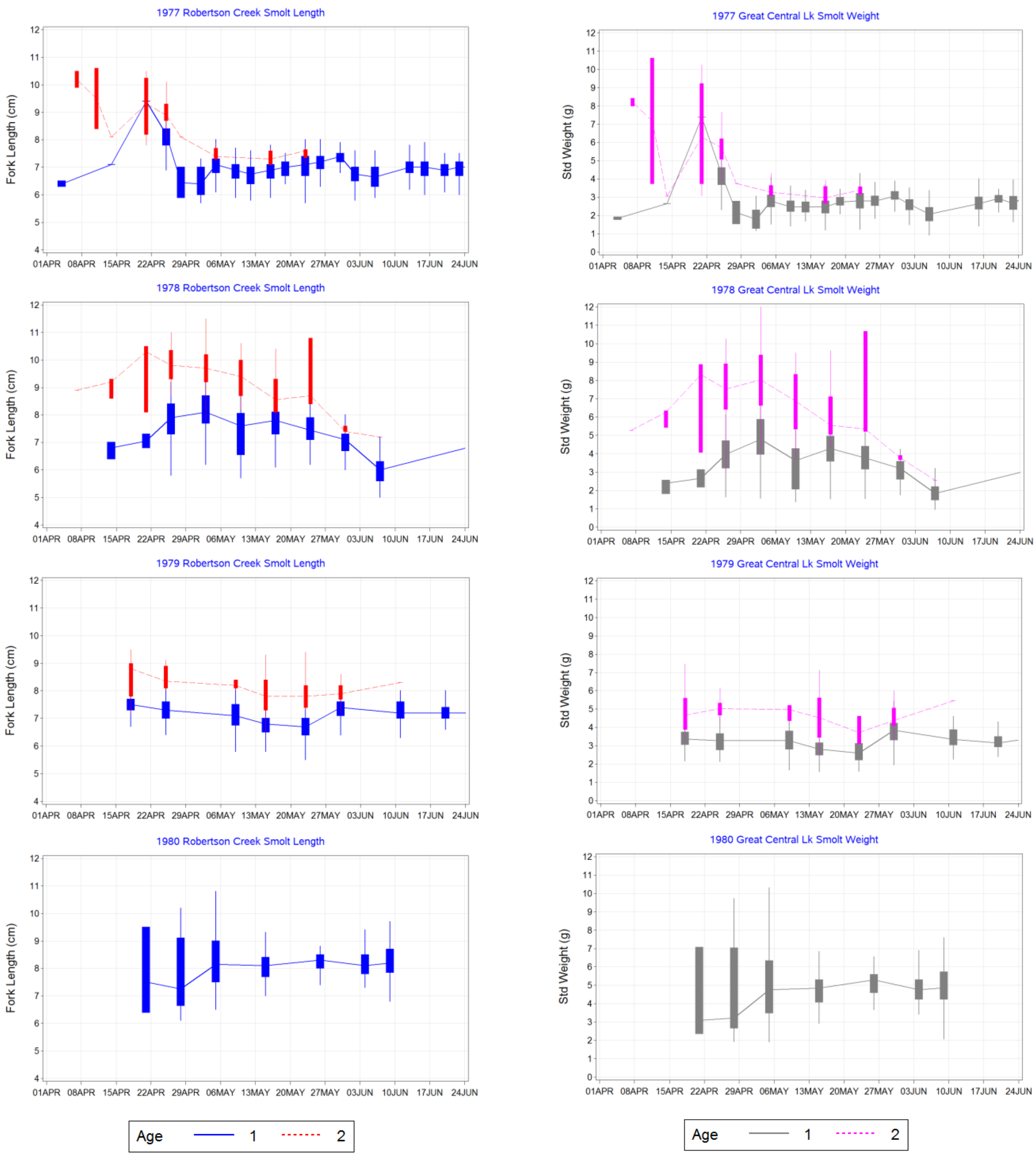


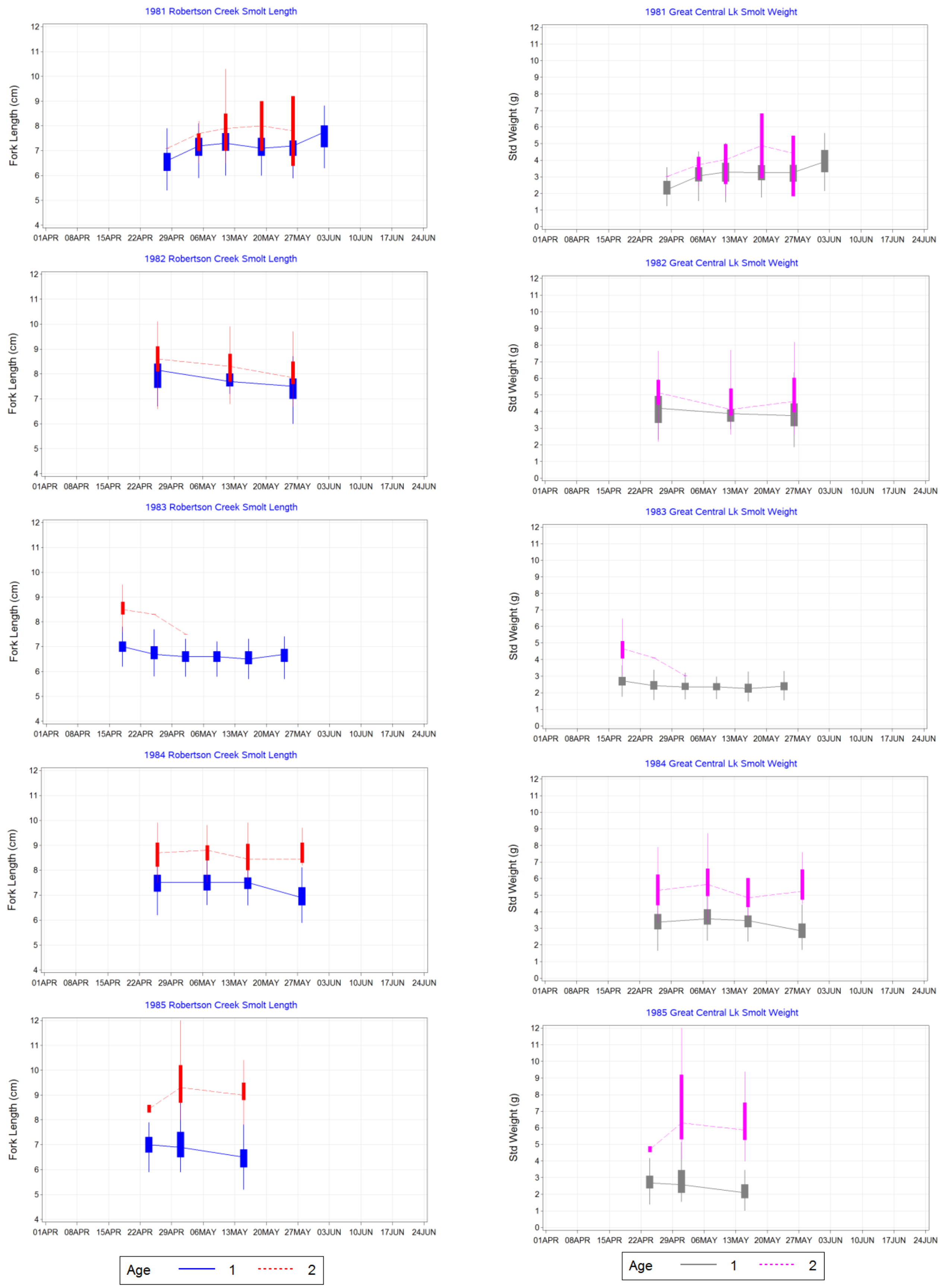
2018 Great Central Lk Sample Size by Week

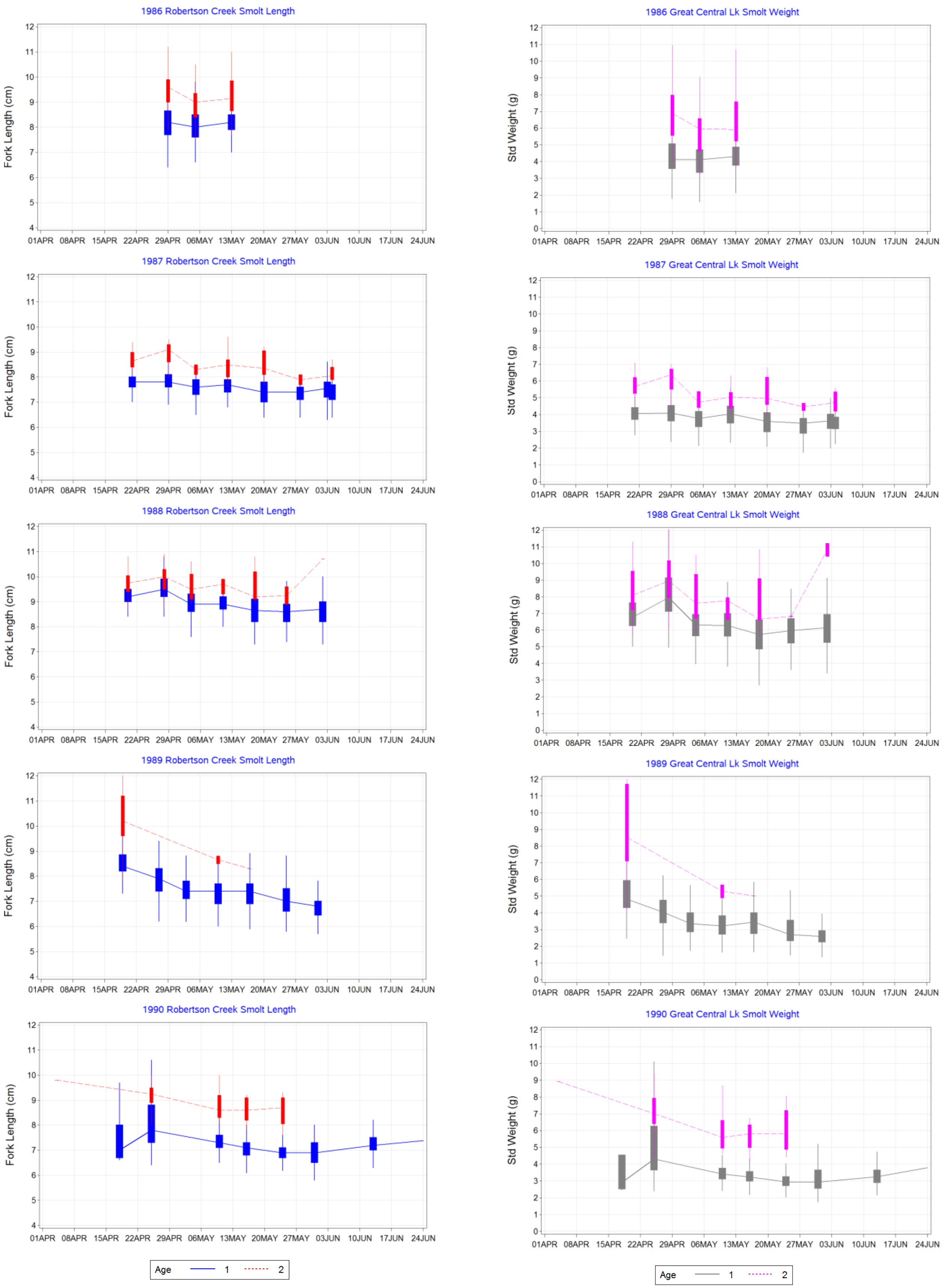


APPENDIX III – Seasonal Trends in Size

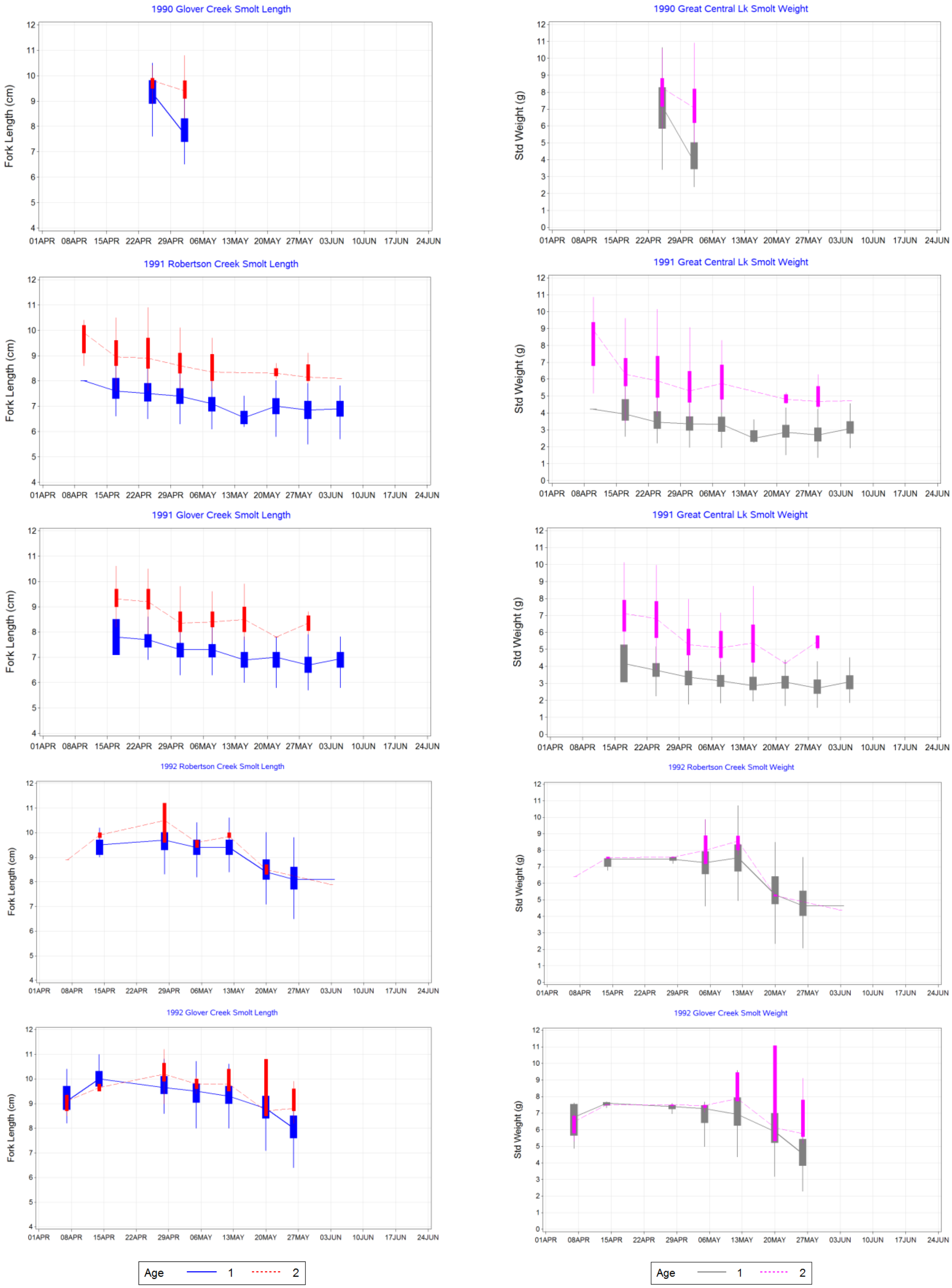
Appendix III. Seasonal time-trends in smolt size (Fork Length, left; Std Weight, right) by year, sample date age class, and site (Robertson Creek, Glover Creek). Box and whiskers represent quartiles and extrema, joined at median.

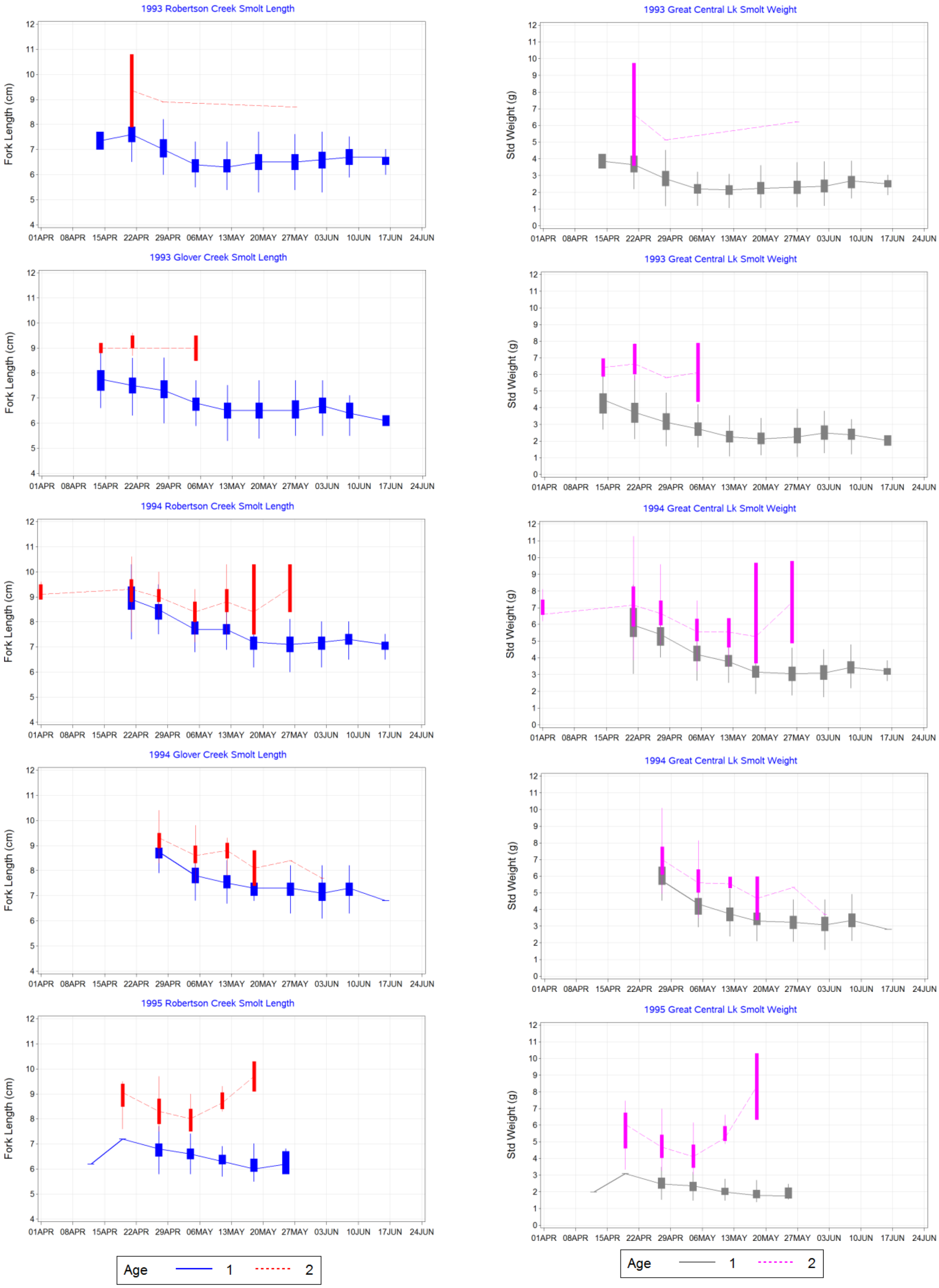


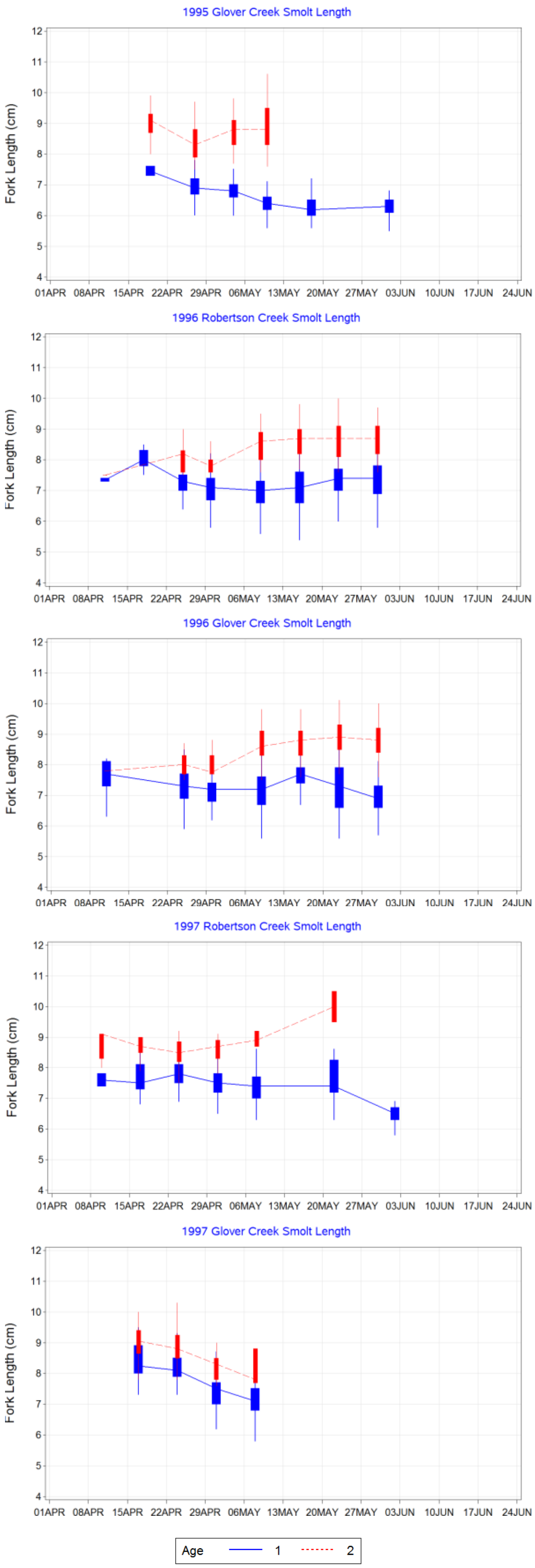

1981 Robertson Creek Smolt Length
1981 Great Central Lk Smolt Weight
1982 Robertson Creek Smolt Length
1982 Great Central Lk Smolt Weight
1983 Robertson Creek Smolt Length
1983 Great Central Lk Smolt Weight
1984 Robertson Creek Smolt Length
1984 Great Central Lk Smolt Weight
1985 Robertson Creek Smolt Length
1985 Great Central Lk Smolt Weight
Fork Length (cm)
Std Weight (g)
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN
Age 1 2
Age 1 2

