

**Canadian Technical Report of
Fisheries and Aquatic Sciences 2295**

1999

**BIOLOGICAL CHARACTERISTICS OF SKEENA RIVER SOCKEYE SALMON
(*Oncorhynchus nerka*) AND THEIR UTILITY FOR STOCK COMPOSITION ANALYSIS OF
TEST FISHERY SAMPLES**

By

D.T. Rutherford, C.C. Wood, M. Cranny¹, and B. Spilsted²

**Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
3190 Hammond Bay Road
Nanaimo, British Columbia
V9R 5K6**

**¹University of Northern British Columbia
Co-operative Education Program
3333 University Way
Prince George, British Columbia
V2N 4Z9**

**²Fisheries and Oceans Canada
Science Branch, Pacific Region
417 2nd Avenue West
Prince Rupert, British Columbia
V8J 1G8**

© Minister of Public Works and Government Services Canada

Cat. No. Fs 97-6/2295E

ISSN 0706-6457

Correct citation for this publication:

Rutherford, D.T., C.C. Wood, M. Cranny, and B. Spilsted. 1999. Biological characteristics of Skeena River sockeye salmon (*Oncorhynchus nerka*) and their utility for stock composition analysis of test fishery samples. Can. Tech. Rep. Fish. Aquat. Sci. 2295: 48p.

TABLE OF CONTENTS

LIST OF TABLES.....	iv
LIST OF FIGURES.....	v
ABSTRACT.....	vi
INTRODUCTION.....	1
METHODS	1
COLLECTION OF SAMPLES.....	1
SAMPLING PROCEDURES	3
SCALE AND OTOLITH ANALYSIS	3
PARASITE EXAMINATION.....	3
PROTEIN ELECTROPHORETIC ANALYSIS.....	3
STOCK COMPOSITION ANALYSIS.....	4
Reference samples.....	4
Simulated mixtures.....	5
Test fishery analysis.....	5
RESULTS.....	6
AGE COMPOSITION.....	6
LENGTH DISTRIBUTION AND SEX RATIO.....	7
PARASITE PREVALENCE.....	7
PROTEIN ELECTROPHORETIC VARIATION.....	7
STOCK COMPOSITION.....	9
Simulated Mixtures.....	9
Test Fishery.....	9
Run Timing.....	10
Spawning Escapements	10
DISCUSSION.....	10
ACKNOWLEDGEMENTS.....	11
REFERENCES.....	12
TABLES.....	15
FIGURES.....	39

LIST OF TABLES

TABLE

1. (A) Summary of sockeye salmon collections from Skeena River spawning locations.
(B) Summary of sockeye salmon collections from the Skeena River test fishery.
2. Enzymes and tissues used to investigate genetic variation in sockeye salmon.
3. Age and sex composition of samples from sockeye salmon spawning locations.
4. Mean post-orbital hypural length distributions by sex, age, and year in samples from sockeye spawning locations.
5. Prevalence of the brain parasite, *Myxobolus arcticus*, in samples from sockeye salmon spawning locations.
6. Prevalence of the parasite, *Philonema oncorhynchi*, in samples from sockeye salmon spawning locations.
7. Summary of allozyme allele frequencies in samples from sockeye salmon spawning locations.
8. Distribution of electrophoretically detectable gene diversity among sockeye salmon collections screened at all 31 loci.
9. Genetic distances and F_{st} estimates for pairwise comparisons among sockeye salmon populations inhabiting different Skeena lakes.
10. Number of polymorphic loci, mean heterozygosity, and variant alleles within sockeye salmon populations inhabiting different Skeena lakes.
11. (A) Results of stock composition analysis within the Babine group using test mixtures of known composition.
(B) Results of stock composition analysis within the Skeena River using test mixtures of known composition.
12. Sockeye salmon stock composition estimates from the Skeena River test fishery, 1987-1997.
13. Sockeye salmon spawning escapements estimated from stock composition analysis of test fishery samples.
14. Comparison of estimated Babine contributions (as a percentage of the total Skeena sockeye salmon return) based on visual enumeration versus stock composition analysis of test fishery samples.

LIST OF FIGURES

FIGURE

1. Map of the Skeena River showing the location of the test fishery, principal sockeye salmon stocks, and spawning sites that were sampled.
2. Variation in freshwater age composition among Skeena River sockeye salmon populations.
3. Variation in mean post-orbital hypural length, by sex, age, and year in samples from sockeye salmon spawning locations pooled into upper, middle, and lower Skeena stock groups.
4. Phylogenetic relationships among Skeena River sockeye salmon collections inferred from allozyme variation at 31 nonselected loci.
5. Similarity dendrogram illustrating the potential for differentiating Skeena River sockeye populations using genetic, parasite, and age composition data in combination.
6. Daily and weekly catch per unit effort (CPUE) in the Skeena River test fishery, 1987-1997.
7. Cumulative stock-specific run timing curves past the Skeena River test fishery, 1987-1996.

ABSTRACT

Rutherford, D.T., C.C. Wood, M. Cranny, and B. Spilsted. 1999. Biological characteristics of Skeena River sockeye salmon (*Oncorhynchus nerka*) and their utility for stock composition analysis of test fishery samples. Can. Tech. Rep. Fish. Aquat. Sci. 2295: 48p.

Sockeye salmon (*Oncorhynchus nerka*) were collected from principal spawning sites and a test fishery within the Skeena River to evaluate the potential for estimating stock composition using genetic and other biological characteristics. Samples from spawning sites were examined for age and length composition, prevalence of the parasites *Myxobolus arcticus* and *Philonema oncorhynchi*, and electrophoretic variation at up to 39 loci. Significant variation in biological characteristics was detected among most rearing lakes but not among sites within lakes. Estimation of stock composition in the test fishery catches using biological characteristics appears to be a valuable tool for enumerating sockeye runs in the Skeena River. Simulations demonstrated that mixing proportions could be estimated reliably for 7 stocks corresponding to the major lake systems examined (Alastair, Lakelse, Kitsumkalum, McDonell, Morice, Swan, Babine-Nilkitkwa, Motase, Bear and Sustut-Johanson). However, fish from spawning sites within these lake systems could not be distinguished reliably. The overall proportion of Babine fish in the test fishery averaged 76% over the 11 years. Escapement estimates generated from stock composition of the test fishery imply larger escapements to non-Babine sites than observed using visual techniques.