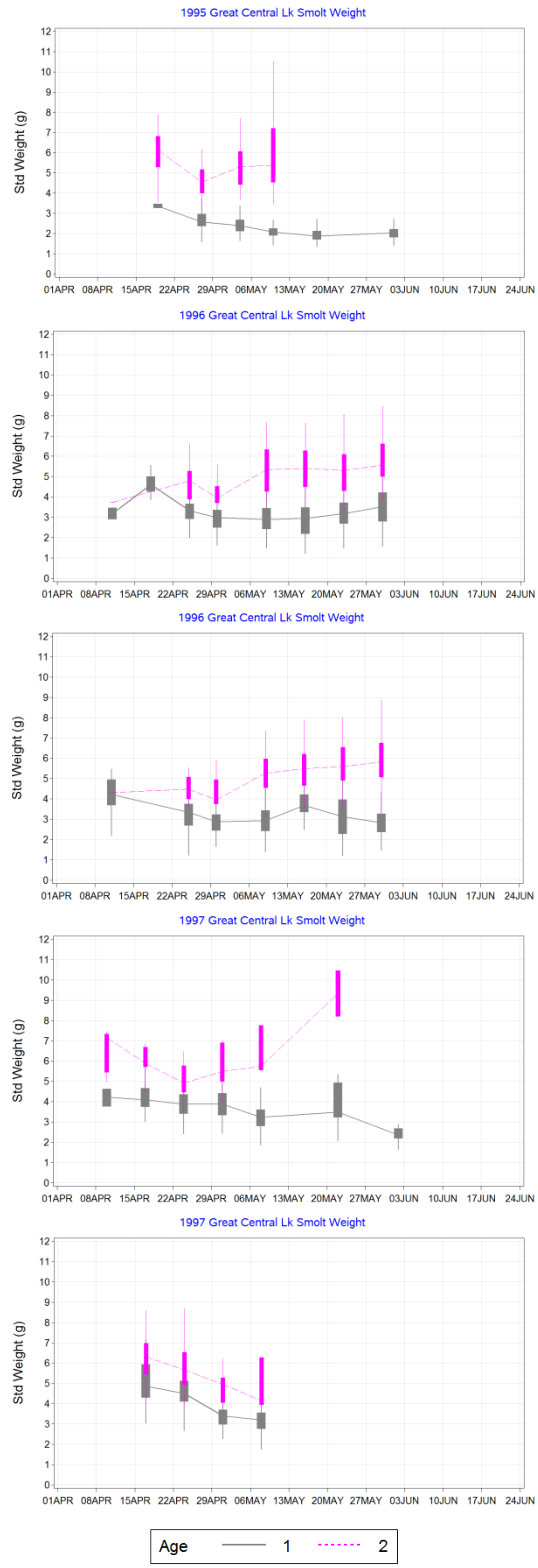


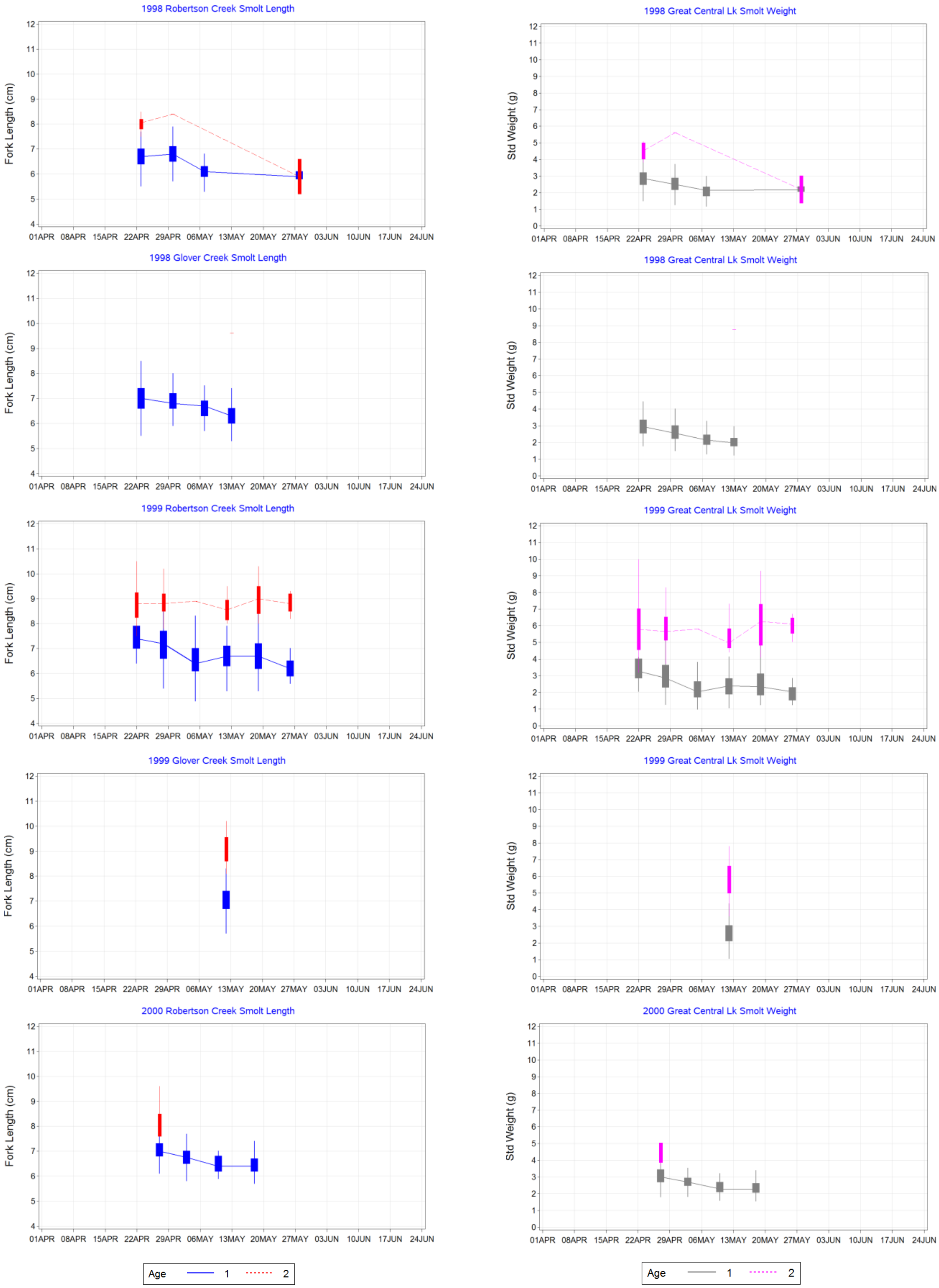
1986 Robertson Creek Smolt Length
1986 Great Central Lk Smolt Weight
1987 Robertson Creek Smolt Length
1987 Great Central Lk Smolt Weight
1988 Robertson Creek Smolt Length
1988 Great Central Lk Smolt Weight
1989 Robertson Creek Smolt Length
1989 Great Central Lk Smolt Weight
1990 Robertson Creek Smolt Length
1990 Great Central Lk Smolt Weight
Fork Length (cm)
Std Weight (g)
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN
Age 1 2
Age 1 2

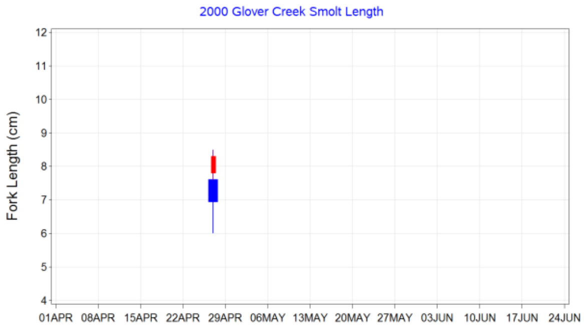

1990 Glover Creek Smolt Length
1990 Great Central Lk Smolt Weight
1991 Robertson Creek Smolt Length
1991 Great Central Lk Smolt Weight
1991 Glover Creek Smolt Length
1991 Great Central Lk Smolt Weight
1992 Robertson Creek Smolt Length
1992 Robertson Creek Smolt Weight
1992 Glover Creek Smolt Length
1992 Glover Creek Smolt Weight
Fork Length (cm)
Std Weight (g)
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN
Age 1 2
Age 1 2

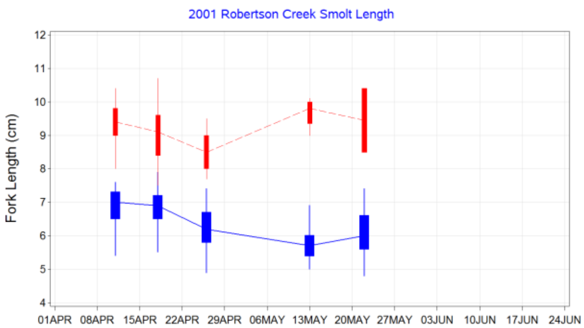

1993 Robertson Creek Smolt Length
Fork Length (cm)
1993 Great Central Lk Smolt Weight
Std Weight (g)
1993 Glover Creek Smolt Length
Fork Length (cm)
1993 Great Central Lk Smolt Weight
Std Weight (g)
1994 Robertson Creek Smolt Length
Fork Length (cm)
1994 Great Central Lk Smolt Weight
Std Weight (g)
1994 Glover Creek Smolt Length
Fork Length (cm)
1994 Great Central Lk Smolt Weight
Std Weight (g)
1995 Robertson Creek Smolt Length
Fork Length (cm)
1995 Great Central Lk Smolt Weight
Std Weight (g)
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN
Age 1 2
Age 1 2

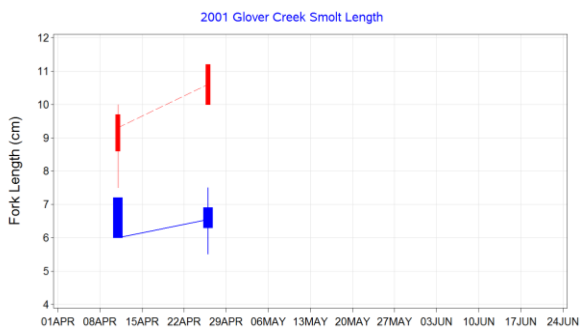

1995 Glover Creek Smolt Length
1996 Robertson Creek Smolt Length
1996 Glover Creek Smolt Length
1997 Robertson Creek Smolt Length
1997 Glover Creek Smolt Length
Fork Length (cm)
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN
Age 1 2

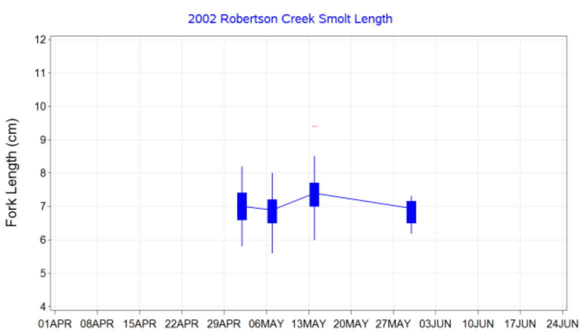

1995 Great Central Lk Smolt Weight
1996 Great Central Lk Smolt Weight
1996 Great Central Lk Smolt Weight
1997 Great Central Lk Smolt Weight
1997 Great Central Lk Smolt Weight
Std Weight (g)
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN
Age 1 2

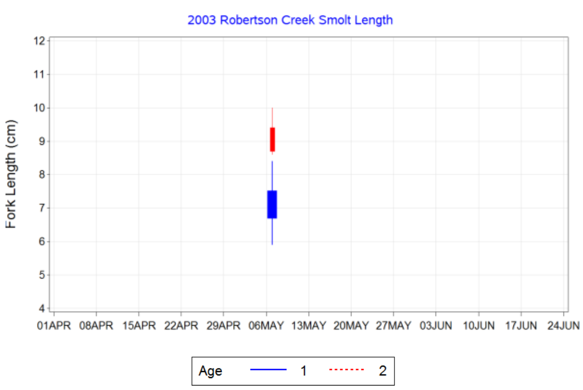

1998 Robertson Creek Smolt Length
1998 Great Central Lk Smolt Weight
1998 Glover Creek Smolt Length
1998 Great Central Lk Smolt Weight
1999 Robertson Creek Smolt Length
1999 Great Central Lk Smolt Weight
1999 Glover Creek Smolt Length
1999 Great Central Lk Smolt Weight
2000 Robertson Creek Smolt Length
2000 Great Central Lk Smolt Weight
Fork Length (cm)
Std Weight (g)
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN
Age 1 2
Age 1 2

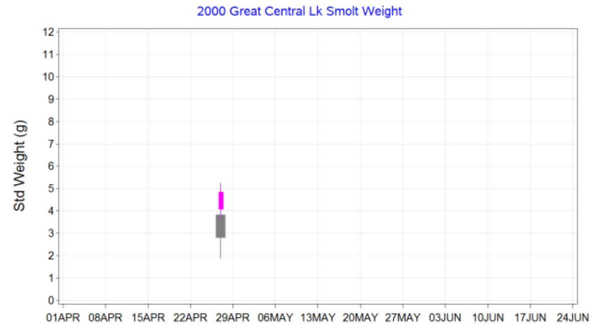

2000 Glover Creek Smolt Length
Fork Length (cm)
12 11 10 9 8 7 6 5 4
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN

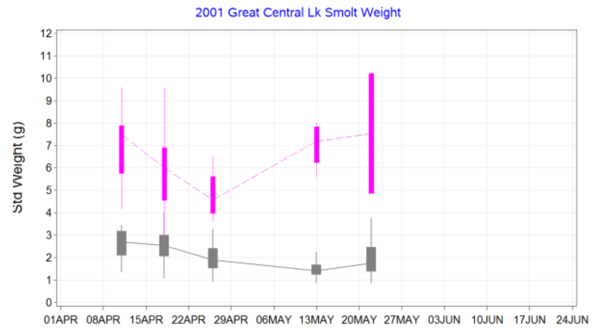

2001 Robertson Creek Smolt Length
Fork Length (cm)
12 11 10 9 8 7 6 5 4
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN

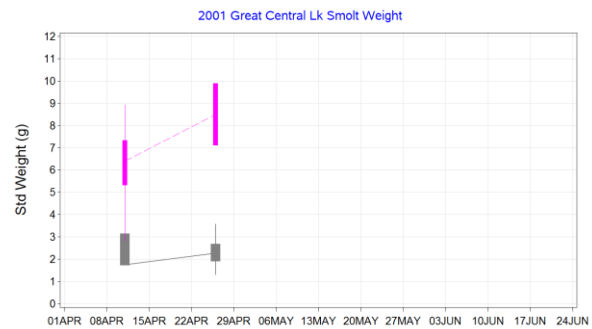

2001 Glover Creek Smolt Length
Fork Length (cm)
12 11 10 9 8 7 6 5 4
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN

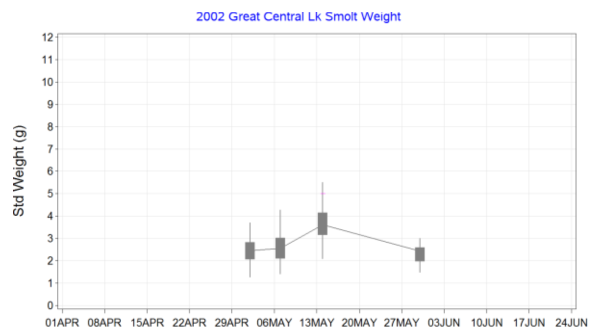

2002 Robertson Creek Smolt Length
Fork Length (cm)
12 11 10 9 8 7 6 5 4
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN

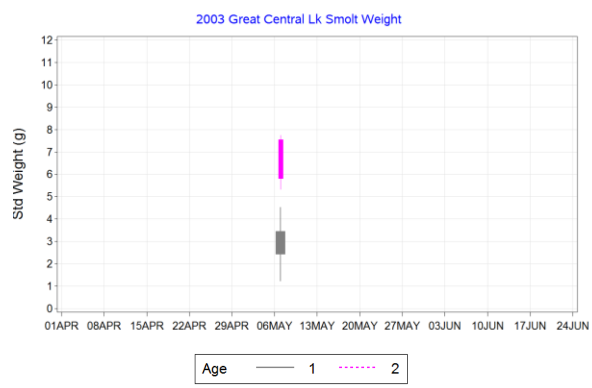

2003 Robertson Creek Smolt Length
Fork Length (cm)
12 11 10 9 8 7 6 5 4
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN
Age 1 2

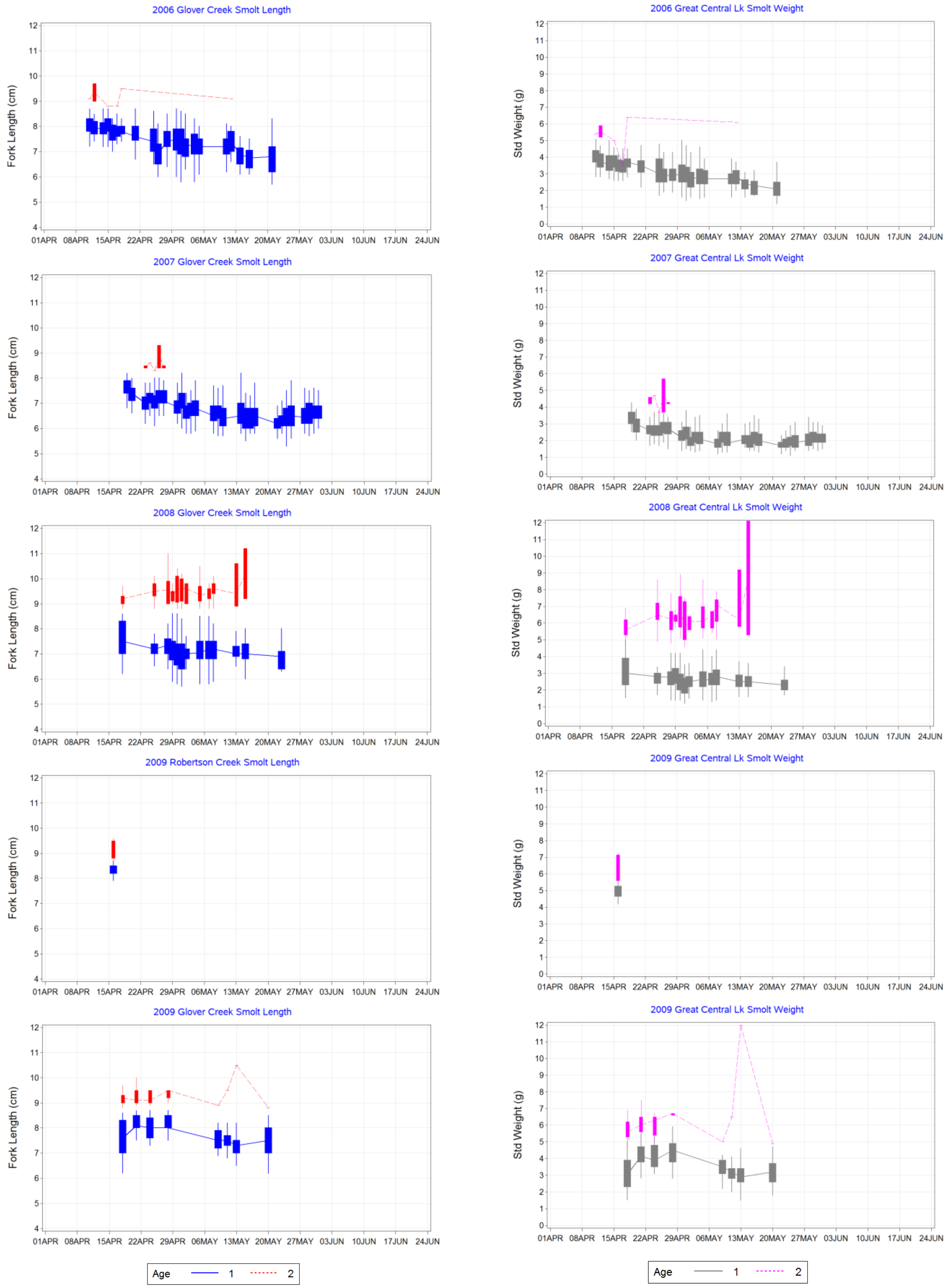

2000 Great Central Lk Smolt Weight
Std Weight (g)
12 11 10 9 8 7 6 5 4 3 2 1 0
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN


2001 Great Central Lk Smolt Weight
Std Weight (g)
12 11 10 9 8 7 6 5 4 3 2 1 0
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN

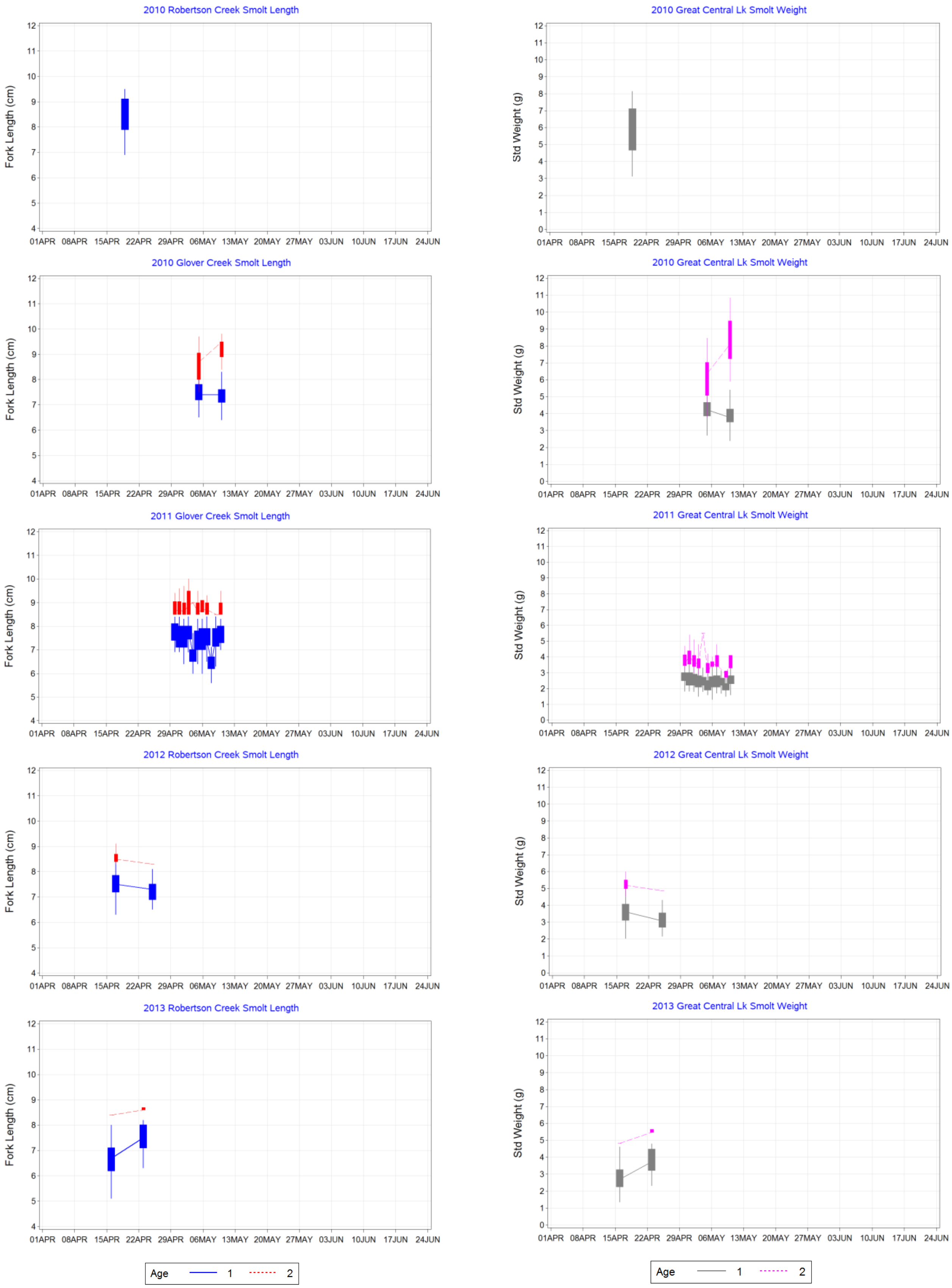

2001 Great Central Lk Smolt Weight
Std Weight (g)
12 11 10 9 8 7 6 5 4 3 2 1 0
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN

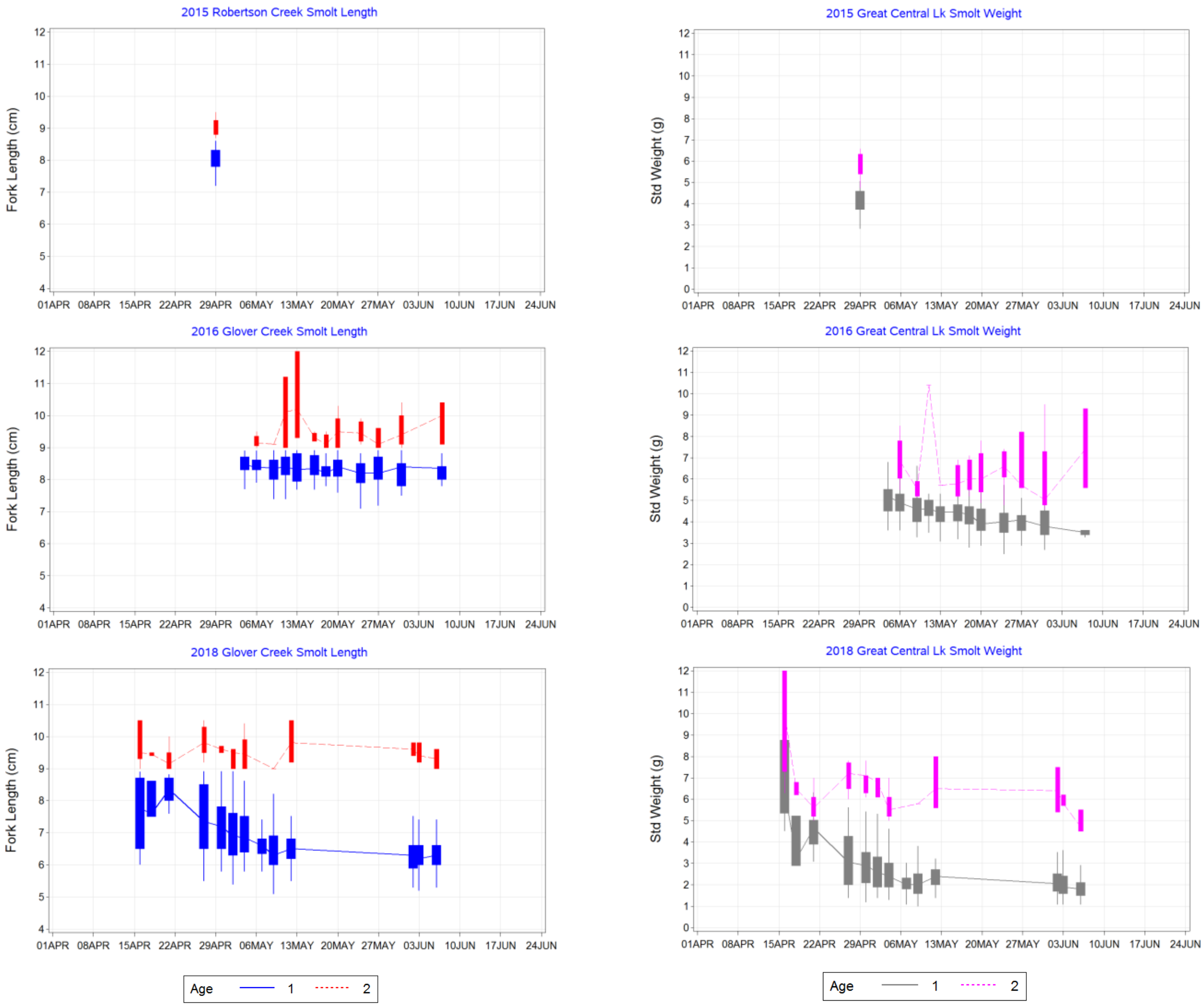

2002 Great Central Lk Smolt Weight
Std Weight (g)
12 11 10 9 8 7 6 5 4 3 2 1 0
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN


2003 Great Central Lk Smolt Weight
Std Weight (g)
12 11 10 9 8 7 6 5 4 3 2 1 0
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN
Age 1 2



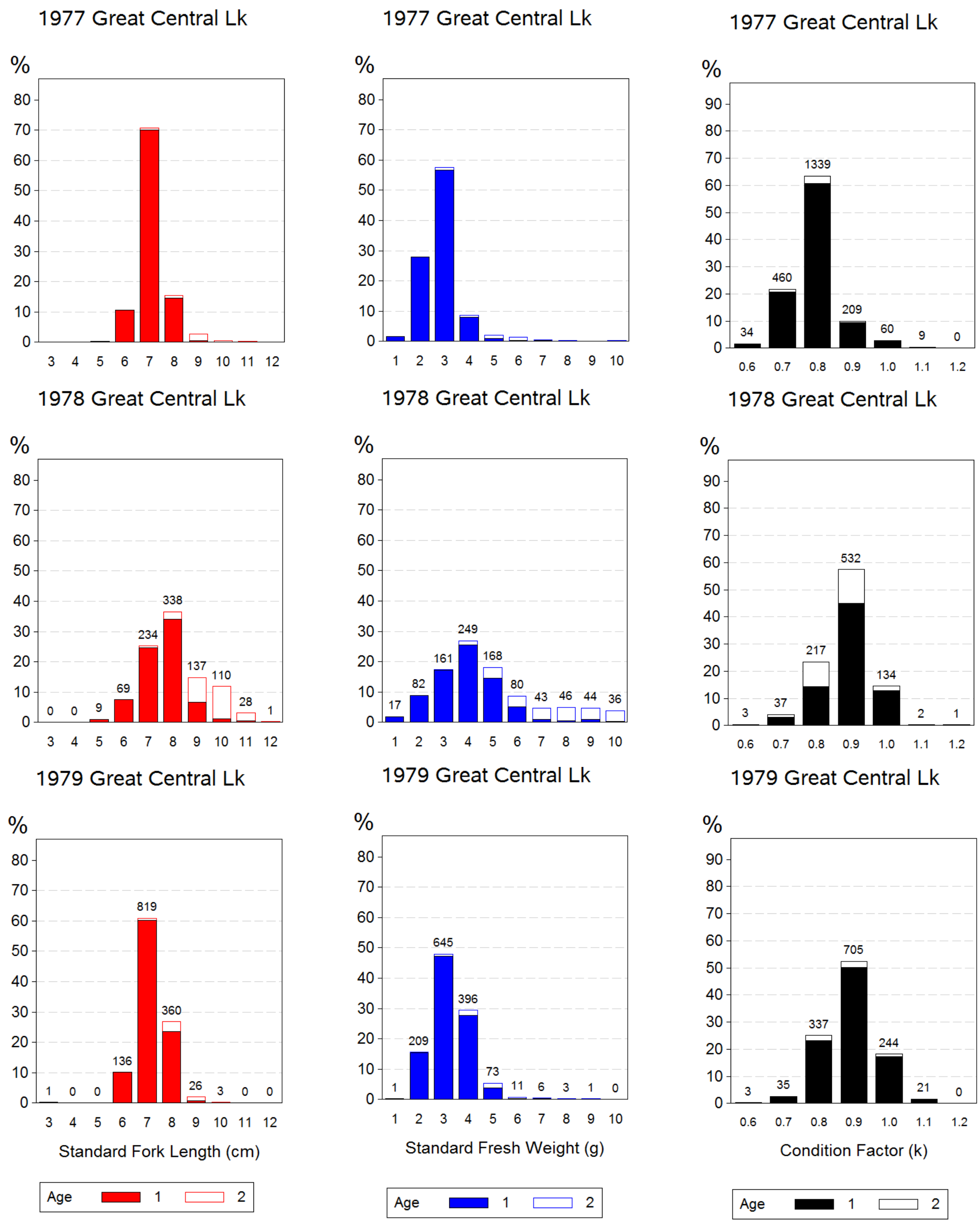
2006 Glover Creek Smolt Length
2006 Great Central Lk Smolt Weight
2007 Glover Creek Smolt Length
2007 Great Central Lk Smolt Weight
2008 Glover Creek Smolt Length
2008 Great Central Lk Smolt Weight
2009 Robertson Creek Smolt Length
2009 Great Central Lk Smolt Weight
2009 Glover Creek Smolt Length
2009 Great Central Lk Smolt Weight
Fork Length (cm)
Std Weight (g)
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN
Age 1 2
Age 1 2

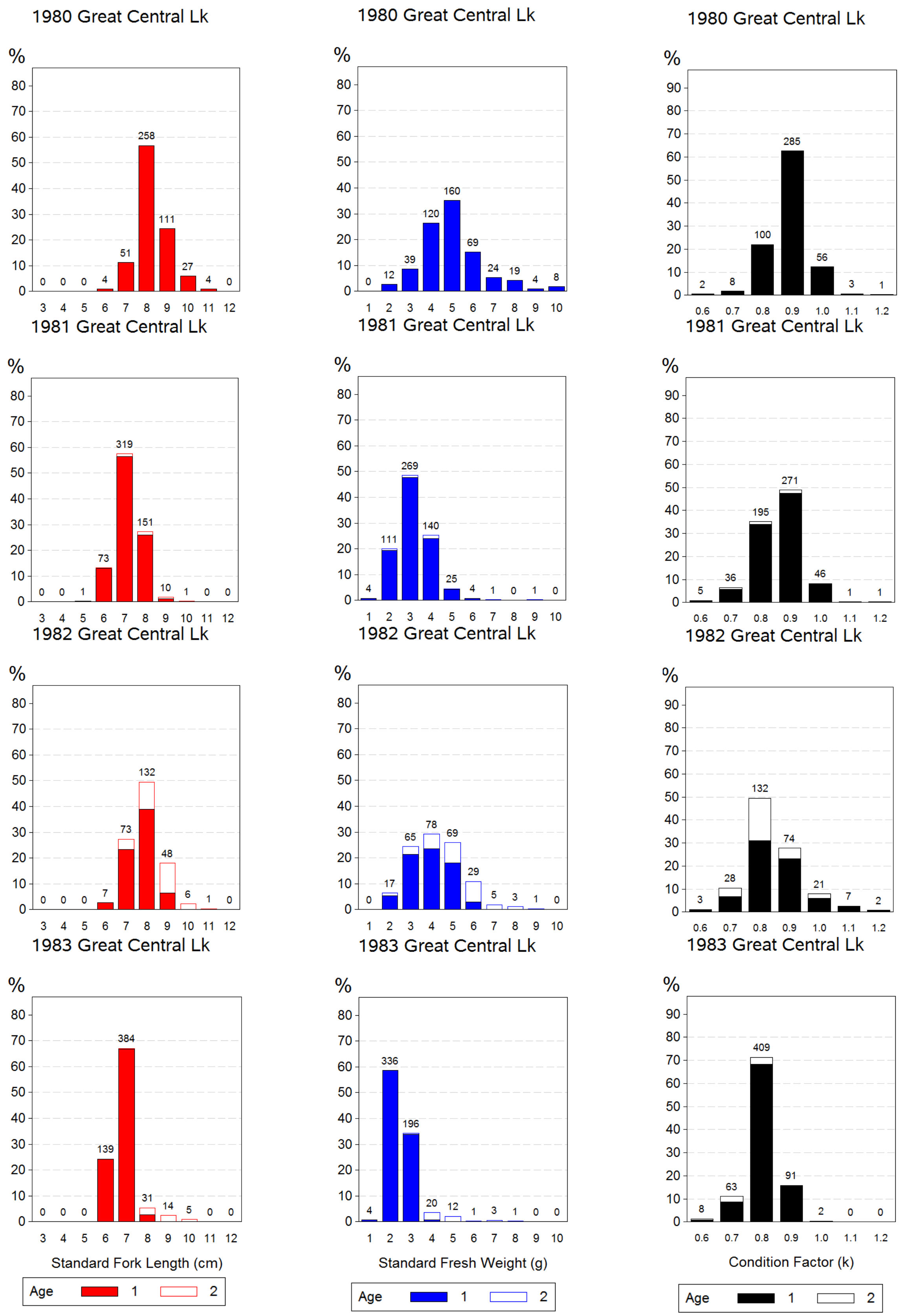

2010 Robertson Creek Smolt Length
2010 Great Central Lk Smolt Weight
2010 Glover Creek Smolt Length
2010 Great Central Lk Smolt Weight
2011 Glover Creek Smolt Length
2011 Great Central Lk Smolt Weight
2012 Robertson Creek Smolt Length
2012 Great Central Lk Smolt Weight
2013 Robertson Creek Smolt Length
2013 Great Central Lk Smolt Weight
Fork Length (cm)
Std Weight (g)
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN
Age 1 2
Age 1 2

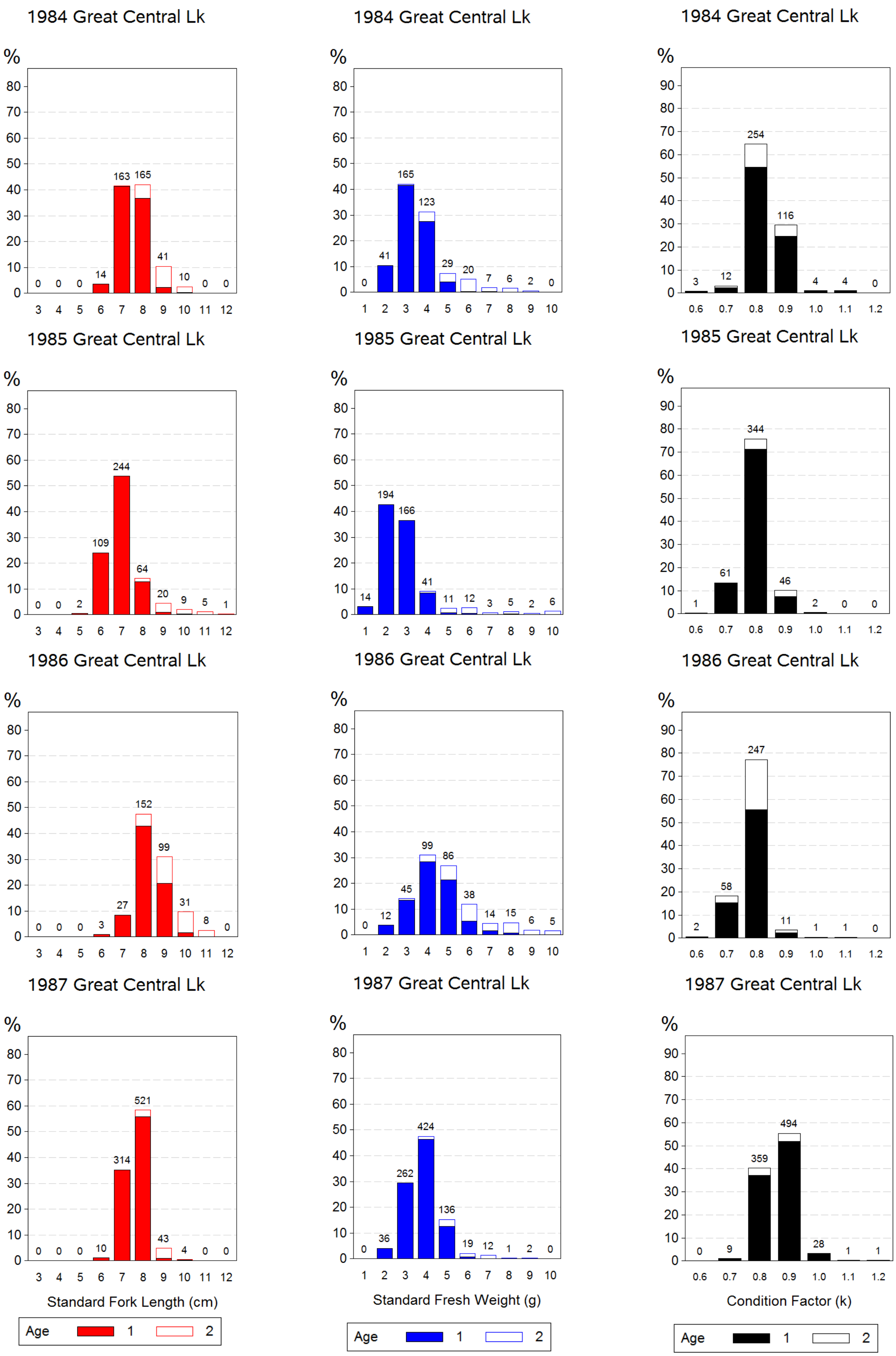

2015 Robertson Creek Smolt Length
2015 Great Central Lk Smolt Weight
2016 Glover Creek Smolt Length
2016 Great Central Lk Smolt Weight
2018 Glover Creek Smolt Length
2018 Great Central Lk Smolt Weight
Fork Length (cm)
Std Weight (g)
01APR 08APR 15APR 22APR 29APR 06MAY 13MAY 20MAY 27MAY 03JUN 10JUN 17JUN 24JUN
Age 1 2
Age 1 2