RÉSUMÉ

Rutherford, D.T., C.C. Wood, M. Cranny, and B. Spilsted. 1999. Biological characteristics of Skeena River sockeye salmon (*Oncorhynchus nerka*) and their utility for stock composition analysis of test fishery samples. Can. Tech. Rep. Fish. Aquat. Sci. 2295: 48p.

On a prélevé des saumons rouges (*Oncorhynchus nerka*) dans les principales frayères du bassin du Skeena et dans le cadre d'une pêche expérimentale réalisée dans ce même bassin pour évaluer dans quelle mesure on peut estimer la composition par stock au moyen de caractéristiques génétiques et d'autres caractéristiques biologiques. On a examiné dans les échantillons prélevés dans les frayères la composition par âge et par longueur, la prévalence des parasites *Myxobolus arcticus* et *Philonema oncorhynchi*, et la variation électrophorétique à un maximum de 39 loci. On a détecté une variation significative des caractéristiques biologiques entre la plupart des lacs d'alevinage, mais pas entre les sites d'un lac donné. L'estimation de la composition par stock dans les prises de la pêche expérimentale au moyen des caractéristiques biologiques s'est révélée un outil précieux pour quantifier les remontes de saumon rouge dans le Skeena. Des simulations ont montré que les proportions des stocks pouvaient être estimées avec fiabilité pour 7 stocks correspondant aux principaux bassins lacustres examinés (Alastair, Lakelse, Kitsumkalum, McDonell, Morice, Swan, Babine-Nilkitkwa, Motase, Bear et Sustut-Johanson). Cependant, les poissons des diverses frayères échantillonées à l'intérieur d'un bassin lacustre donné ne pouvaient être distingués avec fiabilité. La proportion moyenne globale de poissons du lac Babine dans la pêche expérimentale pour les 11 années a été de 76 %. Selon les estimations des échappées obtenues à partir de la composition par stock de la pêche expérimentale, les échappées vers les bassins autres que celui du lac Babine sont supérieures à celles observées au moyen de techniques visuelles.

INTRODUCTION

The Skeena River, located in northern British Columbia, supports large numbers of Pacific salmon and is second only to the Fraser River in its capacity to produce sockeye salmon (Sprout and Kadowaki 1987). At least 70 distinct spawning sites and 27 different lakes are utilized by sockeye salmon within the Skeena watershed (Smith and Lucop 1966). The nursery lakes are distributed from the coast to the high interior regions and vary widely in size and productivity. The Babine-Nilkitkwa lake system is the largest natural lake in British Columbia (500 km^2) and supports the largest single sockeye salmon population in Canada. The Babine population has accounted for 75-95% of Skeena sockeye salmon production, averaging over 3.8 million adult fish annually since 1990 (West and Mason 1987). Fry recruitment is greatly enhanced by spawning channels in the Fulton River and Pinkut Creek which typically account for over 70% of smolt production from the Babine-Nilkitkwa lake system (Wood et al. 1998). Other major sockeye nursery lakes are; Alastair, Lakelse, Kitsumkalum, McDonell, Morice, Swan, Babine, Motase, Bear, Sustut, and Johanson lakes.

The Skeena River gillnet test fishery, also known as the Skeena or Tyee test fishery, is located at Tyee just upstream of the commercial fishing boundary near the mouth of the Skeena River. The test fishery was initially established by the Skeena River Salmon Management Committee and has been conducted annually since 1955. Results from the test fishery provide managers with an index of daily sockeye escapement to the Skeena River system during the management season (Cox-Rogers and Jantz 1993). Test sets are made daily throughout the fishing season at both high and low slack tides, catch is sampled and catch per unit effort recorded. Additional information regarding the Skeena River gillnet test fishery is available in (Cox-Rogers and Jantz 1993, Jantz et al. 1990).

In this report, we present details of a stock identification program initiated by the Department of Fisheries and Oceans in 1987 to provide independent estimates of run timing and escapement for each of the major sockeye populations within the Skeena River. First, we document variation in biological characteristics of mature sockeye salmon collected from spawning escapements between 1982 and 1996. Next, we demonstrate the capabilities of maximum likelihood stock composition analysis using various combinations of biological characteristics for simulated mixtures under ideal conditions. We then present actual results from the Skeena River test fishery program, including run timing, estimates of stock composition of test fishery catches and estimates of spawning escapements from 1987 to 1997. Rutherford et al. (1994) used similar techniques to analyze Nass River test fishery samples collected from 1986-1992.

METHODS

COLLECTION OF SAMPLES

Live sockeye were collected from spawning escapements to 11 major lakes within the Skeena River: Alastair, Lakelse, Kitsumkalum, McDonell, Morice, Swan, Babine, Motase, Bear, Sustut, and Johanson lakes (Figure 1). The Alastair Lake samples were collected from sockeye