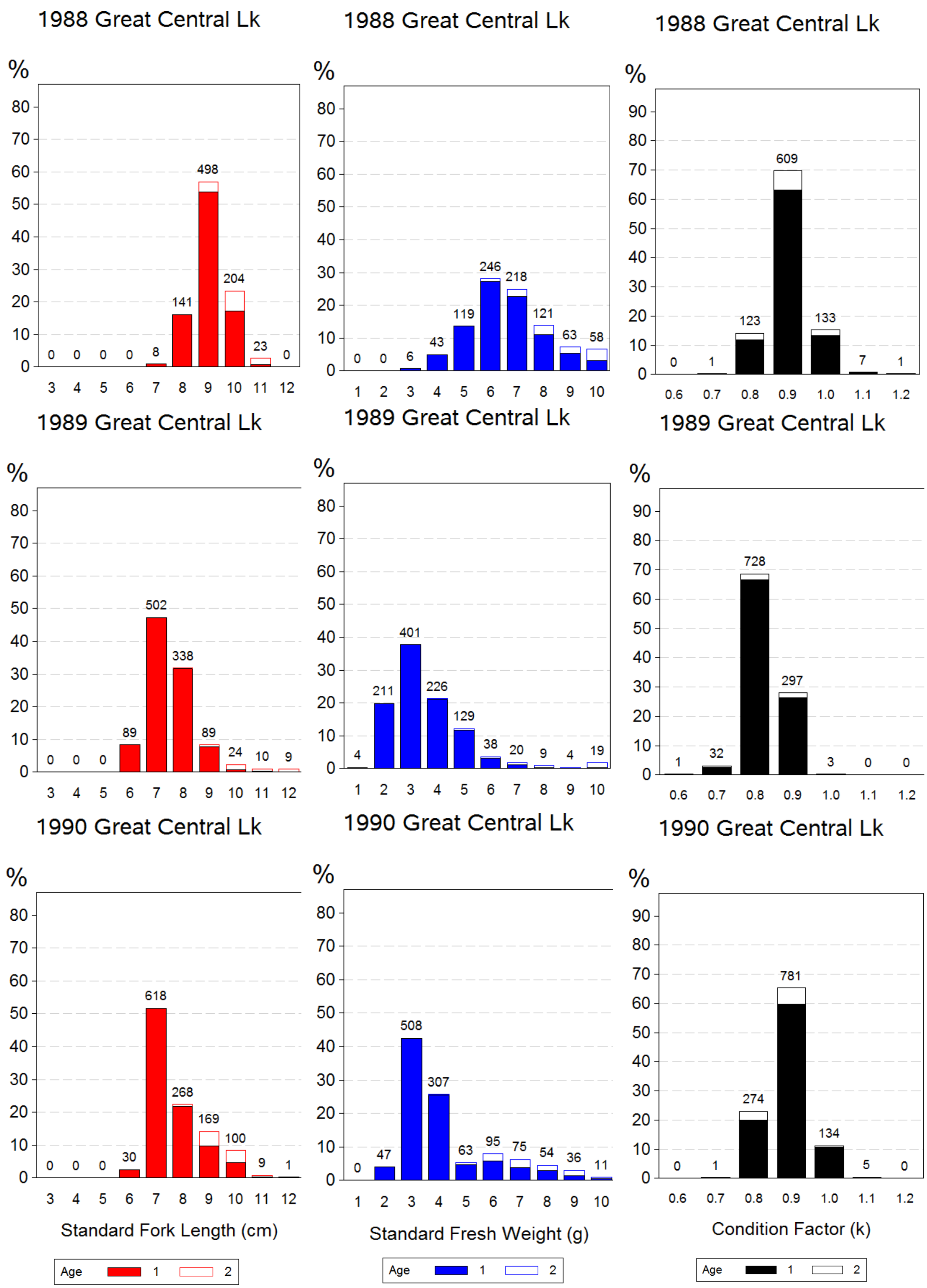
APPENDIX IV – Annual Size Frequency Distributions

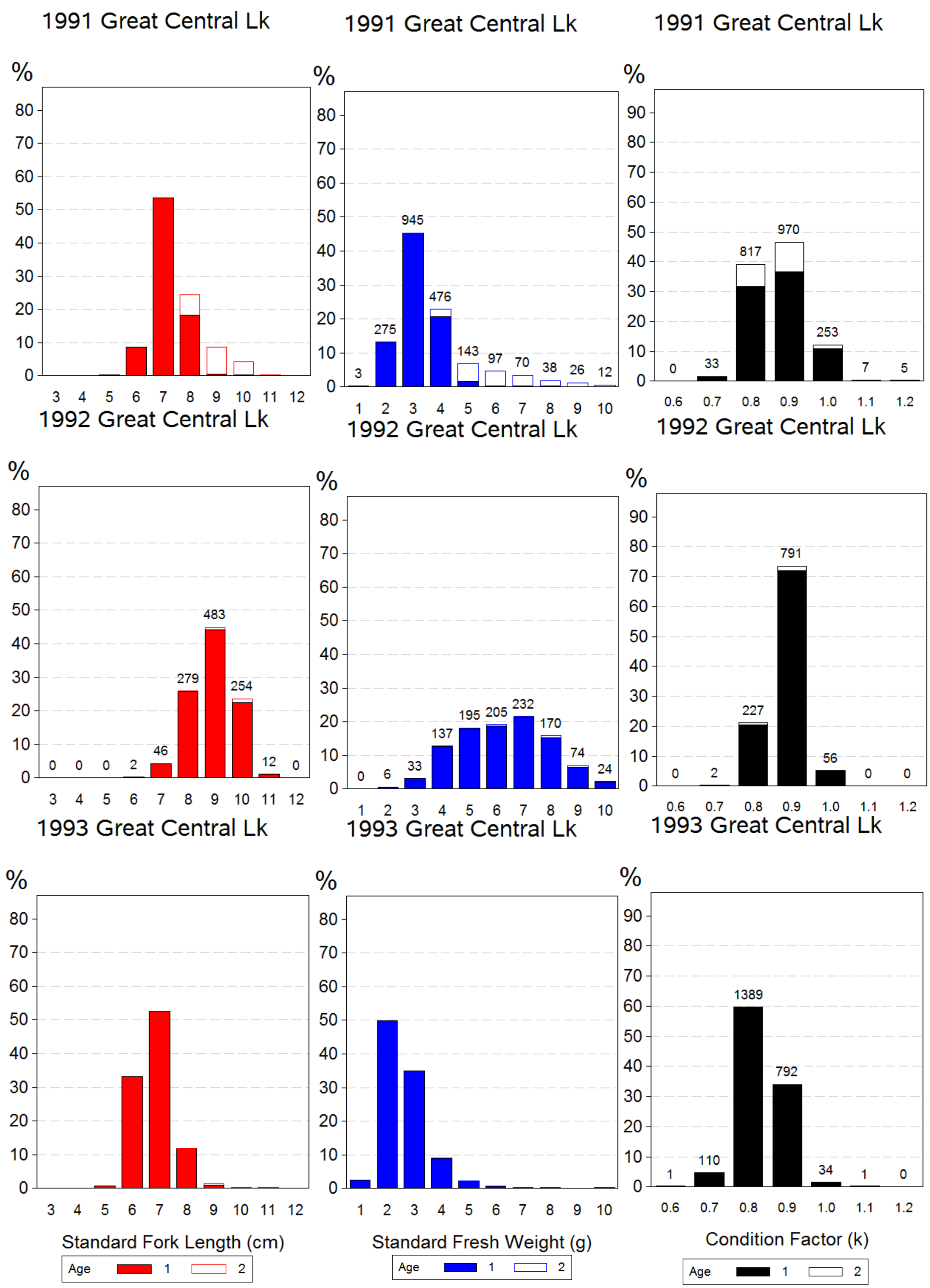
Appendix IV. Great Central Lake Sockeye smolt size frequency distributions (Fork Length (cm), left; Std Weight (g), middle; Condition Factor (k), right) by year and age class.

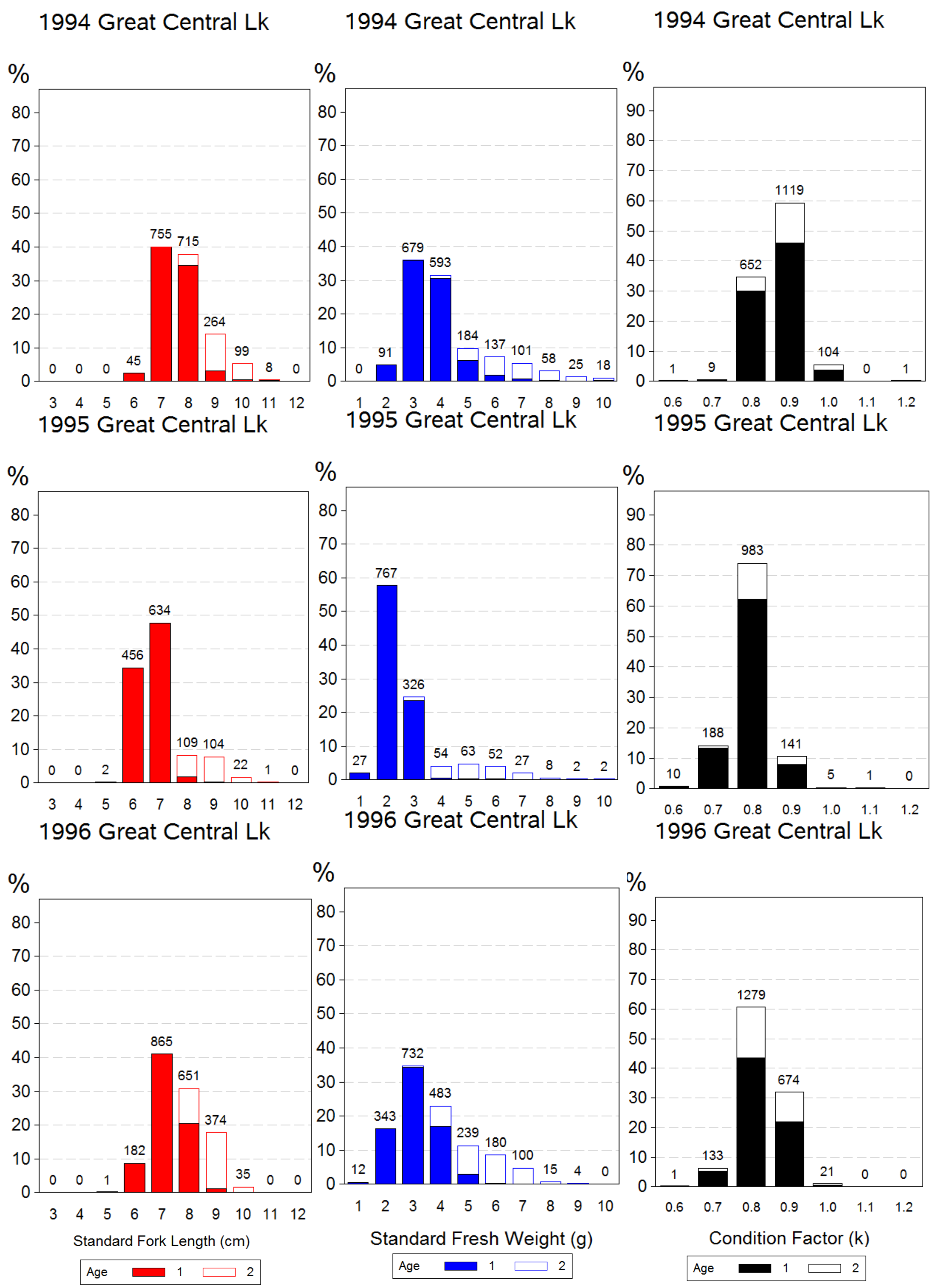


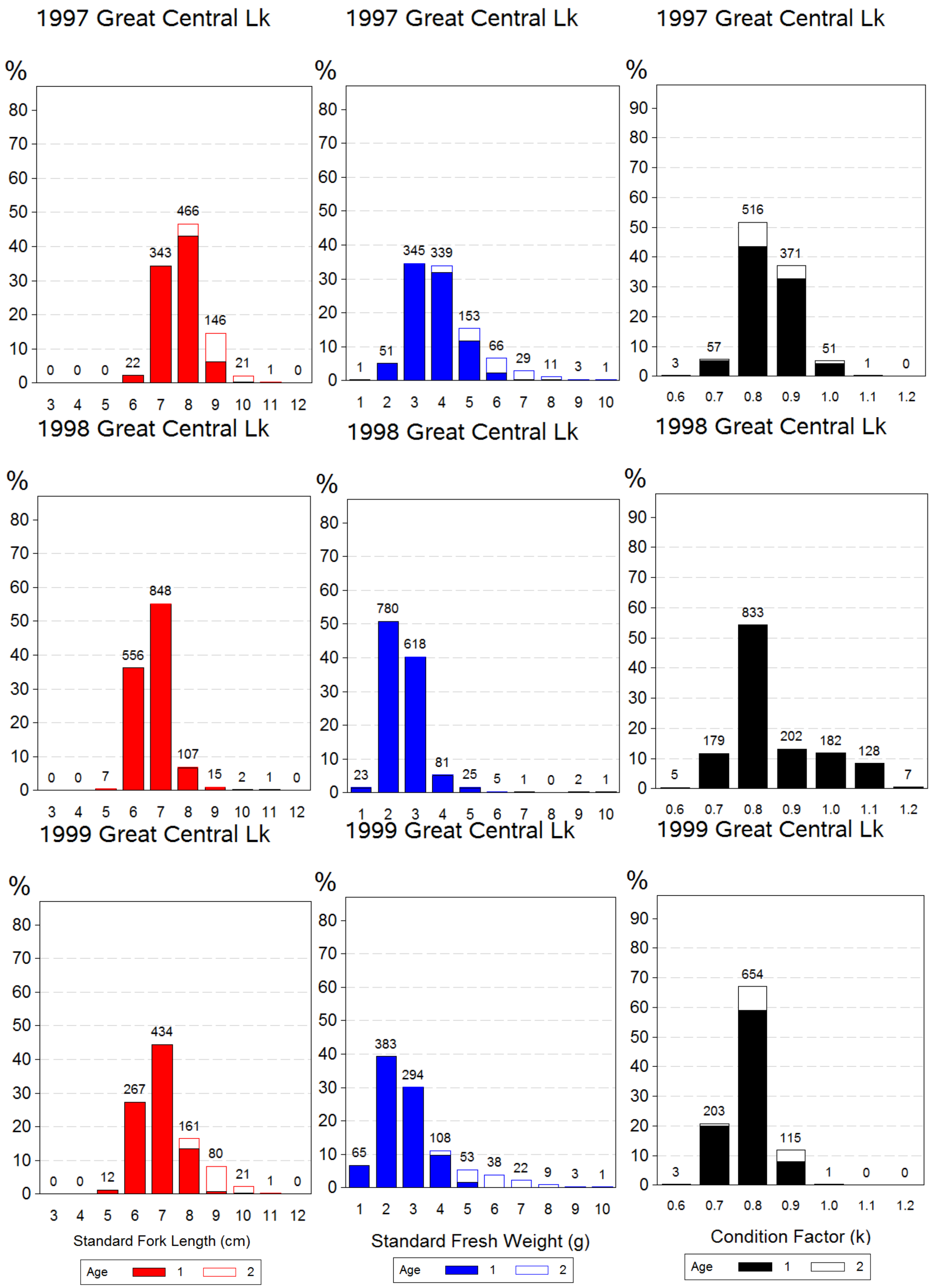

1980 Great Central Lk
1981 Great Central Lk
1982 Great Central Lk
1983 Great Central Lk
%
Standard Fork Length (cm)
Age 1 2
Standard Fresh Weight (g)
Age 1 2
Condition Factor (k)
Age 1 2

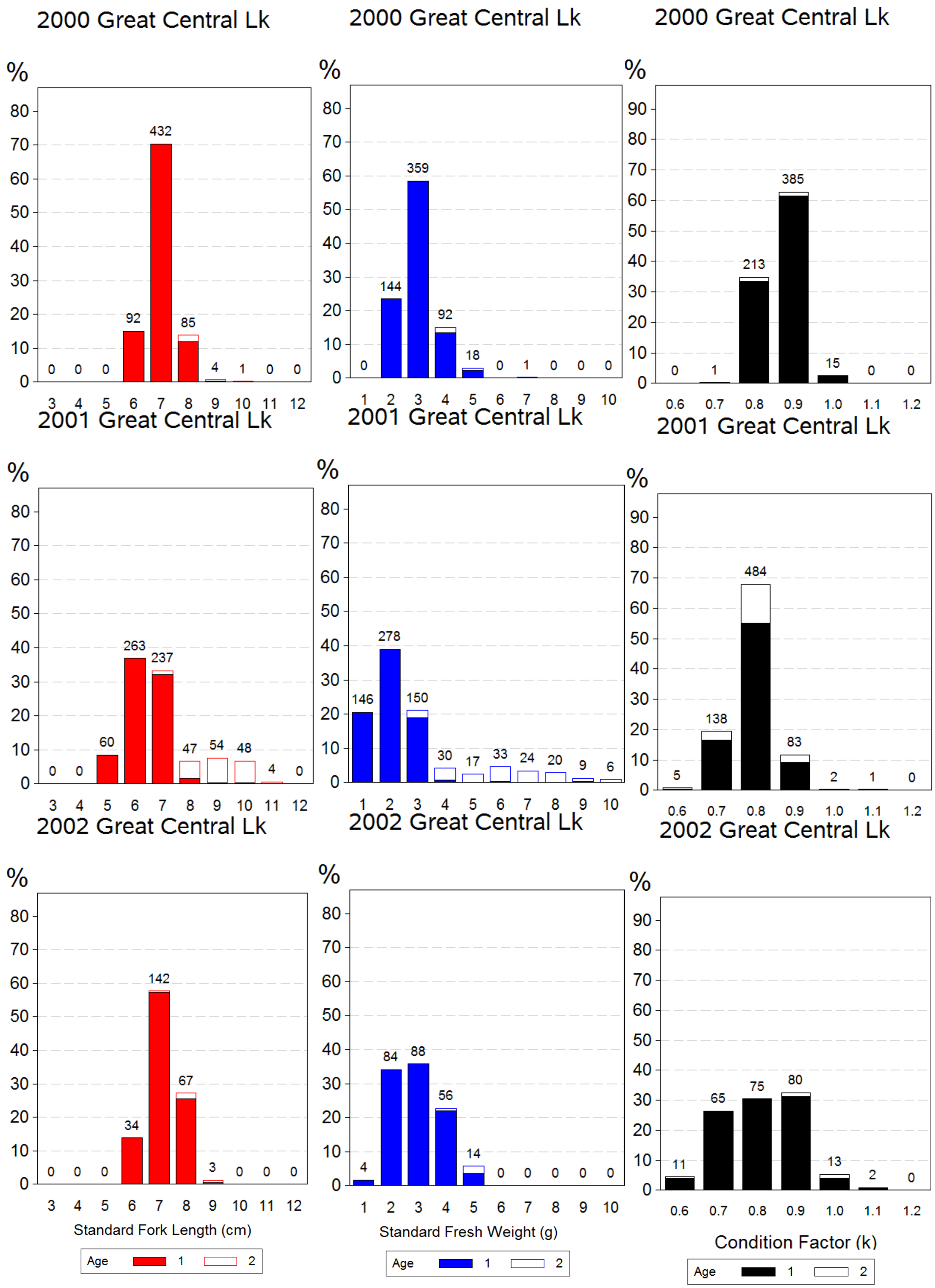

1984 Great Central Lk
1985 Great Central Lk
1986 Great Central Lk
1987 Great Central Lk
%
Standard Fork Length (cm)
Age 1 2
1984 Great Central Lk
1985 Great Central Lk
1986 Great Central Lk
1987 Great Central Lk
%
Standard Fresh Weight (g)
Age 1 2
1984 Great Central Lk
1985 Great Central Lk
1986 Great Central Lk
1987 Great Central Lk
%
Condition Factor (k)
Age 1 2

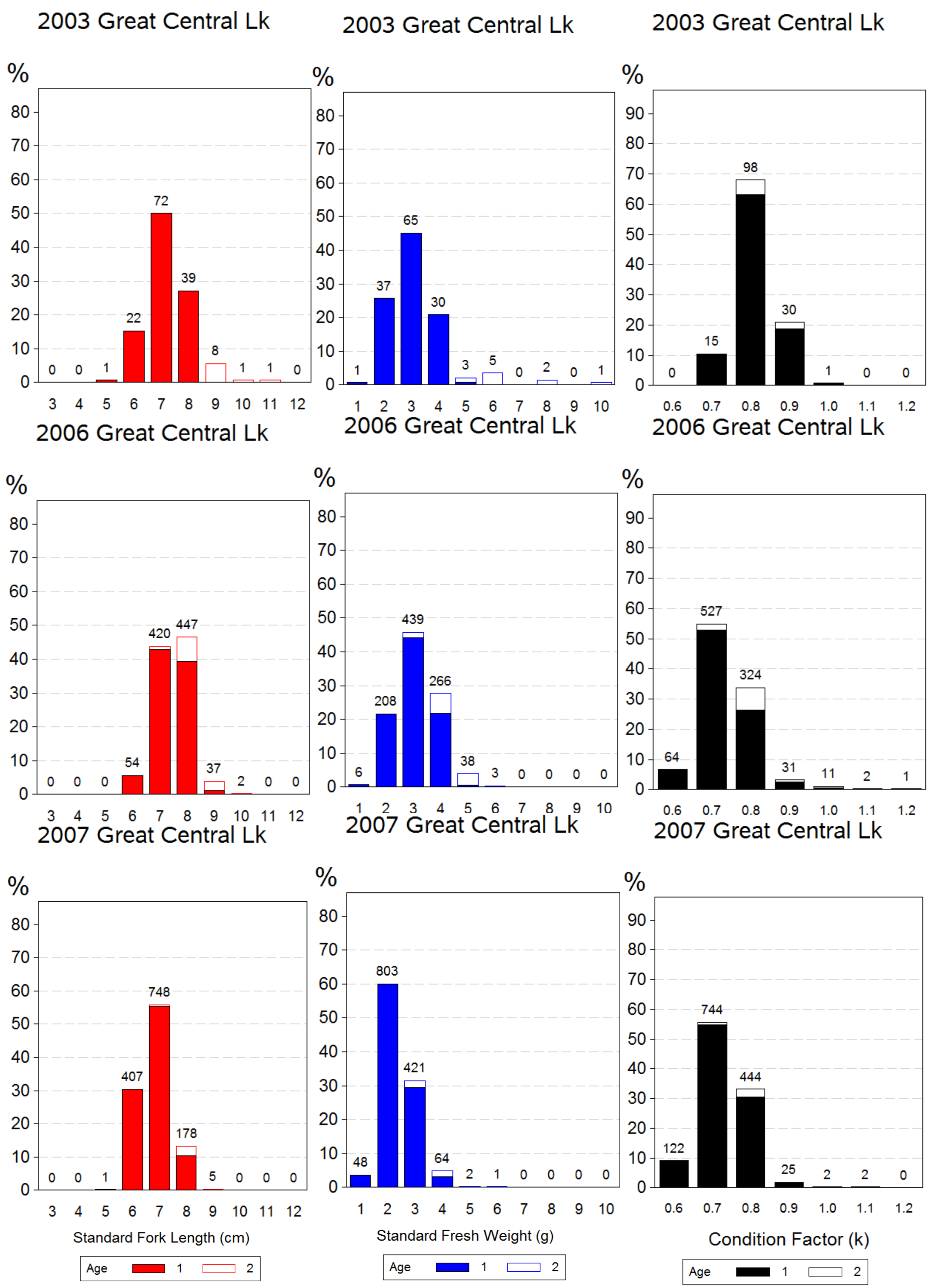

1988 Great Central Lk
%
0 0 0 0 8 141 498 204 23 0
3 4 5 6 7 8 9 10 11 12
1988 Great Central Lk
%
0 0 6 43 119 246 218 121 63 58
1 2 3 4 5 6 7 8 9 10
1988 Great Central Lk
%
0 1 123 609 133 7 1
0.6 0.7 0.8 0.9 1.0 1.1 1.2
1989 Great Central Lk
%
0 0 0 89 502 338 89 24 10 9
3 4 5 6 7 8 9 10 11 12
1989 Great Central Lk
%
4 211 401 226 129 38 20 9 4 19
1 2 3 4 5 6 7 8 9 10
1989 Great Central Lk
%
1 32 728 297 3 0 0
0.6 0.7 0.8 0.9 1.0 1.1 1.2
1990 Great Central Lk
%
0 0 0 30 618 268 169 100 9 1
3 4 5 6 7 8 9 10 11 12
Standard Fork Length (cm)
Age 1 2
1990 Great Central Lk
%
0 47 508 307 63 95 75 54 36 11
1 2 3 4 5 6 7 8 9 10
Standard Fresh Weight (g)
Age 1 2
1990 Great Central Lk
%
0 1 274 781 134 5 0
0.6 0.7 0.8 0.9 1.0 1.1 1.2
Condition Factor (k)
Age 1 2

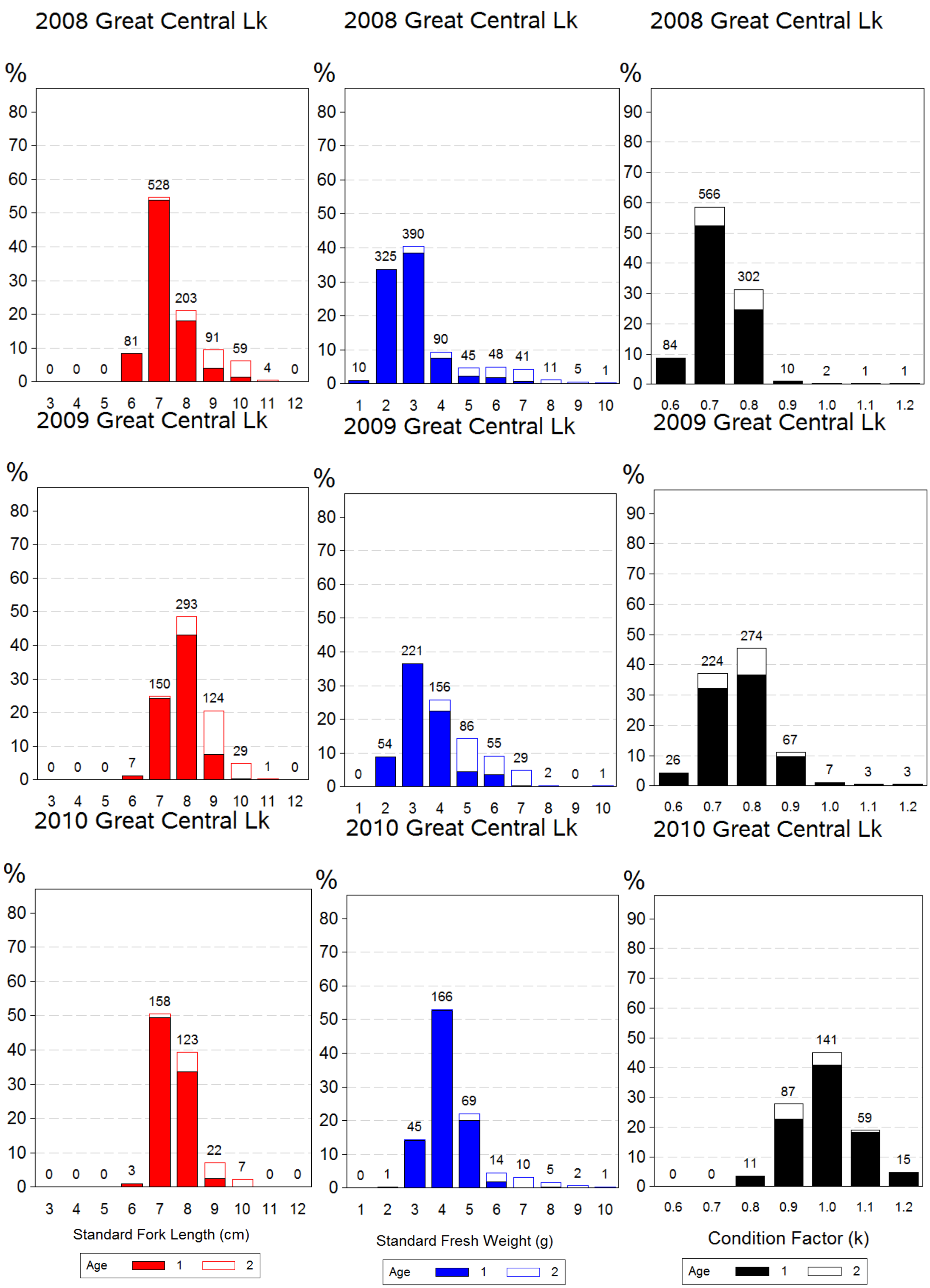

1991 Great Central Lk
1991 Great Central Lk
1991 Great Central Lk
%
3 275 945 476 143 97 70 38 26 12
0 33 817 970 253 7 5
1992 Great Central Lk
1992 Great Central Lk
1992 Great Central Lk
0 0 0 2 46 279 483 254 12 0
0 6 33 137 195 205 232 170 74 24
0 2 227 791 56 0 0
1993 Great Central Lk
1993 Great Central Lk
1993 Great Central Lk
1 110 1389 792 34 1 0
Standard Fork Length (cm)
Age 1 2
Standard Fresh Weight (g)
Age 1 2
Condition Factor (k)
Age 1 2

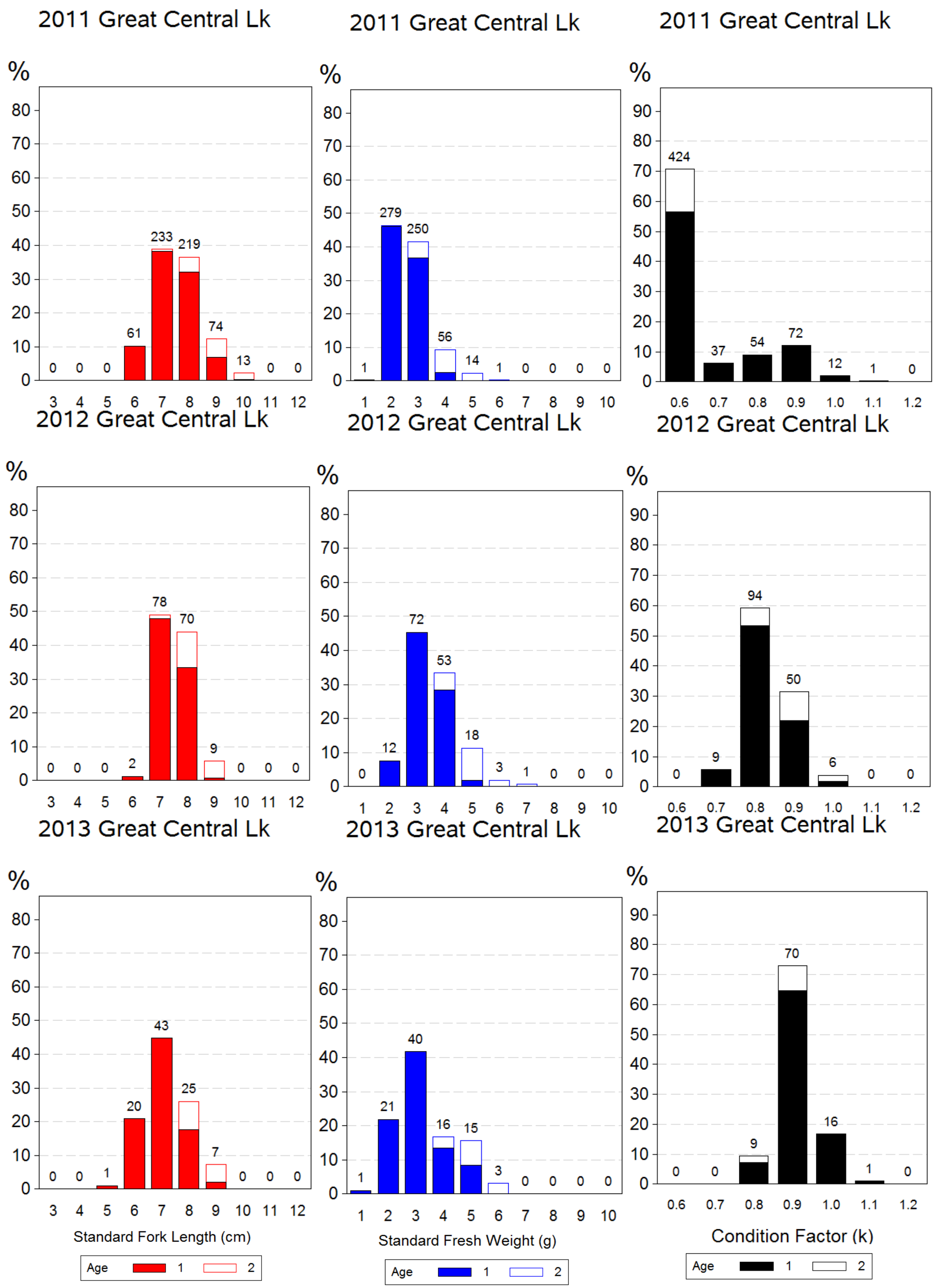

1994 Great Central Lk
1994 Great Central Lk
1994 Great Central Lk
1995 Great Central Lk
1995 Great Central Lk
1995 Great Central Lk
1996 Great Central Lk
1996 Great Central Lk
1996 Great Central Lk
%
0 0 0 45 755 715 264 99 8 0
0 91 679 593 184 137 101 58 25 18
1 9 652 1119 104 0 1
0 0 2 456 634 109 104 22 1 0
27 767 326 54 63 52 27 8 2 2
10 188 983 141 5 1 0
0 0 1 182 865 651 374 35 0 0
12 343 732 483 239 180 100 15 4 0
1 133 1279 674 21 0 0
Standard Fork Length (cm)
Standard Fresh Weight (g)
Condition Factor (k)
Age 1 2
Age 1 2
Age 1 2

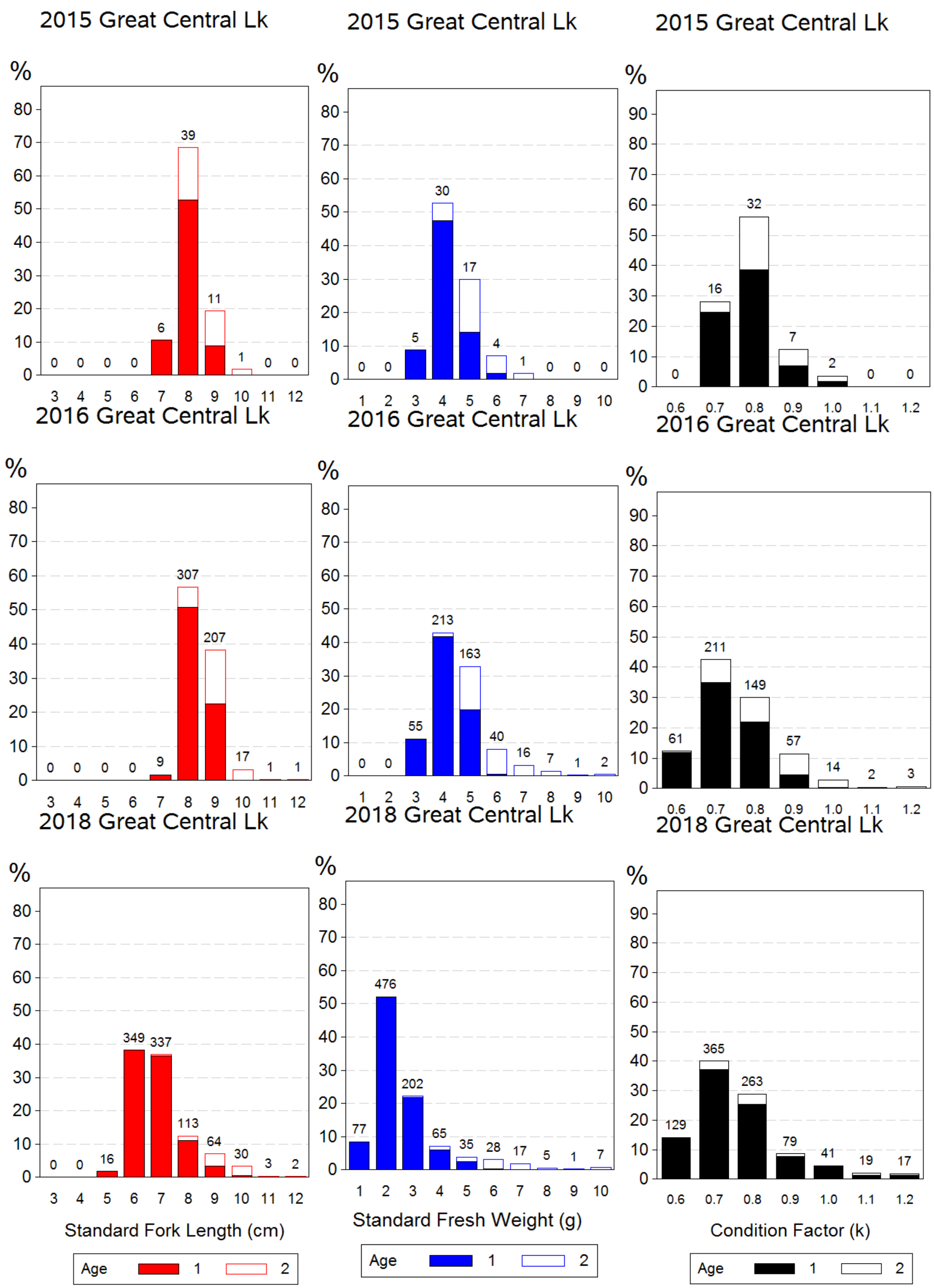

1997 Great Central Lk
%
0 0 0 22 343 466 146 21 1 0
1997 Great Central Lk
%
1 51 345 339 153 66 29 11 3 1
1997 Great Central Lk
%
3 57 516 371 51 1 0
1998 Great Central Lk
%
0 0 7 556 848 107 15 2 1 0
1998 Great Central Lk
%
23 780 618 81 25 5 1 0 2 1
1998 Great Central Lk
%
5 179 833 202 182 128 7
1999 Great Central Lk
%
0 0 12 267 434 161 80 21 1 0
1999 Great Central Lk
%
65 383 294 108 53 38 22 9 3 1
1999 Great Central Lk
%
3 203 654 115 1 0 0
Standard Fork Length (cm)
Age 1 2
Standard Fresh Weight (g)
Age 1 2
Condition Factor (k)
Age 1 2


2000 Great Central Lk
2000 Great Central Lk
2000 Great Central Lk
2001 Great Central Lk
2001 Great Central Lk
2001 Great Central Lk
2002 Great Central Lk
2002 Great Central Lk
2002 Great Central Lk
%
Standard Fork Length (cm)
Standard Fresh Weight (g)
Condition Factor (k)
Age 1 2
Age 1 2
Age 1 2


2003 Great Central Lk
2006 Great Central Lk
2007 Great Central Lk
%
Standard Fork Length (cm)
Standard Fresh Weight (g)
Condition Factor (k)
Age 1 2


2008 Great Central Lk
2008 Great Central Lk
2008 Great Central Lk
2009 Great Central Lk
2009 Great Central Lk
2009 Great Central Lk
2010 Great Central Lk
2010 Great Central Lk
2010 Great Central Lk
%
Standard Fork Length (cm)
Standard Fresh Weight (g)
Condition Factor (k)
Age 1 2
Age 1 2
Age 1 2


2011 Great Central Lk
2011 Great Central Lk
2011 Great Central Lk
2012 Great Central Lk
2012 Great Central Lk
2012 Great Central Lk
2013 Great Central Lk
2013 Great Central Lk
2013 Great Central Lk
%
Standard Fork Length (cm)
Standard Fresh Weight (g)
Condition Factor (k)
Age 1 2
Age 1 2
Age 1 2


2015 Great Central Lk
2015 Great Central Lk
2015 Great Central Lk
2016 Great Central Lk
2016 Great Central Lk
2016 Great Central Lk
2018 Great Central Lk
2018 Great Central Lk
2018 Great Central Lk
%
Standard Fork Length (cm)
Standard Fresh Weight (g)
Condition Factor (k)
Age 1 2
Age 1 2
Age 1 2

APPENDIX V – Annual Length/Weight Relations

Appendix V. Great Central Lake Sockeye smolt length-to-weight relationships (model: Std Weight = a · ForkLength ^{b}) by ocean entry year and age class.