spawning at the mouth of Southend Creek, a tributary to Alastair Lake. Within the Lakelse system, sockeye salmon were collected from spawning sites in both the Schulbuckhand and Williams creeks. The Kitsumkalum Lake sample was collected from sockeye salmon spawning in the upper Kalum spawning channel. The McDonell Lake samples were collected from sockeye salmon spawning between McDonell and Dennis Lake above the confluence with Passby Creek. The Morice Lake samples were collected from sockeye salmon spawning along the shoreline of the Nanika River upstream of Morice Lake. The Swan Lake samples were collected from sockeye salmon spawning in Club Creek between Stephens and Swan Lake. Babine Lake is the largest natural lake in British Columbia with a surface area of approximately 500 km². The majority of spawning occurs within the BLDP spawning channels at Pinkut Creek and Fulton River, several other creeks feeding Babine Lake and the Babine River itself also support sockeye salmon. Sockeye salmon were collected from eleven spawning sites within Babine Lake these include: Lower Babine, Upper Babine, Fulton, Tachek, Pierre, Twain, Pinkut, Four Mile, Shass, Morrison, and Lower Tahlo rivers. All collections were made in close proximity to Babine Lake with the exception of the Tahlo Lake sample which was collected from the Tahlo River near the outlet of Tahlo Lake. Several samples were collected from Fulton River, including Fulton River (above fence), Fulton Channel 1, Fulton Channel 2, and from the Fulton River Fence. Similarly, samples from Pinkut Creek were collected at the fence, channel and river sites. The Motase Lake sample was collected from sockeye salmon spawning in an unnamed creek flowing into the south end of the lake. Within the Bear Lake system samples were collected from sockeye salmon spawning in both Azuklotz and Salix creeks. Sustut Lake samples were collected from sockeye salmon as they passed by a counting weir located on the Sustut River below Sustut Lake but above the confluence with the Johanson River. Johanson Lake samples were collected from sockeye salmon in the Johanson River just above the confluence with the Sustut River. In addition a mixed Sustut/Johanson sockeye salmon sample was collected at a counting fence located on the Sustut River below the confluence with the Johanson River.

At most sites, live sockeye salmon were collected using tangle nets with 110-millimeter mesh and or a 30-meter beach seine net with 75-mm mesh. Trap boxes attached to weirs and beach seine nets were used to collect the Johanson and Sustut samples. Typically, spawning ground sites were sampled only once over a period of 1 or 2 days during peak spawning activity (Table 1A). At the BLDP sites sockeye salmon were sampled at several periods during the run.

Adult sockeye salmon samples were collected from the Skeena River gillnet test fishery annually from 1987 to 1997 (Table 1B). Up to 175 sockeye salmon per week were sampled for the duration of the test fishery. A representative sample of the entire annual run was obtained by subsampling each week's sampled catch in proportion to run size as indicated by the Skeena River gillnet test fishery catch per unit effort (CPUE). In addition, adult sockeye salmon were sampled in 1988 from a seine test fishery operating at Aberdeen, 1 km upriver the Skeena River gillnet test fishery. A representative annual sample from this seine test fishery was obtained by subsampling each week's seine catch in proportion to run size as indicated by the Skeena River gillnet test fishery CPUE.

SAMPLING PROCEDURES

Most fish were sampled in the field for post-orbital hypural and fork length, sex, scales, otoliths, brains (to examine for the parasite, *Myxobolus arcticus*) and heart, liver, eyeball and skeletal muscle tissues (for protein electrophoretic analysis). Body cavities of unspawned or partially spawned fish were inspected to score presence or absence of the parasite *Philonema oncorhynchi* (Table 1). All fish were alive when captured and tissues were frozen within 4-8 h of death to preserve enzyme activity. Forceps and knives were wiped and rinsed carefully after sampling each fish to avoid contaminating subsequent specimens with *M. arcticus* spores. Otoliths were stored in trays or vials containing glycerine/water solution and scales were mounted on gummed cards.

SCALE AND OTOLITH ANALYSIS

Total age of sockeye salmon in the test fishery samples was determined from scales only. Age of mature sockeye in escapement samples was determined from scales and/or the surface of otoliths as described by Bilton and Jenkinson (1968). Otolith ages were used to interpret scale growth zones when it was not possible to determine total age from scales alone owing to resorption of scale margins in spawning fish.

PARASITE EXAMINATION

Brains from sockeye salmon were examined for the presence of the parasite *M. arcticus*, by digesting brain tissue in a pepsin-hydrochloric acid solution. Following centrifugation, the sediment was examined microscopically for presence of spores. Parasite prevalence refers to the proportion of the brain samples carrying the parasite. The intensity of infection within individual fish was not evaluated.

The body cavities of unspawned and partially spawned sockeye salmon were visually inspected for the presence and absence of *P. oncorhynchi*. Because the parasite *P. oncorhynchi* is often exuded with the spawn, spawned out fish were inspected for presence only. Again the intensity of infection within individual fish was not evaluated.

Sockeye salmon collected in 1993 from Sustut and Johanson lakes were not inspected for *P. oncorhynchi*; however, a mixed Sustut/Johanson sample collected in 1996 was inspected.

PROTEIN ELECTROPHORETIC ANALYSIS

Tissue samples were stored at < -20 C and later analyzed by horizontal starch gel electrophoresis as described by Aebersold et al. (1987). Alleles and loci are designated using the nomenclature proposed by Shaklee et al. (1990). Allozyme variation was assayed at 39 loci which exhibit simple Mendelian segregation (Table 2). Six of the 39 loci (*mAAT-1**, *PEP-LT**, *mAHI,2**, *AH-3**, and *AH-4**) were examined in the most recent collections because they showed useful variation in other sockeye salmon populations (Winans et al. 1996). The remaining 33 loci were not selected on *a priori* expectation of finding polymorphism; rather they were all loci for

which reliable electrophoretic techniques and scoring criteria were available when the study began in 1984.

Allele frequencies were determined by direct count for all loci except *PGM-1** where the frequency of the variant null allele was estimated as the square root of the null genotype frequency, assuming Hardy-Weinberg equilibrium. Loci were defined as "high polymorphic", "low polymorphic" or monomorphic if the relative frequency of variant alleles (q) was $q > 0.05$, $0 < q \leq 0.05$, or $q = 0$, respectively. To facilitate comparisons with other studies, only data for the subset of 33 non-selected loci were used in computing average heterozygosity at Hardy-Weinberg equilibrium (using BIOSYS, Swofford and Selander 1981).