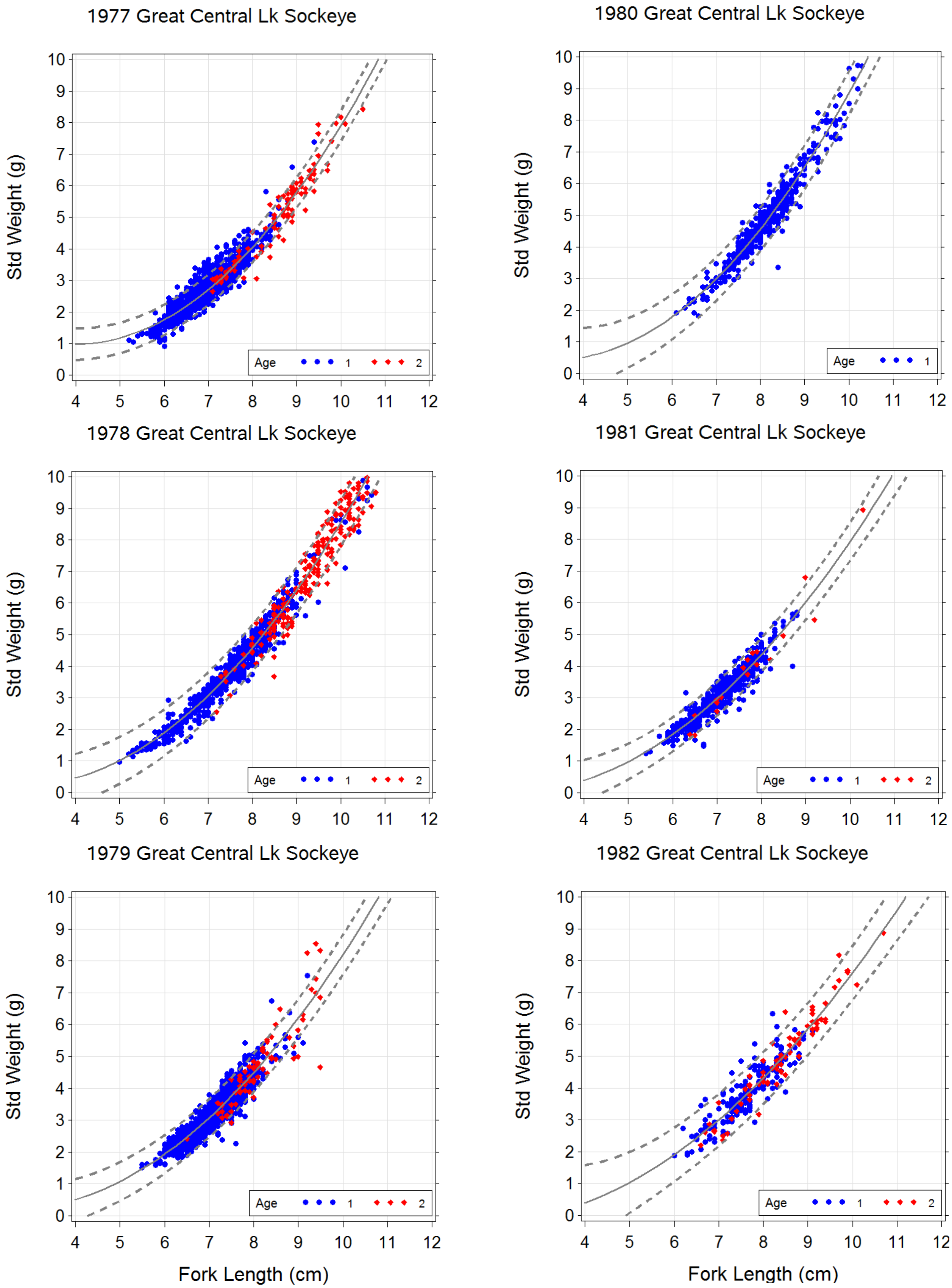
Stock Great Central Lk

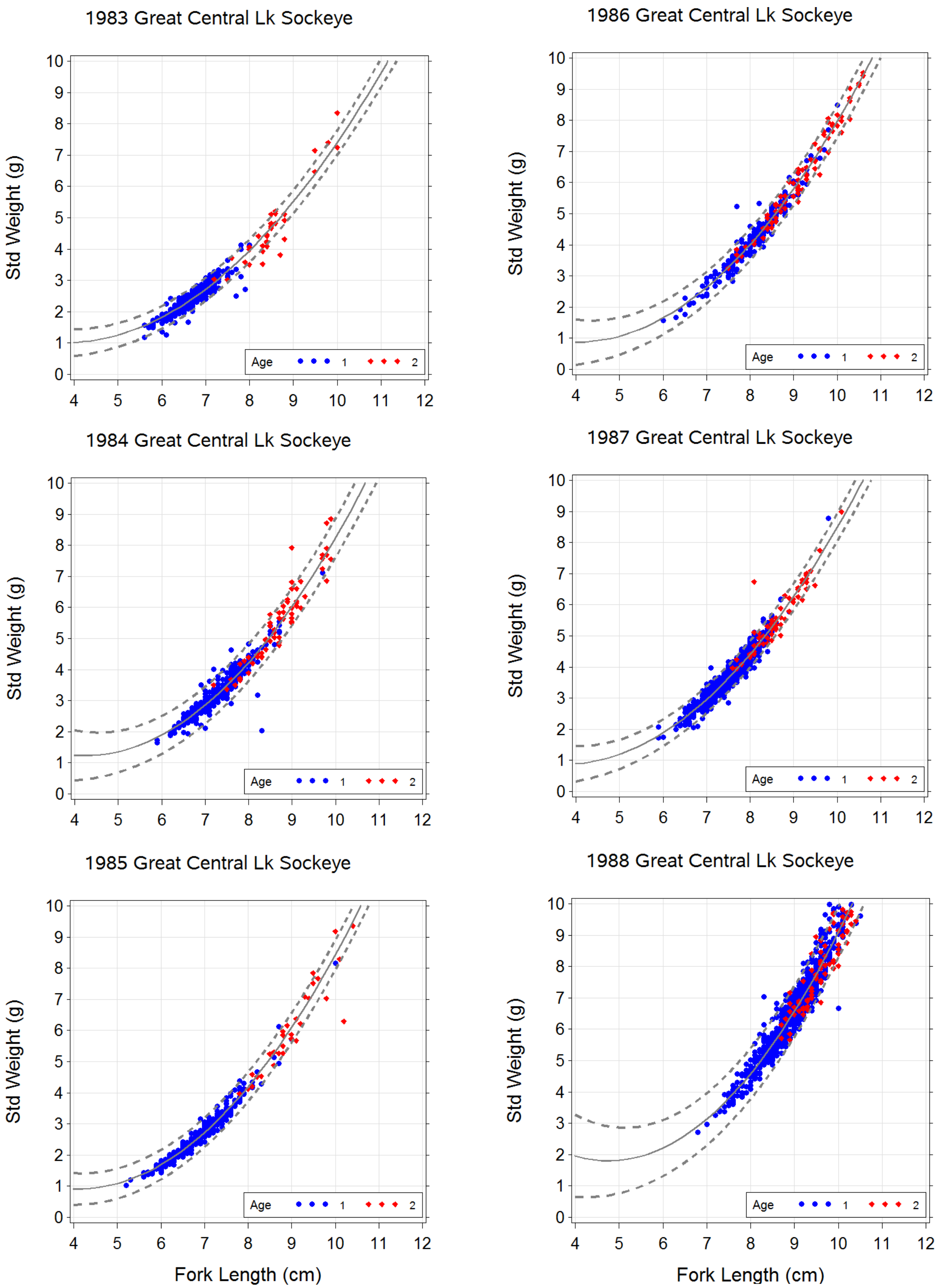
	Age							
	1				2			
	a	b	Rsq	N	a	b	Rsq	N
Year								
1977	0.0077	3.011	0.86	2012	0.0082	2.975	0.93	93
1978	0.0080	3.052	0.95	696	0.0118	2.855	0.91	203
1979	0.0106	2.912	0.87	1272	0.0111	2.878	0.83	69
1980	0.0073	3.091	0.93	448				
1981	0.0091	2.971	0.88	535	0.0062	3.139	0.94	16
1982	0.0162	2.683	0.80	188	0.0111	2.854	0.92	75
1983	0.0122	2.779	0.86	536	0.0070	3.030	0.87	33
1984	0.0109	2.861	0.87	328	0.0072	3.061	0.91	61
1985	0.0056	3.185	0.97	416	0.0110	2.867	0.88	28
1986	0.0055	3.167	0.95	236	0.0073	3.037	0.97	76
1987	0.0084	3.012	0.92	823	0.0173	2.676	0.88	65
1988	0.0081	3.047	0.93	761	0.0128	2.840	0.82	73
1989	0.0076	3.042	0.97	1013	0.0154	2.719	0.92	26
1990	0.0116	2.868	0.97	1078	0.0137	2.800	0.92	104
1991	0.0138	2.764	0.87	1689	0.0129	2.817	0.92	385
1992	0.0079	3.052	0.97	1038	0.0114	2.884	0.95	21
1993	0.0068	3.102	0.95	2309	0.0034	3.408	0.87	14
1994	0.0089	2.983	0.94	1505	0.0094	2.973	0.94	373
1995	0.0115	2.799	0.90	1073	0.0082	2.994	0.97	282

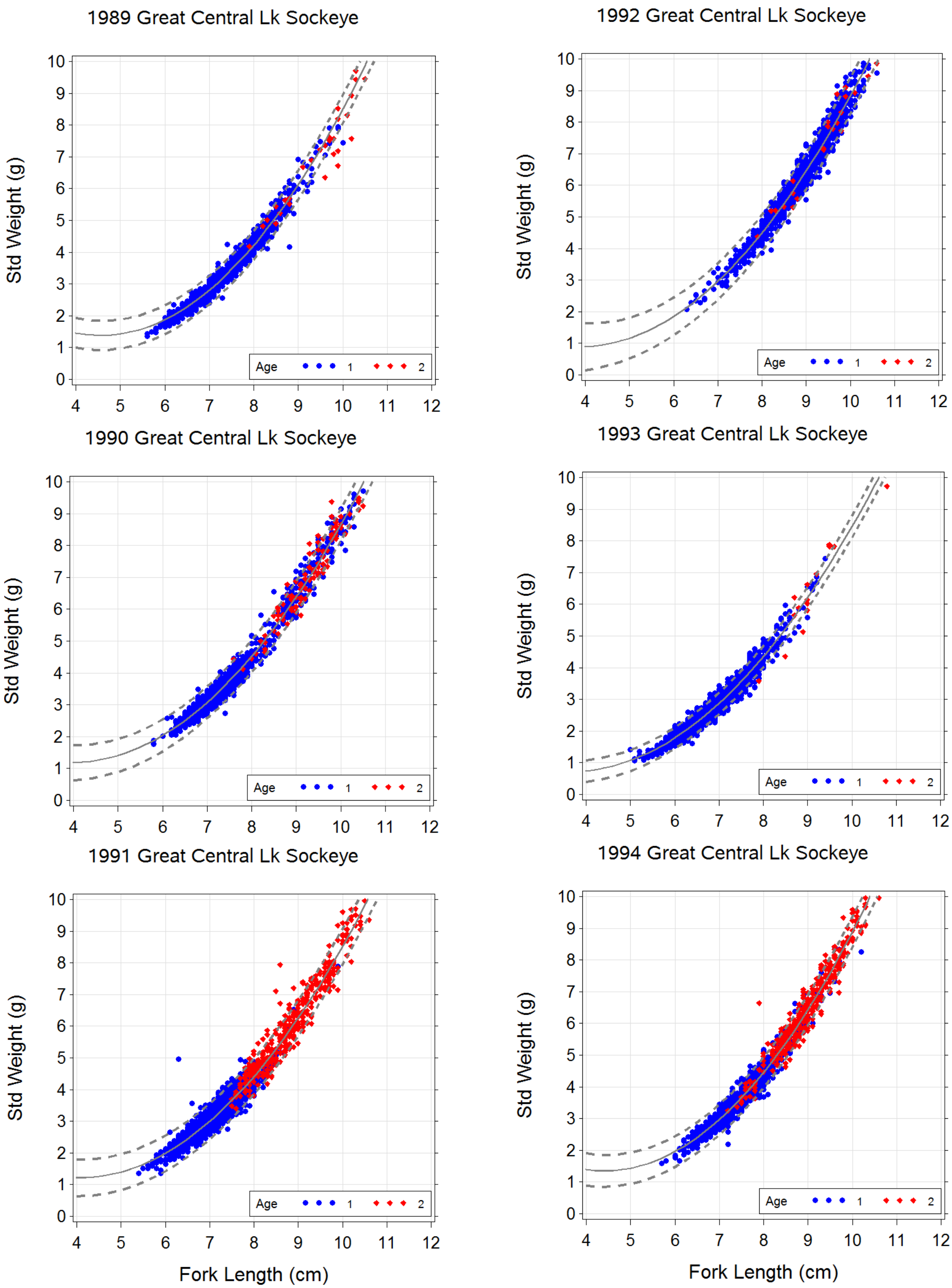
(Continued)

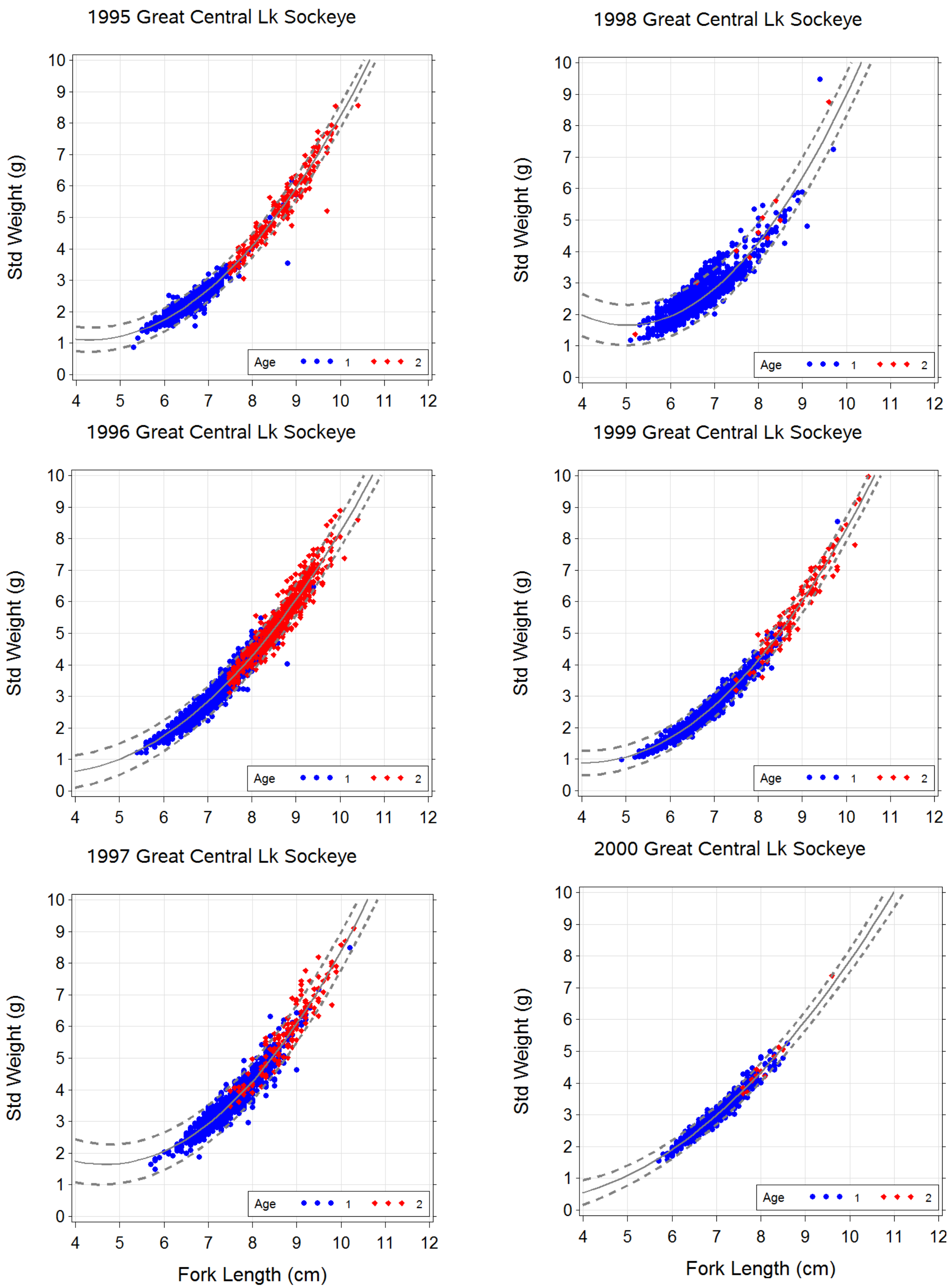
Stock Great Central Lk

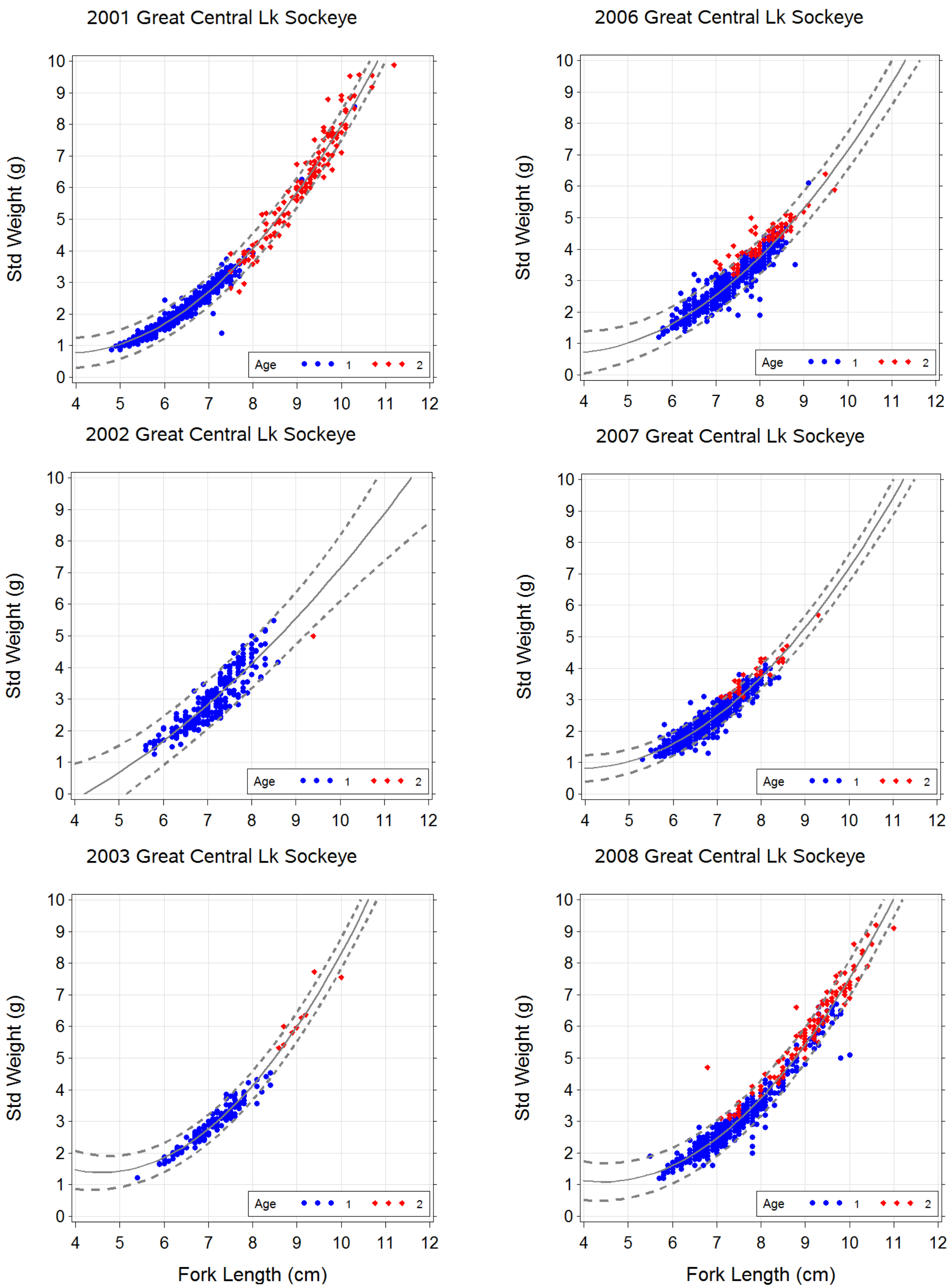
	Age							
	1				2			
	a	b	Rsq	N	a	b	Rsq	N
Year								
1996	0.0072	3.063	0.94	1380	0.0131	2.792	0.94	724
1997	0.0139	2.749	0.90	849	0.0096	2.941	0.92	145
1998	0.0179	2.603	0.78	1517	0.0164	2.724	0.94	14
1999	0.0062	3.125	0.96	838	0.0063	3.119	0.94	134
2000	0.0117	2.846	0.95	588	0.0255	2.481	0.95	22
2001	0.0081	2.986	0.95	564	0.0078	3.010	0.95	143
2002	0.0079	3.010	0.82	237	0.4813	1.093	0.55	5
2003	0.0114	2.827	0.94	132	0.0258	2.489	0.81	7
2006	0.0095	2.866	0.86	851	0.0566	2.058	0.81	105
2007	0.0093	2.870	0.88	1285	0.0323	2.304	0.89	50
2008	0.0080	2.940	0.92	825	0.0144	2.718	0.94	136
2009	0.0081	2.960	0.84	458	0.0363	2.308	0.87	141
2010	0.0266	2.505	0.80	269	0.0755	2.058	0.83	39
2011	0.1918	1.276	0.44	524	0.1293	1.575	0.71	72
2012	0.0153	2.690	0.89	130	0.0310	2.399	0.90	25
2013	0.0144	2.760	0.97	81	0.0190	2.633	0.96	11
2015	0.0368	2.257	0.76	39	0.0531	2.131	0.92	14
2016	0.0262	2.387	0.50	362	0.1204	1.765	0.40	130
2018	0.0161	2.596	0.79	829	0.0573	2.100	0.74	75