For subsequent analyses, replicate samples from different spawning sites in the same year, or collected at different times during the run, were pooled after comparing allele frequencies using exact tests for population differentiation (GENEPOP, version 3.1, Raymond and Rousset 1995). Although small but statistically significant differences were detected among some large replicate samples collected within the same year from different sites in Babine Lake, these samples were pooled because no consistent or obvious pattern of differentiation could be discovered (see Varnavskaya et al. 1994). To illustrate the persistence of population differentiation among lakes, a neighbour-joining tree (Saitou and Nei 1987) was constructed (using PHYLIP version 3.4, J. Felsenstein, University of Washington, Seattle, WA) from Cavalli-Sforza and Edwards (1967) chord distances based on allele frequency data from the same subset of 31 loci. Finally, all replicate samples within lakes were pooled before computing pairwise genetic chord distances (using PHYLIP) and pairwise F_{st} statistics (using GENEPOP) to summarize the overall extent of differentiation between populations inhabiting different lakes.

To check for the possibility of scoring errors and of samples being admixtures of genetically distinct populations, genotype frequencies at all loci excluding *PGM-1* were examined for heterozygote deficiency relative to Hardy-Weinberg expectations within each sample using the Markov chain method for estimating exact probabilities (GENEPOP). A hierarchical gene diversity analysis (Chakraborty 1980) was performed using BIOSYS to assess the relative magnitude of geographical and annual variation among 42 samples that had been assayed for variation at a comparable subset of 31 loci. The nested hierarchy included 11 lakes and 22 spawning sites, some of which had been sampled repeatedly for up to 3 years.

STOCK COMPOSITION ANALYSIS

Reference samples

Biological data from sockeye salmon escapement samples were used to characterize 20 reference stocks. Four different combinations of biological characteristics ("marker sets") were used to estimate the stock composition of simulated mixture samples. These marker sets are listed as G, GP, GP*, and GP*A. G denoted the 5 polymorphic biochemical genetic markers *PGM-1**, *PGM-2**, *LDH-B2**, *PEPC**, *ALAT**; P denotes the parasite *Myxobolus arcticus*; P*, *M. arcticus* and the parasite *Philonema oncorhynchi*; and A, freshwater age.

Genetic, parasite and freshwater age data collected from escapement samples in different years were pooled to form the reference sample for a particular stock. Genotypic frequencies for reference stocks were "smoothed" to multinomial distributions specified by the observed allele frequencies (assuming Hardy-Weinberg equilibrium within stocks). Brain parasite, *P. oncorhynchi* prevalence data, and age composition data were summarized as empirical frequency distributions of two-bin histograms for the parasite data and four-bin histograms for the age data.

A similarity dendrogram for the 20 reference stocks was constructed using log-likelihood ratio distances (Wood 1989) calculated for the GP*A marker set to reflect the overall potential for differentiating individual stocks using the combined power of differences in allozyme allele frequencies, *M. arcticus*, *P. oncorhynchi* prevalence and freshwater age composition.

Simulated Mixtures

To evaluate the potential reliability of stock composition estimates for Skeena River sockeye salmon, we used the computer program SPAM (Version 3.2, Alaska Department of Fish and Game 1995.) to analyze "test" mixtures of known stock composition. This program uses search algorithms by Masuda et al. (1991) to implement the conditional maximum likelihood method (e.g., Fournier et al. 1984) and provides bootstrap resampling procedures to introduce random sampling error independently to both the test mixtures and reference samples. The test mixtures comprised 150 fish each, all were selected randomly from a single stock (with the exception of Babine, see below) to highlight potential errors.

The simulations were first run using the GP*A marker set and simulated mixtures generated from 10 Babine Lake reference samples. This was done to evaluate our ability to reliably estimate contributions from spawning sites within Babine Lake. The second set of simulations was performed using the 4 different marker sets G, GP, GP*, GP*A. Separate mixtures were generated from all reference samples with the exception of the Babine group which comprised 40% Fulton, 20% Pinkut and 5% each of the other Babine spawning sites. However, all Babine sites were included as separate reference samples for the stock composition analysis. The allocate/sum method (Wood et al. 1987) was used to estimate contributions by the Babine and Lakelse groups.

Test fishery analysis

Stock composition of the Skeena test fishery was estimated by maximum likelihood analysis using 20 reference stocks and the GP*A marker set as described in the preceding section. The only exception was that *PEPC** and *ALAT** were not assayed in the 1987 Skeena test fishery samples and *M. arcticus* was not assayed in the 1997 Skeena test fishery samples; consequently these markers could not be included in the respective marker sets for those years. Also note that reference samples included genetic and parasite data pooled across years. In general these traits have been stable over time (Wood et al. 1988). Stock composition of the Skeena test fishery was estimated for each statistical week and for the entire season for all years except 1994 and 1997 when sampling was only sufficient to provide seasonal estimates.

Cumulative run timing curves were calculated by normalizing weekly stock-specific stock composition estimates so that they summed to one over the entire season. Cumulative curves were only generated for stocks that contributed > 1% in at least two of the weeks sampled.

Escapement estimates for non-Babine stocks were computed using the annual stock composition estimates from the Skeena test fishery in conjunction with the Babine fence counts and in-river catch data. First, the total sockeye salmon catch in-river was allocated to individual Skeena stocks using the stock composition estimates from the Skeena test fishery, assuming that catch was proportional to abundance. In-river catch data was only available by region and reported for four regions (Terrace, Hazelton, Smithers and Babine Fence). Skeena test fishery stock composition was used to allocate Terrace catch. Hazelton catches were allocated by re-normalizing Skeena test fishery stock composition with Alastair, Lakelse, Kitsumkalum and McDonell stocks excluded. Smithers catches were allocated by re-normalizing Skeena test fishery stock composition with Swan Lake stock excluded in addition to the stocks excluded for the Hazelton catches. Second, the total Babine run was calculated by summing the fence count and the catch of Babine sockeye from each of the four regions. Third, the total sockeye salmon run past the Skeena test fishery was calculated by dividing the total Babine run by the estimated proportion of Babine sockeye in the test fishery. Finally, escapements to non-Babine stocks were calculated by multiplying the in-river run by their respective mixing proportions in the Skeena test fishery and subtracting their respective catches in the river.

RESULTS

AGE COMPOSITION

Freshwater age composition varied significantly among lakes ($p<0.001, \chi^2$). Age 2.* fish were the dominant age class in samples from Morice and Johanson lakes where proportions were 0.913 and 0.746 respectively when pooled across years. Age 2.* fish were also abundant in the samples from Alastair, Motase and Sustut lakes with proportions ranging between 0.24 to 0.37. Age 1.* fish were dominant in samples from all other lakes with proportions exceeding 0.94 (Figure 2, Table 3).

Age 1.* fish comprised over 95% of fish sampled in all but one sample from spawning sites within Babine Lake. The exception was Four Mile Creek where 84% of the samples were age 1.*. Freshwater age composition varied significantly between the two spawning sites within Bear Lake ($p<0.011$), but these samples were collected in different years. In contrast, no variation was observed between the two spawning sites within Lakelse Lake.

Age 1.3 fish were generally the dominant age class in samples from Alastair, Lakelse, McDonell, Motase and Kitsumkalum lakes. Age 1.2 and 1.3 fish were the dominant age class in samples from various locations within Babine Lake. Age 2.2 and 2.3 fish were the dominant age classes in samples from Morice Lake (Table 3). Average age composition by brood year could not be calculated due to the limited number of consecutive years sampled.

LENGTH DISTRIBUTION AND SEX RATIO

Post-orbital hypural length within age class varied significantly among lakes ($P<0.001$, ANOVA). Length samples from upper Skeena sockeye salmon (Bear, Motase) were significantly larger than those from the middle Skeena (Babine, Swan, McDonell, Morice) and lower Skeena (Alastair, Lakelse) in both 1987 for age 1.3 males and females, and in 1988 for females (p always < 0.001), but not in 1988 for males ($p>0.300$, Table 4, Figure 3). Length data were insufficient to permit analysis for other years. No consistent differences in length were detected between samples from different lakes within the upper and middle Skeena stock groups. Length samples from Kitsumkalum sockeye salmon were the smallest within the lower Skeena group. Post-orbital hypural length varied significantly among sites within Babine Lake ($P<0.001$) but no consistent differences were observed when partitioned into early, mid, and late run timing groups.

Sex ratio ranged from 14 to 68 % female among samples (Table 3). This variation and bias in sex ratio probably arises for two reasons: first, sex ratios sometimes change throughout the spawning period (Lorz and Northcote 1965; McCart 1970) and not all stocks were sampled at the time of peak spawning activity; and second, the sampling gear tended to select males over females because the large teeth and hooked snouts of males increased their probability of entanglement in nets. Also, a few of the samples up to and including 1995 were deliberately stratified by sex to achieve a 50:50 sex ratio.

PARASITE PREVALENCE

The prevalence of the brain parasite, *Myxobolus arcticus*, differed significantly among stocks ($P<0.001, \chi^2$). Samples from Swan, Sustut and Johanson lake had prevalence greater than 99% whereas all other stocks sampled, with the exception of Lakelse, had prevalences of less than 3 %. The greatest annual variation observed was in samples from Lakelse Lake where prevalence ranged from 4% in 1998 to 17% in 1983 (Table 5).

The prevalence of the parasite *Philonema oncorhynchi* also differed significantly among stocks ($P<0.001$) ranging from 0-100% among stocks sampled (Table 6). Motase, McDonell, Bear, Babine, Morrison, Swan and Kitsumkalum sockeye salmon exhibited the highest prevalence ($\geq 90\%$), whereas Alastair and Lakelse exhibited the lowest at 0%. Morice and Sustut sockeye salmon had intermediate prevalences of 73% and 82% respectively.

PROTEIN ELECTROPHORETIC VARIATION

Of the 33 non-selected loci examined initially, 10 (30%) were high polymorphic and at least 14 (42%) were low polymorphic, conservatively assuming that variation existed at only one locus of each pair of isoloci (Table 7). Only 4 (*mAAT-1**, *PEP-LT**, and *mAHI,2**) of the 6 loci added because they had been reported high polymorphic elsewhere were also high polymorphic in some Skeena populations, making a total of 14 high polymorphic loci. Only 4 loci (*PGM-1**, *PGM-2** *ALAT** and *mAAT-1**) were polymorphic in all populations examined. Two of these loci also showed the greatest variability among populations, with the frequency of *PGM-1*-100* ranging from 0.001-0.316, and *ALAT*100* ranging from 0.108-0.617. No two populations were fixed for

alternative alleles at any locus. Four additional loci were potentially very useful for genetic stock identification: *mAAT-I** (100 allele frequency range 0.670-0.992), *LDH-B2** (0.800-1.000), *PGM-2** (0.585-0.967), *PEPC** (0.684-1.000), and *sAAT-I** (0.687-1.000). Common allele frequencies at other loci were never less than 0.873.

Genotype frequency distributions within samples generally conformed to Hardy-Weinberg expectations but 17 tests at individual loci deviated significantly after allowing for multiple comparisons at different loci within each of 51 samples. Heterozygote deficiencies were not observed consistently at any single locus (as would be expected from scoring errors) or within a particular sample (as would be expected from admixtures or non-representative samples). The greatest number of deficiencies was detected at *ALAT** (4) followed by *PEPC** (3). Four samples contained a significant deficiency of heterozygotes at more than a single locus, but only 2 loci were involved in each case. However, it may be significant that half of these cases involved both samples from Morice Lake – those from the Nanika River in 1988 and 1994.