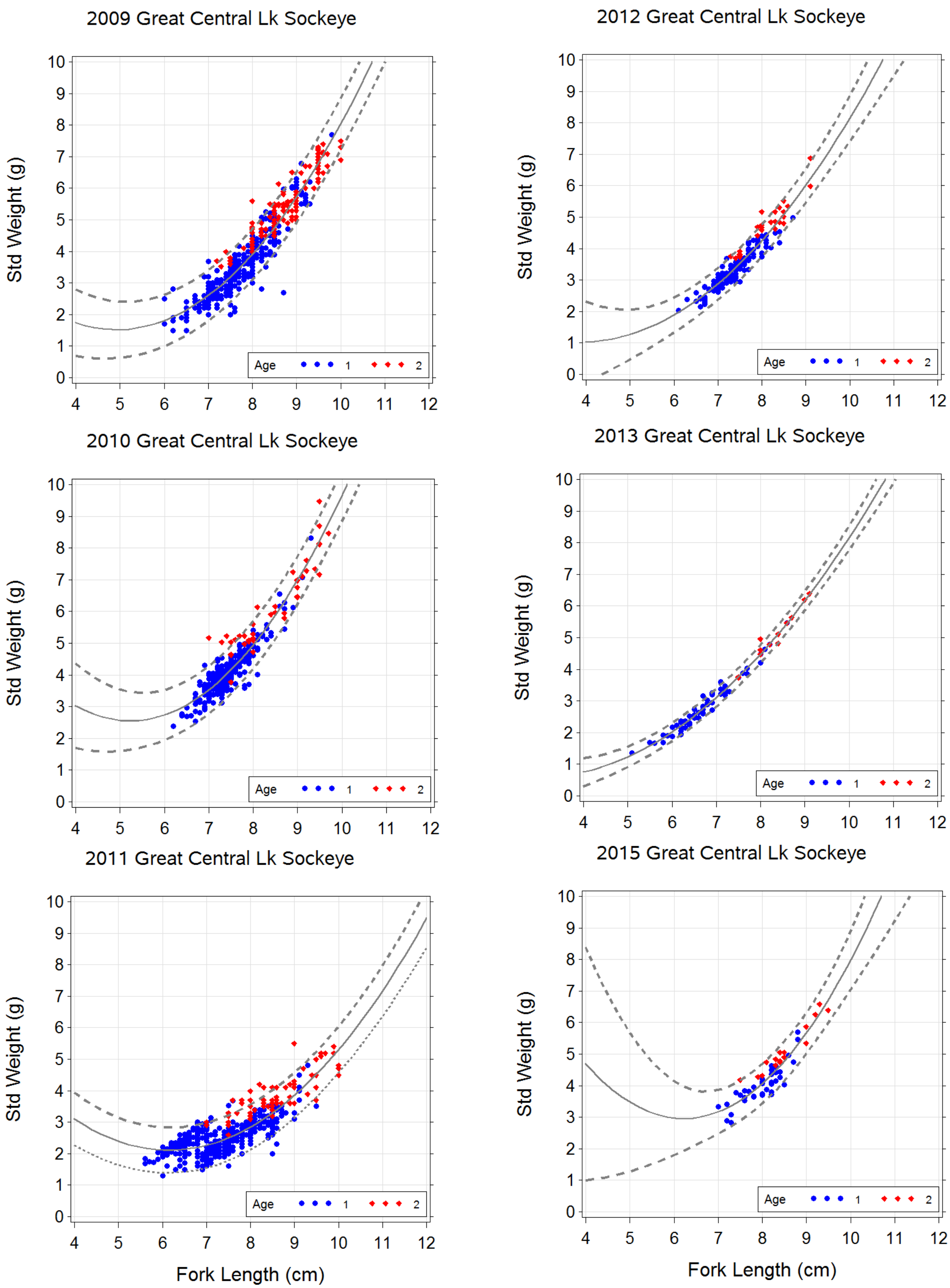

1977 Great Central Lk Sockeye
1980 Great Central Lk Sockeye
1978 Great Central Lk Sockeye
1981 Great Central Lk Sockeye
1979 Great Central Lk Sockeye
1982 Great Central Lk Sockeye
Std Weight (g)
Fork Length (cm)
Age
1
2

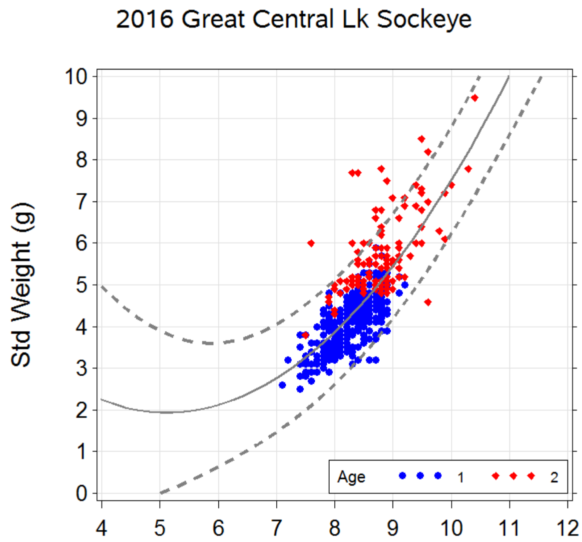

1983 Great Central Lk Sockeye
1986 Great Central Lk Sockeye
1984 Great Central Lk Sockeye
1987 Great Central Lk Sockeye
1985 Great Central Lk Sockeye
1988 Great Central Lk Sockeye
Std Weight (g)
Fork Length (cm)
Age 1 2

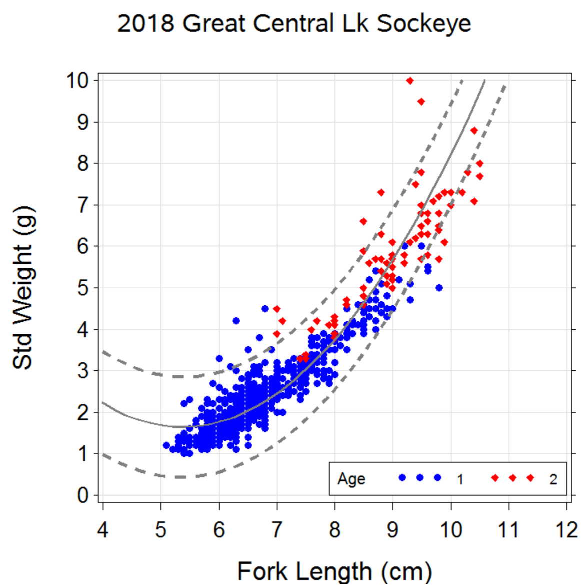

1989 Great Central Lk Sockeye
1990 Great Central Lk Sockeye
1991 Great Central Lk Sockeye
1992 Great Central Lk Sockeye
1993 Great Central Lk Sockeye
1994 Great Central Lk Sockeye
Std Weight (g)
Fork Length (cm)
Age 1 2


1995 Great Central Lk Sockeye
1998 Great Central Lk Sockeye
1996 Great Central Lk Sockeye
1999 Great Central Lk Sockeye
1997 Great Central Lk Sockeye
2000 Great Central Lk Sockeye
Std Weight (g)
Fork Length (cm)
Age 1 2
0 1 2 3 4 5 6 7 8 9 10
4 5 6 7 8 9 10 11 12


2001 Great Central Lk Sockeye
2006 Great Central Lk Sockeye
2002 Great Central Lk Sockeye
2007 Great Central Lk Sockeye
2003 Great Central Lk Sockeye
2008 Great Central Lk Sockeye
Std Weight (g)
Fork Length (cm)
Age
1
2


2009 Great Central Lk Sockeye
2012 Great Central Lk Sockeye
2010 Great Central Lk Sockeye
2013 Great Central Lk Sockeye
2011 Great Central Lk Sockeye
2015 Great Central Lk Sockeye
Std Weight (g)
Fork Length (cm)
Age
1
2


2016 Great Central Lk Sockeye
Std Weight (g)
0
1
2
3
4
5
6
7
8
9
10
4
5
6
7
8
9
10
11
12
Age
1
2


2018 Great Central Lk Sockeye
Std Weight (g)
0
1
2
3
4
5
6
7
8
9
10
4
5
6
7
8
9
10
11
12
Fork Length (cm)
Age
1
2

APPENDIX VI – Annual Pre-smolt & Smolt Statistics

Appendix VI. Annual Sockeye smolt size statistics and pre-smolt size and abundance (K. D. Hyatt and D. P. Rankin unpub. data). Stepwise regression analysis for final age 1 smolt length retains only pre-smolt length (P = 0.08) and an interaction term for pre-smolt forklength x pre-smolt abundance at time of ATS sample date (P = 0.03).

Annual Smolt and Pre-Smolt Size Data

Smolt Year	ATS Date	Week Since July	Juvenile Sockeye Abundance	Juvenile Sockeye Density	PreSmolt Forklength	Smolt Abundance	Best Age1 Fork	Best Age2 Fork
1978	07NOV77	20	9.436	1,900	66	8.910	76	95
1979	17OCT78	16	15.692	3,100	.	15.700	70	81
1980	19DEC79	25	7.680	1,800	64	7.400	82	.
1981	27NOV80	22	11.847	2,300	63	9.600	71	77
1982	14SEP81	12	10.161	2,000	68	9.500	76	84
1983	11NOV82	20	15.479	3,100	55	13.200	66	79
1984	01NOV83	19	10.207	2,000	57	9.100	73	87
1985	15OCT84	16	12.355	2,400	59	10.400	68	93
1986	10DEC85	24	10.233	2,000	66	9.500	81	92
1987	02OCT86	14	6.030	1,500	56	5.200	75	85
1988	23SEP87	13	4.030	1,000	73	3.800	89	98
1989	13OCT88	16	7.125	1,400	57	6.400	73	85
1990	24OCT89	17	9.087	1,800	53	7.200	76	93
1991	05MAR91	36	11.033	2,300	65	10.700	71	88
1992	30OCT91	18	4.835	1,000	62	4.800	88	95
1993	27OCT92	18	8.546	1,700	62	7.150	66	89
1994	13OCT93	16	4.433	900	.	3.900	74	89
1995	20OCT94	17	4.943	1,900	53	3.400	65	81
1996	23NOV95	21	10.023	2,000	.	9.400	71	84
1997	20NOV96	21	4.431	900	61	4.400	75	86
1998	20NOV97	21	17.814	3,500	.	16.790	67	75
1999	02DEC98	23	12.144	2,700	64	11.800	68	88
2000	29NOV99	23	7.431	1,500	.	6.500	69	78
2001	30NOV00	23	13.605	3,800	54	13.600	61	91
2002	04DEC01	23	3.739	800	64	3.730	71	82
2003	15JAN03	29	10.517	2,200	59	10.500	71	93
2004	22JAN04	30	10.861	2,600	51	10.900	.	.
2005	08DEC04	24	8.446	1,700	51	8.500	.	.
2006	16FEB06	33	3.975	900	64	4.000	72	78
2007	05FEB07	32	5.654	1,100	56	5.600	67	78
2008	08NOV07	19	4.225	900	54	4.780	72	90
2009	17NOV08	21	4.063	800	59	3.760	75	85
2010	11JAN10	29	7.593	1,500	52	5.170	74	84
2011	01DEC10	23	11.015	2,166	.	11.000	73	85
2012	22NOV11	22	16.267	3,199	49	15.656	73	79
2013	26NOV12	22	15.175	2,984	46	15.170	75	85
2014	20NOV13	21	7.927	1,600	53	10.110	.	.
2015	02MAR15	36	.	.	52	0.745	80	85
2016	12NOV15	20	.	.	54	3.790	83	88
2017	.	.	.	.	.	12.048	.	.
2018	03DEC17	23	.	.	54	.	68	91
2019	06NOV18	19	.	.	55	.	.	.

Annual Smolt and Pre-Smolt Size Data

The REG Procedure
Model: MODEL1
Dependent Variable: Best_Age1_Pooled Best Age1 Fork

Number of Observations Read	42
Number of Observations Used	28
Number of Observations with Missing Values	14

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	353.98084	117.99361	3.91	0.0210
Error	24	724.73345	30.19723		
Corrected Total	27	1078.71429			

Root MSE	5.49520	R-Square	0.3282
Dependent Mean	73.21429	Adj R-Sq	0.2442
Coeff Var	7.50564		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	71.55609	1.19575	59.84	<.0001
STD_YearVar	Year	1	-1.16667	1.48126	-0.79	0.4386
STD_PreSmoltForklength	PreSmoltForklength	1	2.29447	1.24559	1.84	0.0779
STD_Presmolt_x_Abund	Presmolt x Abund	1	-2.37033	1.02010	-2.32	0.0289

APPENDIX VII – Sample Meta-Data

Appendix VIII. Sample meta-data, including total catch (where available) and total fish sampled by sample date, sample site, gear type, agency (sampling crews: PBS-DFO, RCH-DFO, HFN) and fish preservative code and type.

				Site					
				Glover Pond				Robertson Creek	
				DIPNET		TRAP		FYKE	
				Catch	Sampled	Catch	Sampled	Catch	Sampled
Year	Date	Agency	Preservative						
1977	04APR77	PBS	99 Formalin						2
	07APR77	PBS	99 Formalin						2
	11APR77	PBS	99 Formalin						2
	14APR77	PBS	99 Formalin						2
	21APR77	PBS	01 Formalin						5
	25APR77	PBS	01 Formalin						117
	28APR77	PBS	01 Formalin						3
	02MAY77	PBS	01 Formalin						6
	05MAY77	PBS	97 Formalin						169
	09MAY77	PBS	01 Formalin						191
	12MAY77	PBS	99 Formalin						60
	16MAY77	PBS	01 Formalin						190
	19MAY77	PBS	99 Formalin						125
	23MAY77	PBS	01 Formalin						201
	26MAY77	PBS	01 Formalin						228
	30MAY77	PBS	97 Formalin						222
	02JUN77	PBS	99 Formalin						130
	06JUN77	PBS	99 Formalin						47
	13JUN77	PBS	95 Formalin						203
	16JUN77	PBS	96 Formalin						207
	20JUN77	PBS	99 Formalin						70
	23JUN77	PBS	99 Formalin						50
	27JUN77	PBS	99 Formalin						55
	30JUN77	PBS	99 Formalin						34
1978	07APR78	PBS	99 Formalin						1
	14APR78	PBS	99 Formalin						6
	21APR78	PBS	99 Formalin						5
	26APR78	PBS	99 Formalin						70
	03MAY78	PBS	99 Formalin						233
	10MAY78	PBS	99 Formalin						71
	17MAY78	PBS	99 Formalin						319
	24MAY78	PBS	99 Formalin						121
	31MAY78	PBS	99 Formalin						83
	07JUN78	PBS	99 Formalin						43
1979	18APR79	PBS	99 Formalin						97
	25APR79	PBS	99 Formalin						100
	09MAY79	PBS	99 Formalin						201
	15MAY79	PBS	99 Formalin						225
	23MAY79	PBS	99 Formalin						204
	30MAY79	PBS	99 Formalin						216
	11JUN79	PBS	99 Formalin						102
	20JUN79	PBS	99 Formalin						100
	27JUN79	PBS	99 Formalin						100
1980	21APR80	PBS	01 Formalin						3
	28APR80	PBS	01 Formalin						8
1980	05MAY80	PBS	01 Formalin						100
	15MAY80	PBS	01 Formalin						100
	26MAY80	PBS	01 Formalin						44
	04JUN80	PBS	01 Formalin						100
	09JUN80	PBS	01 Formalin						100
1981	28APR81	PBS	01 Formalin						100
	05MAY81	PBS	01 Formalin						85
	11MAY81	PBS	01 Formalin						85
	19MAY81	PBS	01 Formalin						133
	26MAY81	PBS	01 Formalin						116
	02JUN81	PBS	01 Formalin						36
1982	26APR82	PBS	01 Formalin						118
	12MAY82	PBS	01 Formalin						50
	26MAY82	PBS	01 Formalin						99
1983	18APR83	PBS	01 Formalin						100
	25APR83	PBS	01 Formalin						100
	02MAY83	PBS	01 Formalin						100
	09MAY83	PBS	01 Formalin						99
	16MAY83	PBS	01 Formalin						100
	24MAY83	PBS	01 Formalin						74
1984	26APR84	PBS	01 Formalin						100
	07MAY84	PBS	01 Formalin						100
	16MAY84	PBS	01 Formalin						100
	28MAY84	PBS	01 Formalin						100
1985	24APR85	PBS	01 Formalin						194
	01MAY85	PBS	01 Formalin						116
	15MAY85	PBS	01 Formalin						144
1986	29APR86	PBS	01 Formalin						102
	05MAY86	PBS	01 Formalin						111
	13MAY86	PBS	01 Formalin						107
1987	21APR87	PBS	01 Formalin						102
	29APR87	PBS	01 Formalin						153
	05MAY87	PBS	01 Formalin						101
	12MAY87	PBS	01 Formalin						101
	20MAY87	PBS	01 Formalin						102
	28MAY87	PBS	01 Formalin						107
	03JUN87	PBS	01 Formalin						118
	04JUN87	PBS	01 Formalin						108
1988	20APR88	PBS	01 Formalin						40
	28APR88	PBS	01 Formalin						145
	04MAY88	PBS	01 Formalin						141
	11MAY88	PBS	01 Formalin						174
	18MAY88	PBS	01 Formalin						110

(Continued)

				Site					
				Glover Pond				Robertson Creek	
				DIPNET		TRAP		FYKE	
Year	Date	Agency	Preservative	Catch	Sampled	Catch	Sampled	Catch	Sampled
1988	25MAY88	PBS	01 Formalin						90
	02JUN88	PBS	01 Formalin						77
1989	19APR89	PBS	01 Formalin						72
	27APR89	PBS	01 Formalin						165
	03MAY89	PBS	01 Formalin						130
	10MAY89	PBS	01 Formalin						166
	17MAY89	PBS	01 Formalin						117
	25MAY89	PBS	01 Formalin						167
	01JUN89	PBS	01 Formalin						200
1990	04APR90	PBS	01 Formalin						1
	18APR90	PBS	01 Formalin						5
	25APR90	PBS	01 Formalin		111				199
	02MAY90	PBS	01 Formalin		200				
	10MAY90	PBS	01 Formalin						200
	16MAY90	PBS	01 Formalin						200
	24MAY90	PBS	01 Formalin						171
	31MAY90	PBS	01 Formalin						27
	13JUN90	PBS	01 Formalin						76
	28JUN90	PBS	01 Formalin						6
1991	10APR91	PBS	01 Formalin	0	0			12	12
	17APR91	PBS	01 Formalin	42	42			50	49
	24APR91	PBS	01 Formalin	94	134			156	117
	01MAY91	PBS	01 Formalin	246	200			465	200
	08MAY91	PBS	01 Formalin	247	200			1,083	200
	15MAY91	PBS	01 Formalin	56	56			10	10
	22MAY91	PBS	01 Formalin	116	116			190	189
	29MAY91	PBS	01 Formalin	113	117			347	200
	05JUN91	PBS	01 Formalin	100	102			137	141
1992	24MAR92	PBS	01 Formalin						1
	07APR92	PBS	01 Formalin		16				1
	14APR92	PBS	01 Formalin		16				7
	28APR92	PBS	01 Formalin		100				58
	05MAY92	PBS	01 Formalin		138				200
	12MAY92	PBS	01 Formalin		115				200
	20MAY92	PBS	01 Formalin		133				137
	26MAY92	PBS	01 Formalin		103				186
	03JUN92	PBS	01 Formalin						2
1993	14APR93	PBS	01 Formalin	28	24			2	2
	21APR93	PBS	01 Formalin	102	95			83	81
	28APR93	PBS	01 Formalin	212	199			771	199
	05MAY93	PBS	01 Formalin	154	152			220	222
	12MAY93	PBS	01 Formalin	146	144			1,116	200
	19MAY93	PBS	01 Formalin	121	121			206	187
1993	27MAY93	PBS	01 Formalin	108	108			164	162
	02JUN93	PBS	01 Formalin	109	109			338	200
	08JUN93	PBS	01 Formalin	41	41			46	44
	16JUN93	PBS	01 Formalin	2	2			19	19
1994	31MAR94	PBS	01 Formalin						5
	21APR94	PBS	01 Formalin						160
	27APR94	PBS	01 Formalin		53				100
	05MAY94	PBS	01 Formalin		107				200
	12MAY94	PBS	01 Formalin		114				200
	18MAY94	PBS	01 Formalin		46				196
	26MAY94	PBS	01 Formalin		57				73
	02JUN94	PBS	01 Formalin		114				118
	08JUN94	PBS	01 Formalin		137				181
	16JUN94	PBS	01 Formalin		1				31
1995	12APR95	PBS	01 Formalin						1
	19APR95	PBS	01 Formalin		56				15
	27APR95	PBS	01 Formalin		173				200
	04MAY95	PBS	01 Formalin		191				200
	10MAY95	PBS	01 Formalin		147				
	11MAY95	PBS	01 Formalin						52
	18MAY95	PBS	01 Formalin		187				55
	25MAY95	PBS	01 Formalin						6
	01JUN95	PBS	01 Formalin		78				
1996	11APR96	PBS	01 Formalin		6				3
	18APR96	PBS	01 Formalin						6
	25APR96	PBS	01 Formalin		108				107
	30APR96	PBS	01 Formalin		200				200
	09MAY96	PBS	01 Formalin		184				200
	16MAY96	PBS	01 Formalin		200				200
	23MAY96	PBS	01 Formalin		130				200
	30MAY96	PBS	01 Formalin		164				200
1997	10APR97	PBS	01 Formalin					8	8
	17APR97	PBS	01 Formalin		76				27
	24APR97	PBS	01 Formalin		135				170
	01MAY97	PBS	01 Formalin		180				83
	08MAY97	PBS	01 Formalin		152				138
	22MAY97	PBS	01 Formalin					18	18
	02JUN97	PBS	01 Formalin					25	11
1998	23APR98	PBS	01 Formalin	200	200			250	200
	30APR98	PBS	01 Formalin	240	240			350	240
	07MAY98	PBS	01 Formalin	230	230			70	70
	13MAY98	PBS	01 Formalin		272				
	28MAY98	PBS	01 Formalin					40	81

(Continued)