Allele frequencies did not differ significantly among sites within the same nursery lake sample within the same year except for small, non-persistent and unexplained differences observed among some enhanced and unenhanced sites within Babine Lake (reported previously by Varnavskaya et al. 1994; Wood et al. 1994).

Hierarchical gene diversity analysis of samples collected from 22 spawning sites, some resampled in 3 different years, indicated that <0.1% of the total genetic variation could be attributed to variation among sites within lakes compared with 1.8% attributed to annual variation within sites and (Table 8). The nursery lake was the most important level of differentiation among samples, accounting for 4.0% of the total variation.

The persistence of population structure at the lake level is illustrated by the fact that replicate samples from the same lake in different years cluster together in the neighbour-joining tree (Figure 4). An exception was the 1987 sample from Lakelse Lake which is grouped with the Babine samples. The neighbour-joining tree also reveals a cline of secondary clustering within the Skeena with lower Skeena sites tending to cluster in the lower right hand side, and upper Skeena sites clustering on the upper left hand side of Figure 4.

After pooling samples within lakes, statistically significant differences in allele frequencies were detected between all pairs of lakes compared except Sustut and Johanson lakes. Although the lack of differentiation between Sustut and Johanson lakes probably reflects historical or continuing gene flow, it is worth noting that Sustut and Johanson lakes were sampled in only one year; consequently, sample sizes are lower than for other comparisons, resulting in reduced statistical power to detect differentiation. Excluding the Sustut-Johanson comparison, pairwise F_{st} estimates range from 0.03 to 0.20 (Table 9). Thus, it is reasonable to conclude that sockeye salmon inhabiting different lakes in the Skeena River typically exist as “local populations” as defined by Wood and Holtby (1998).

Mean heterozygosity over a non-selected (“random”) sample of 33 loci averaged 4.7% (range 2.9-6.8%) across populations in the 11 lake systems studied (Table 10). No obvious difference in mean heterozygosity was evident among populations. Neither the average number of

polymorphic loci nor the maximum number of polymorphic loci observed within samples varied significantly among populations ($p>0.05$). Only 5-12 (23-55%) of the 22 variant alleles detected in the Skeena were observed within any single population.

STOCK COMPOSITION

Simulated Mixtures

Variation in biological characteristics among spawning sites within Babine Lake was insufficient to estimate mixing proportions in simulated mixtures of known spawning site composition (Figure 5). Where the actual composition was 100% for the selected spawning site, mean estimated proportions ranged from 41-76% implying a bias of 24-59%. However, more reliable estimates were obtained for the Babine group as a whole when estimated proportions to all Babine sub-stocks were pooled using the allocate-sum method (Bias <8%, Table 11A).

Estimated mixing proportions for the individual spawning sites within Lakelse Lake (Williams and Schulbuckhand) were more reliable but mean estimates did not exceed 0.921 where the actual value was 1.000 implying a bias of at least 8%. Again, reliable estimates were obtained for Lakelse by pooling the mixing proportions for Williams and Schulbuckhand (bias < 1%, Table 11B).

Stock composition analysis of mixtures of known composition demonstrated that the variation in biological characters observed among Skeena sockeye from different rearing lakes can be used to estimate their proportions (to rearing lake level) in test fishery catches. In the 20-stock mixture problem using the full biological marker set and summing allocations to the rearing lake level. Estimated mixing proportions for 7 of the 10 stocks were consistently reliable in that bias <5% and 95% confidence intervals always included the true value. Estimated mixing proportions for Bear, Motase, and McDonell were somewhat less reliable with bias ranging from 7-12%.

Test Fishery

Annual and weekly stock composition estimates for the Skeena test fishery in 1987-1997 are summarized in Table 12. Estimated annual contributions from Babine Lake averaged 76% and ranged from 63% (in 1992) to 86% (in 1996). In 1988 two test fisheries were conducted and estimated annual contributions from Babine Lake were 73% from the Skeena (gillnet) test fishery and 76% from the seine test fishery. These samples were not completely independent in that the same weights reflecting weekly CPUE in the Skeena test fishery were used to pool the respective weekly sample when reconstructing the seasonal samples (Figure 6).

The maximum estimated annual contribution from Kitsumkalum Lake sockeye salmon was 15% in 1993 and ranged as low as 0% and averaged 4% over the 11 years. The maximum estimated annual contribution from Morice Lake sockeye salmon was 14% in 1992 and ranged as low as 0% and averaged 4%. The maximum estimated annual contribution from McDonell Lake sockeye salmon was 12% in 1988 and ranged as low as 0% and averaged 4%. Both Lakelse and Swan lakes never exceeded 7% and averaged less than 3%. Alastair, Motase, Bear and Sustut

sockeye salmon were the lowest, each stock averaged less than 1.5% and individual contributions never exceeded 5%.

Run Timing

The earliest migrating sockeye salmon in the Skeena River were the Alastair and Lakelse lake stocks with most of the migration passing the test fishery between statistical week 25 and 30 (Figure 7). The Swan, Morice, Sustut and McDonell Lake stocks also had early run timing relative to the Babine Lake stock. Run timing within this early group appeared to be highly variable for all stocks except Swan Lake. The Babine stock was prevalent throughout the entire Skeena test fishery. Its run timing was the least variable and intermediate with 50% of the stock passing the test fishery by statistical week 31. The Kitsumkalum stock was the latest to migrate past the test fishery. The Bear and Motase lake stocks had highly variable run timing but, on average, were similar in timing to the Babine stock (Figure 7). Variability in run timing may only be apparent, reflecting imprecision in the sampling at the test fishery or in the estimation of stock composition.

Spawning Escapement

Sockeye salmon escapements to Babine Lake, enumerated reliably at the Babine counting fence, were the largest in the Skeena River, ranging from 0.98 to 2.1 million fish between 1987 and 1997. Escapements to other stocks were estimated from stock composition analysis of test fishery samples and are reported in Table 13. The sum of visual estimates of sockeye salmon escapement to non-Babine sites from the BC16 database accounts for only 1.6 to 24.0% (average 12%), of the non-Babine escapement estimated by stock composition analysis (Table 14).

DISCUSSION

Sockeye salmon inhabiting different lakes within the Skeena River exhibit considerable variation in biological characteristics. The stocks in Morice and Johanson lakes are unique in that most fish sampled had spent 2 years in fresh water before migrating to sea. The parasite *P. oncorhynchi* was absent in the two lower Skeena stocks, Alastair and Lakelse, but occurred elsewhere. The parasite *M. arcticus* was prevalent in the Swan Lake and Sustut River stocks but nowhere else. Sockeye salmon from the upper Skeena stocks were larger than those from the middle and lower Skeena. The persistence of this variation suggests the pattern may be real. However, this length variation could possibly be an artifact of sampling as collection methods varied and this pattern is not evident in the Fraser or Nass rivers (J. Woodey, Pacific Salmon Commission, Vancouver, pers. comm.; Rutherford et al. 1994). Substantial differences in allozyme frequencies were evident among all stocks inhabiting different lakes except between Johanson and Sustut lakes, both in the Sustut River. In contrast, very little variation in biological characteristics existed among the 10 spawning sites sampled within the Babine Lake system. Similarly, little variation was observed among the two spawning sites sampled within Lakelse Lake.

Simulations under ideal conditions, using the characteristics described in this report indicated that mixing proportions for individual sites within Babine Lake cannot be estimated reliably (bias always >20%). However mixing proportions can be estimated with reasonable accuracy (bias < 5%) for 7 major stock groupings: Alastair, Lakelse, Kitsumkalum, Morice, Swan, Babine, and Sustut/Johanson. Estimates for simulated mixtures comprising only Babine Lake sites (i.e. the "100% Babine group" mixture) were consistently reliable (bias<4%). Some misallocation to the Babine group occurred with the "100% McDonell" and "100 % Motase" simulated mixtures indicating that these stocks should be included within the Babine group if higher accuracy is required.

The overall proportion of Babine fish in the Skeena River test fishery has averaged 76% over the 11 years since the stock identification program was implemented. This result is surprising considering that the sockeye salmon escapement past the Babine fence has accounted for over 90% of the recorded Skeena escapement. Visual estimates of escapement to non-Babine sites from 1987-1997 account for only 1.6-24.0% (average 12%) of the estimate derived from stock composition analysis after accounting for in-river catches downstream of the Babine fence. Even after summing the Motase and McDonell stocks with the Babine grouping to compensate for possible errors revealed in the simulations, visual enumeration at the other non-Babine sites still accounts for only 3.4-66.9% (average 19%) of the estimate derived from stock composition analysis.

The accuracy of the stock composition estimates depends on samples being representative. First, samples from both the spawning sites and the test fishery must represent the actual runs; second the test fishery CPUE must be a reliable index of relative abundance to ensure appropriate weighting of weekly samples over the entire season. Recent studies of the Skeena River test fishery indicate that factors such as gear saturation, size selectivity, and stock-specific vulnerability may bias both catch samples and CPUE data (Cox-Rogers and Jantz 1993). However, it seems doubtful that these known sources of bias are sufficient to explain the large discrepancy between estimates of non-Babine escapement from our stock composition estimates and from visual enumeration.

ACKNOWLEDGEMENTS

We would like to thank all those who assisted in the collection and analysis of samples including David Southgate, Mike Jakubowski, and Steve Bachen of Fisheries and Oceans Canada; Tessi Fumerton of Aqua Life Diagnostics and Cliff Stevens of Alphagen Diagnostics. Robert Johnson, Jon Bonneschranz, and Ken Kristmanson conducted the test fishing. Lester Jantz, Steve Cox-Rogers, David Peacock and Skip McKinnell provided helpful advice on interpreting data.

REFERENCES

- Aebersold, P.B., G.A. Winans, D.J. Teel, G.B. Milner, and F.M. Utter. 1987. Manual for starch gel electrophoresis: a method for the detection of genetic variation. NOAA (National Oceanic and Atmospheric Administration) Technical Report NMFS (National Marine Fisheries Service) 61.
- Alaska Department of Fish and Game. 1995. SPAM; Statistical program for analyzing mixtures. ADF&G, Genetics Lab, Anchorage, Alaska.
- Bilton, H.T., and D.W. Jenkinson. 1968. Comparison of otolith and scale methods for aging sockeye (*Oncorhynchus nerka*) and chum (*O. keta*) salmon. J. Fish. Res. Bd. Canada. 15: 1067-1069.
- Cavalli-Sforza, L.L., and A.W.F. Edwards. 1967. Phylogenetic analysis: models and estimation procedures. Am. J. Human Genet. 19:233-257.
- Chakraborty, R. 1980. Gene diversity analysis in nested subdivided populations. Genetics 96:721-726.
- Clayton, J.W., and D.N. Tretiak. 1972. Amine-citrate buffers for pH control in starch gel electrophoresis. J. Fish. Res. Bd. Canada 29: 1169-1172.
- Cox-Rogers, S., and L. Jantz. 1993. Recent trends in the catchability of sockeye salmon in the Skeena River gillnet test fishery, and impacts on escapement estimation. Can. Man. Rep. Fish. Aquat. Sci. 2219: 111+19 p.
- Fournier, D.A., T.D. Beacham, B.E. Riddell, and C. Busack. 1984. Estimating stock composition in mixed-stock fisheries using morphometric, meristic and electrophoretic characteristics. Can. J. Fish. Aquat. Sci. 41: 400-408.
- Jantz, L., R. Kadowaki, and B. Spilsted. 1990. Skeena River salmon test fishery, 1987. Can. Data Rep. Fish. Aquat. Sci. No. 804. 151 p.
- Lorz, H.W., and T.G. Northcote. 1965. Factors affecting stream location, and timing intensity of entry by spawning kokanee (*Oncorhynchus nerka*) onto an inlet of Nicola Lake, British Columbia. J. Fish. Res. Bd. Can. 22: 665-687
- Markert, C.L., and I. Faulhaber. 1965. Lactate dehydrogenase isozyme patterns in fish. J. Exp. Zool. 156: 319-332.
- Masuda, M., S. Nelson, and J. Pella. 1991. The computer programs for computing conditional maximum likelihood estimates of stock composition from discrete characters. USA-DOC-NOAA-NMFS, Auke Bay Laboratories, Auke Bay, Alaska.