				Site					
				Glover Pond				Robertson Creek	
				DIPNET		TRAP		FYKE	
				Catch	Sampled	Catch	Sampled	Catch	Sampled
Year	Date	Agency	Preservative						
1999	22APR99	PBS	01 Formalin					42	42
	28APR99	PBS	01 Formalin					240	200
	05MAY99	PBS	01 Formalin					220	190
	12MAY99	PBS	01 Formalin	200	200			210	210
	19MAY99	PBS	01 Formalin					237	146
	26MAY99	PBS	01 Formalin					17	24
2000	27APR00	Consultant	01 Formalin	125	150			400	187
	03MAY00	Consultant	01 Formalin					1,000	200
	10MAY00	Consultant	01 Formalin					22	18
	18MAY00	Consultant	01 Formalin					0	60
2001	11APR01	PBS	01 Formalin		26				36
	18APR01	PBS	01 Formalin						300
	26APR01	PBS	01 Formalin		65				300
	13MAY01	PBS	01 Formalin						100
	22MAY01	PBS	01 Formalin						80
2002	02MAY02	PBS	02 Ethanol						54
	07MAY02	PBS	02 Ethanol						85
	14MAY02	PBS	02 Ethanol						95
	30MAY02	PBS	02 Ethanol						12
2003	07MAY03	PBS	11 Frozen						144
2006	11APR06	RCH	00 None			128	50		
	12APR06	RCH	00 None			202	20		
	14APR06	RCH	00 None			158	20		
	15APR06	RCH	00 None			717	20		
	16APR06	RCH	00 None			275	20		
	17APR06	RCH	00 None			1,486	20		
	18APR06	RCH	00 None			3,126	50		
	21APR06	RCH	00 None				100		
	25APR06	RCH	00 None				50		
	26APR06	RCH	00 None				50		
	28APR06	RCH	00 None				50		
	30APR06	RCH	00 None				100		
	01MAY06	RCH	00 None				50		
	02MAY06	RCH	00 None			1,840	50		
	04MAY06	RCH	00 None			601	50		
	05MAY06	RCH	00 None			1,645	50		
	11MAY06	RCH	00 None			468	100		
	12MAY06	RCH	00 None			372	20		
	14MAY06	RCH	00 None			750	20		
	16MAY06	RCH	00 None			62	20		
	21MAY06	RCH	00 None			183	50		
2007	19APR07	RCH	00 None			177	50		
	20APR07	RCH	00 None			861	50		
2007	23APR07	RCH	00 None			765	50		
	24APR07	RCH	00 None			1,081	50		
	25APR07	RCH	00 None			1,446	50		
	26APR07	RCH	00 None			1,268	50		
	27APR07	RCH	00 None			3,649	50		
	30APR07	RCH	00 None			1,132	50		
	01MAY07	RCH	00 None			1,152	50		
	02MAY07	RCH	00 None			1,246	50		
	03MAY07	RCH	00 None			1,114	50		
	04MAY07	RCH	00 None			897	50		
	08MAY07	RCH	00 None			487	50		
	09MAY07	RCH	00 None			1,721	50		
	10MAY07	RCH	00 None			609	50		
	14MAY07	RCH	00 None			694	50		
	15MAY07	RCH	00 None			325	50		
	16MAY07	RCH	00 None			170	50		
	17MAY07	RCH	00 None			199	50		
	22MAY07	RCH	00 None			69	50		
	23MAY07	RCH	00 None			39	39		
	24MAY07	RCH	00 None			112	50		
	25MAY07	RCH	00 None			75	50		
	28MAY07	RCH	00 None			126	50		
	29MAY07	RCH	00 None			139	50		
	30MAY07	RCH	00 None			153	50		
	31MAY07	RCH	00 None			108	50		
2008	18APR08	RCH	00 None			187	50		
	25APR08	RCH	00 None			468	98		
	28APR08	RCH	00 None			1,362	100		
	29APR08	RCH	00 None			1,065	50		
	30APR08	RCH	00 None			781	100		
	01MAY08	RCH	00 None			340	50		
	02MAY08	RCH	00 None			384	50		
	05MAY08	RCH	00 None			861	100		
	07MAY08	RCH	00 None			321	100		
	08MAY08	RCH	00 None			283	100		
	13MAY08	RCH	00 None			147	50		
	15MAY08	RCH	00 None			182	100		
	23MAY08	RCH	00 None			18	18		
2009	16APR09	PBS	00 None					39	27
	18APR09	RCH	00 None			62	50		
	21APR09	RCH	00 None			321	100		
	24APR09	RCH	00 None			114	50		
	28APR09	RCH	00 None			216	50		

(Continued)

				Site					
				Glover Pond				Robertson Creek	
				DIPNET		TRAP		FYKE	
				Catch	Sampled	Catch	Sampled	Catch	Sampled
Year	Date	Agency	Preservative						
2009	09MAY09	RCH	00 None			38	38		
	11MAY09	RCH	00 None			197	100		
	13MAY09	RCH	00 None			266	90		
	20MAY09	RCH	00 None			200	100		
2010	19APR10	PBS	02 Ethanol						6
	05MAY10	PBS	02 Ethanol		161				
	10MAY10	PBS	02 Ethanol		146				
2011	30APR11	RCH	00 None	864	50				
	01MAY11	RCH	00 None	146	50				
	02MAY11	RCH	00 None	260	50				
	03MAY11	RCH	00 None	874	50				
	04MAY11	RCH	00 None	361	50				
	05MAY11	RCH	00 None	1,178	50				
	06MAY11	RCH	00 None	976	50				
	07MAY11	RCH	00 None	2,263	50				
	08MAY11	PBS	02 Ethanol	232	102				
	09MAY11	RCH	00 None		50				
	10MAY11	RCH	00 None	341	50				
2012	17APR12	PBS	02 Ethanol						101
	25APR12	PBS	02 Ethanol						58
2013	16APR13	PBS	02 Ethanol						58
	23APR13	PBS	02 Ethanol						38
2015	29APR15	PBS	02 Ethanol						57
2016	04MAY16	HFN	00 None		22				
	06MAY16	HFN	00 None		47				
	09MAY16	HFN	00 None		52				
	11MAY16	HFN	00 None		58				
	13MAY16	HFN	00 None		23				
	16MAY16	HFN	00 None		32				
	18MAY16	HFN	00 None		58				
	20MAY16	HFN	00 None		52				
	24MAY16	HFN	00 None		99				
	27MAY16	HFN	00 None		54				
	31MAY16	HFN	00 None		39				
	07JUN16	HFN	00 None		9				
2018	16APR18	HFN	00 None		11				
	18APR18	HFN	00 None		5				
	21APR18	HFN	00 None		16				
	27APR18	HFN	00 None		31				
	30APR18	HFN	00 None		100				
	02MAY18	HFN	00 None		100				
	04MAY18	HFN	00 None		100				
	07MAY18	HFN	00 None		100				
2018	09MAY18	HFN	00 None		98				
	12MAY18	HFN	00 None		56				
	02JUN18	HFN	00 None		97				
	03JUN18	HFN	00 None		100				
	06JUN18	HFN	00 None		100				
All				10,527	9,641	39,640	3,843	8,603	21,222

APPENDIX VIII – Data Issues

Smolt data collected over the years have been managed in a variety of ways, but data storage is divided into two basic formats:

1. **SAS Database** - For the years 1977-1996, smolt size, age and meta-data were keypunched and uploaded into structured SAS datasets. Subsequently, SAS programming procedures for smolt data management was replaced with unstructured spreadsheet workbook files.
2. **Excel Workbooks** - As of 1997, smolt size and age data were managed in Microsoft Excel spreadsheets, in different formats and data structures. Field trip meta-data were usually stored in separate Excel spreadsheets (Survey Trip Reports, or STRs) and/or in data spreadsheets specific to stock-year-sample-date. File naming conventions and data structures were not always adhered to.

To collate all datasets into one location for compilation and analysis, a spreadsheet-based inventory was created to track the file locations and contents of the Excel workbook files. **Smolt Data Inventory.xlsx** is a meta-data inventory spreadsheet documenting the existence of smolt survey datasets based on information collated from STRs and known smolt sample spreadsheets. The Inventory spreadsheet data is organized by smolt ocean entry year, lake/stock (GCL/Sproat/Henderson only), sample site and sample date. For each record, the following variables are listed (where available): Trip, Sample Number, Sample Type (1=Smolt, 2=ATS (excluded from smolt analyses)), #Sets, SoakTime, Total Catch, Total Retained (sample), Crew or Agency, fish Preservation Code and Preservative Type (used to identify appropriate conversion to "standard" fresh weight), Gear Code and Gear Type, Size Data Resolution (individual Fish, or summarized by Date or Year), Comments, and Data Source (filename and location).

This assisted in the compilation of the smolt survey observations, i.e. the individual fish meristics, standard weights, and age data. The raw data were organized in **Smolt Size Data 1997-2018.xlsx.** The individual fish size and age data, where available, have been retrieved from the data sources identified in **Smolt Data Inventory.xlsx** and consolidated into stock-specific tabs (GCL, SPR, etc) to structure the data by Stock, Sample Date, Sample Number and Fish Number. Meta-data include Species Code, Gear Code, Site Code, Lab Processor, and Notes. Size data include ForkLength (fresh only), and may include either Preserved Wet Weight or Fresh Standard Weight, or both. Age data include (where available) Scale Book Number, Scale Number, Scale Quality and Scale Age. In the absence of scale age data, an Assigned Age may be applied. The Final Age value is set to the Scale Age or Assigned Age, and is used as the fish's age class in analyses.

Age Data - Between 1977 and 1986, all fish captured and retained were scale-sampled for age analysis. After 1986, scale sampling was reduced in scope, and focused on fish in the overlapping age range of 75 – 90 mm, with few fish <70 mm (assumed age 1) or >90 mm (assumed age 2) in fork length scale-sampled. In many cases, scale sampling did not occur at all, or was limited by sample size, or did occur but the scales were never aged. In-season analyses by sampling crews often assumed all unaged fish were age 1 (not unreasonable for Henderson Lake Sockeye, or perhaps Sproat Lake Sockeye, but potentially problematic for Great Central Lake Sockeye with its larger proportion of age 2 fish in the population), or assigned to age based on a conventional threshold that varied between years and stocks from 70 – 90 mm. The misclassification of fish age may lead to directional biases in annual smolt size summaries. If many average-sized fish are left unaged, while all small and big fish are assigned, then the mean size of age 1s will be biased downward, and age 2 mean size would be biased upward. To reduce the potential bias in age classification, the following procedures were applied to smolt survey data with missing ages (1987-2018):

1. Where Scale Age exists and is not ambiguous or erroneous, the Final Age was set to the Scale Age.
2. An Assigned Age can be applied to overrule an erroneous or ambiguous Scale Age.
3. In the absence of Scale Age or Assigned Age, Final Age is set for very small and very large fish based on unambiguous size rules associated with fork length (e.g. If Forklength < 70 mm, Final Age = 1; If ForkLength > 100 mm, Final Age = 2, etc).
4. For mid-range sizes (70-100 mm), bimodality in the size distributions can be used to classify unaged fish to age in some years. However, high overlap in size distributions between age classes, plus a general trend for larger fish emigrating earlier in the season, required some attention to sample timing and proportions by age at specific size classes. Thus:
    a. Year-specific age proportions from scale data by year, month (April versus May/June) and 5 mm length class were used to classify unaged fish to age class. For example, if scale analysis indicated 80% of aged fish 90-95 mm in length in April 1999 were age 1, then the smallest (by weight) 8 of 10 unaged fish in that size class in 1999 were assigned age 1, and the largest 2 of 10 fish were assigned age 2. Age proportions for May-June would be applied to classify unaged fish in subsequent months. For very low sample sizes of unaged fish (e.g. <10 fish), the default age assignment was age 1 since age 1 fish are predominant in the population. In the absence of age data from scale samples for a given year, the multi-year age proportions by forklength size class were used to assign age.
    b. Fish-specific age assignments were entered into the Assigned Age column in the spreadsheet, and thereby incorporated into the Final Age value.
    c. Assigned ages for the Excel spreadsheet data (1997-2018) are recorded and annotated in **Smolt Size Data 1997-2018.xlsx**.
    d. Unassigned age classes in the mid-sized length range in the **SAS database** data (1986-1996) were programmatically defaulted to age 1, with individual fish re-assignments to age 2 as as shown in Table 7, below.

Data Omissions – Outliers and anomalies that were omitted from analyses included:

1. **Rare ages –** fish aged 0 or 3 omitted:
    a. 25-Apr-77 – Sample 1: Fish 10; Sample 2: Fish 49, 70, 73
    b. 52 fish aged 3 in April and May 1978 omitted
    c. Eight fish aged 3 in April and May 1988 omitted
    d. 25-Apr-90 – Data from both sites excluded from further analyses due to large differences (up to 12 mm) in mean length at age between sites.
2. **Outliers** – Omissions include:
    a. 07-May-84: Sample Number 1, Fish Numbers 30, 67, 79, 84, 91, 92
    b. 10-May-90, Sample Number 1, Fish Number 119, Forklength 173 mm

Other – In 1992 and 1994, smolt surveys occurred on March 31st. For plotting purposes, the survey date was reassigned to April 1st of the year for these samples.

Table 7. Great Central Lake Sockeye programmatic assignments to age 2, by sample date and fish number, 1987-1996.

Year	Date	Fish	Metric	Size Class	Fork Length	Final Age
1987	21APR87	68	forklength	90-100	97	2
		74	forklength	90-100	102	2
		101	forklength	90-100	94	2
		131	forklength	90-100	95	2
		132	forklength	90-100	95	2
	29APR87	53	forklength	81-85	84	2
		93	forklength	81-85	81	2
		137	forklength	81-85	82	2
		139	forklength	81-85	83	2
	05MAY87	40	forklength	76-80	79	2
		47	forklength	76-80	79	2
		75	forklength	76-80	79	2
1994	21APR94	98	forklength	76-80	76	2
		106	forklength	76-80	80	2
		137	forklength	81-85	85	2
		146	forklength	81-85	85	2
		154	forklength	81-85	84	2
		157	forklength	70-75	73	2
1995	19APR95	7	stdweight	>3.0	72	2
		56	stdweight	>3.0	73	2
	27APR95	19	stdweight	>3.0	73	2
		22	stdweight	>3.0	74	2
		24	stdweight	>3.0	73	2
		32	stdweight	>3.0	73	2
		33	stdweight	>3.0	73	2
		40	stdweight	>3.0	72	2
		44	stdweight	>3.0	73	2
		56	stdweight	>3.0	73	2
		63	stdweight	>3.0	74	2
		67	stdweight	>3.0	74	2
		75	stdweight	>3.0	71	2
		76	stdweight	>3.0	74	2
		81	stdweight	>3.0	72	2
		94	stdweight	>3.0	73	2
		95	stdweight	>3.0	72	2
		105	stdweight	>3.0	73	2
		106	stdweight	>3.0	73	2
		109	stdweight	>3.0	74	2
		116	stdweight	>3.0	73	2
		118	stdweight	>3.0	72	2
		119	stdweight	>3.0	73	2
		124	stdweight	>3.0	73	2
		135	stdweight	>3.0	72	2
		136	stdweight	>3.0	73	2
		137	stdweight	>3.0	73	2
		151	stdweight	>3.0	71	2
		152	stdweight	>3.0	74	2
		161	stdweight	>3.0	74	2
		172	stdweight	>3.0	73	2
		173	stdweight	>3.0	72	2
1995	27APR95	177	stdweight	>3.0	74	2
		182	stdweight	>3.0	74	2
	04MAY95	1	stdweight	>2.85	73	2
		7	stdweight	>2.85	72	2
		11	stdweight	>2.85	74	2
		14	stdweight	>2.85	74	2
		18	stdweight	>2.85	72	2
		19	stdweight	>2.85	72	2
		26	stdweight	>2.85	71	2
		34	stdweight	>2.85	73	2
		36	stdweight	>2.85	72	2
		44	stdweight	>2.85	72	2
		46	stdweight	>2.85	73	2
		54	stdweight	>2.85	70	2
		66	stdweight	>2.85	72	2
		75	stdweight	>2.85	72	2
		86	stdweight	>2.85	72	2
		95	stdweight	>2.85	70	2
		106	stdweight	>2.85	72	2
		115	stdweight	>2.85	73	2
		127	stdweight	>2.85	71	2
		129	stdweight	>2.85	73	2
		135	stdweight	>2.85	71	2
		139	stdweight	>2.85	72	2
		143	stdweight	>2.85	73	2
		152	stdweight	>2.85	70	2
		159	stdweight	>2.85	72	2
		163	stdweight	>2.85	73	2
		184	stdweight	>2.85	71	2
		185	stdweight	>2.85	73	2
		186	stdweight	>2.85	70	2
		189	stdweight	>2.85	72	2
		200	stdweight	>2.85	73	2
	10MAY95	12	stdweight	>2.85	73	2
		24	stdweight	>2.85	71	2
		29	stdweight	>2.85	70	2
		98	stdweight	>2.85	70	2
		101	stdweight	>2.85	71	2
		112	stdweight	>2.85	73	2
	11MAY95	12	stdweight	>2.85	73	2
	18MAY95	2	stdweight	>2.85	73	2
		8	stdweight	>2.85	72	2
		41	stdweight	>2.85	70	2
		63	stdweight	>2.85	74	2
		122	stdweight	>2.85	87	2
		141	stdweight	>2.85	69	2
1996	11APR96	1	stdweight	>3.4	73	2
		3	stdweight	>3.4	73	2

(Continued)

Year	Date	Fish	Metric	Size Class	Fork Length	Final Age
1996	11APR96	6	stdweight	>3.4	77	2
	25APR96	6	stdweight	>3.4	74	2
		7	stdweight	>3.4	73	2
		18	stdweight	>3.4	74	2
		22	stdweight	>3.4	74	2
		27	stdweight	>3.4	74	2
		29	stdweight	>3.4	74	2
		30	stdweight	>3.4	73	2
		32	stdweight	>3.4	74	2
		35	stdweight	>3.4	73	2
		39	stdweight	>3.4	74	2
		46	stdweight	>3.4	74	2
		49	stdweight	>3.4	74	2
		51	stdweight	>3.4	74	2
		53	stdweight	>3.4	73	2
		56	stdweight	>3.4	74	2
		69	stdweight	>3.4	74	2
		70	stdweight	>3.4	74	2
		74	stdweight	>3.4	73	2
		78	stdweight	>3.4	73	2
		79	stdweight	>3.4	73	2
		89	stdweight	>3.4	74	2
		91	stdweight	>3.4	74	2
		95	stdweight	>3.4	74	2
		99	stdweight	>3.4	74	2
		102	stdweight	>3.4	73	2
	30APR96	40	stdweight	>3.4	74	2
		48	stdweight	>3.4	73	2
		57	stdweight	>3.4	75	2
		59	stdweight	>3.4	75	2
		62	stdweight	>3.4	75	2
		65	stdweight	>3.4	75	2
		66	stdweight	>3.4	75	2
		85	stdweight	>3.4	75	2
		113	stdweight	>3.4	75	2
		124	stdweight	>3.4	75	2
		126	stdweight	>3.4	75	2
		129	stdweight	>3.4	75	2
		132	stdweight	>3.4	75	2
		141	stdweight	>3.4	74	2
		145	stdweight	>3.4	75	2
		146	stdweight	>3.4	75	2
		149	stdweight	>3.4	75	2
		168	stdweight	>3.4	75	2
		181	stdweight	>3.4	75	2
		186	stdweight	>3.4	75	2
		192	stdweight	>3.4	75	2
		195	stdweight	>3.4	75	2
1996	09MAY96	6	stdweight	>3.4	71	2
		7	stdweight	>3.4	72	2
		13	stdweight	>3.4	73	2
		16	stdweight	>3.4	74	2
		29	stdweight	>3.4	74	2
		37	stdweight	>3.4	74	2
		43	stdweight	>3.4	72	2
		56	stdweight	>3.4	73	2
		64	stdweight	>3.4	73	2
		79	stdweight	>3.4	74	2
		82	stdweight	>3.4	74	2
		97	stdweight	>3.4	74	2
		98	stdweight	>3.4	73	2
		119	stdweight	>3.4	74	2
		130	stdweight	>3.4	73	2
		136	stdweight	>3.4	73	2
		137	stdweight	>3.4	74	2
		152	stdweight	>3.4	72	2
		157	stdweight	>3.4	74	2
		158	stdweight	>3.4	74	2
		162	stdweight	>3.4	74	2
		177	stdweight	>3.4	73	2
		182	stdweight	>3.4	74	2
		199	stdweight	>3.4	73	2
	16MAY96	72	stdweight	>3.4	75	2
		92	stdweight	>3.4	75	2
		96	stdweight	>3.4	73	2
		98	stdweight	>3.4	73	2
		141	stdweight	>3.4	75	2
		177	stdweight	>3.4	74	2
		186	stdweight	>3.4	74	2
	23MAY96	28	stdweight	>3.4	74	2
		56	stdweight	>3.4	75	2
		73	stdweight	>3.4	75	2
		99	stdweight	>3.4	75	2
		102	stdweight	>3.4	75	2
		103	stdweight	>3.4	75	2
		144	stdweight	>3.4	73	2
		145	stdweight	>3.4	75	2
		187	stdweight	>3.4	75	2
		190	stdweight	>3.4	74	2
	30MAY96	3	stdweight	>3.4	74	2
		9	stdweight	>3.4	75	2
		23	stdweight	>3.4	75	2
		39	stdweight	>3.4	77	2
		48	stdweight	>3.4	75	2
		56	stdweight	>3.4	74	2
		57	stdweight	>3.4	73	2

(Continued)

Year	Date	Fish	Metric	Size Class	Fork Length	Final Age
1996	30MAY96	58	stdweight	>3.4	73	2
		66	stdweight	>3.4	74	2
		72	stdweight	>3.4	75	2
		77	stdweight	>3.4	74	2
		112	stdweight	>3.4	73	2
		114	stdweight	>3.4	74	2
		117	stdweight	>3.4	74	2
		119	stdweight	>3.4	73	2
		120	stdweight	>3.4	73	2
		123	stdweight	>3.4	75	2
		126	stdweight	>3.4	74	2
		130	stdweight	>3.4	72	2
		135	stdweight	>3.4	74	2
		137	stdweight	>3.4	72	2
		141	stdweight	>3.4	74	2
		150	stdweight	>3.4	74	2
		152	stdweight	>3.4	73	2
		158	stdweight	>3.4	73	2
		163	stdweight	>3.4	75	2
		165	stdweight	>3.4	73	2
		167	stdweight	>3.4	75	2
		183	stdweight	>3.4	74	2
		190	stdweight	>3.4	73	2
		200	stdweight	>3.4	74	2