- McCart, P.J. 1970. A polymorphic population of *Oncorhynchus nerka* in Babine Lake, British Columbia. Ph.D. thesis, University of British Columbia, Vancouver, B.C.
- Raymond M. & Rousset F, 1995. GENEPOP (version 1.2): population genetics software for exact tests and ecumenicism. J. Heredity, 86:248-249
- Ridgway, G.J., S.W. Sherburne, and R.D. Lewis. 1970. Polymorphisms in the esterases of Atlantic herring. Trans. Am. Fish. Soc. 99: 147-151.
- Rutherford, D.T., C.C. Wood, A.L. Jantz, and D.R. Southgate. 1994. Biological characteristics of Nass River sockeye salmon (*Oncorhynchus nerka*) and their utility for stock composition analysis of test fishery samples. Can. Tech. Rep. Fish. Aquat. Sci. 1988 65p.
- Saitou, N., and M. Nei. 1987. The neighbour-joining method: a new method for reconstructing phylogenetic trees. Mol. Biol. Evol. 4: 406-425.
- Shaklee, J.B., F.W. Allendorf, D. C. Morizot, and G.S. Whitt. 1990. Gene nomenclature for protein-coding loci in fish. Trans. Am. Fish. Soc. 119: 1-13.
- Smith, H.D., and J. Lucop. 1966. Catalogue of salmon spawning grounds and tabulation of escapements in the Skeena River and Department of Fisheries Statistical Area 4. Fish. Res. Bd. Can. Man. Rep. Ser. (Biol.), Nanaimo, 882:1-7.
- Sprout, P. E., and R.K. Kadowaki. 1987. Managing the Skeena River sockeye salmon (*Oncorhynchus nerka*) fishery – the process and the problems. In H.D. Smith, L. Margolis, and C. C. Wood [ed.] Sockeye salmon (*Oncorhynchus nerka*) population biology and future management. Can. Spec. Publ. Fish. Aquat. Sci. 96. p. 385-395.
- Swofford, D.L., and R.B. Selander. 1981. Biosys-1: a FORTRAN program for the comprehensive analysis of electrophoretic data in population genetics and systematics. J. Hered. 72:281-283.
- Varnavskaya, N.V., C.C. Wood, R.J. Everett, R.L. Wilmont, V.S. Varnavsky, V.V. Midanaya, and T.P. Quinn. 1994. Genetic differentiation of sub-populations of sockeye salmon (*Oncorhynchus nerka*) within large lakes of Alaska, British Columbia and Kamchatka (Russia). Can. J. Fish. Aquat. Sci. 51 (suppl. 1) 147-157.
- West, C.J., and J.C. Mason. 1987. Evaluation of sockeye salmon (*Oncorhynchus nerka*) production from the Babine Lake Development Project. In H.D. Smith, L. Margolis, and C. C. Wood [ed.] Sockeye salmon (*Oncorhynchus nerka*) population biology and future management. Can. Spec. Publ. Fish. Aquat. Sci. 96. P. 176-190.
- Winans, G.A., P.B. Aebersold, R.S. Waples. 1996. Allozyme variability of *Oncorhynchus nerka* in the Pacific Northwest, with special consideration to populations of Redfish Lake, Idaho. Trans. Am. Fish. Soc. 125:645-663.

- Wood, C.C. 1989. Utility of similarity dendograms in stock composition analysis. Can. J. Fish. Aquat. Sci. 46:2121-2128.
- Wood, C.C., S. McKinnell, T.J. Mulligan, and D.A. Fournier. 1987. Stock identification with the maximum-likelihood mixture model: sensitivity analysis and application to complex problems. Can. J. Fish. Aquat. Sci. 44:866-881
- Wood, C.C., G.T. Oliver, and D.T. Rutherford. 1988. Comparison of several biological markers used for stock identification of sockeye salmon (*Oncorhynchus nerka*) in northern British Columbia and Southeast Alaska. Can. Tech. Rep. Fish. Aquat. Sci. 1624: 55p.
- Wood, C.C., B.E. Riddell, D.T. Rutherford, and R.W. Wither. 1994. Biochemical genetic survey of sockeye salmon (*Oncorhynchus nerka*) in Canada. Can. J. Fish. Aquat. Sci. 51(Suppl. 1): 114-131.
- Wood, C.C., and L.B. Holtby. 1998. Defining conservation units for Pacific salmon using genetic survey data. p. 233-250 *In:* B. Harvey, C. Ross, D. Greer, and J. Carolsfeld (ed.). Action Before Extinction: An International Conference on Conservation of Fish Genetic Diversity. World Fisheries Trust, Victoria, Canada
- Wood, C.C., D.T. Rutherford, D. Bailey, and M. Jakubowski. 1998. Assessment of sockeye salmon production in Babine Lake, British Columbia with forecast for 1998. Can. Tech. Rep. Fish. Aquat. Sci. 2241: 50p.

Table 1A. Summary of sockeye salmon collections from Skeena River spawning locations.

Lake	Collection Location	Site #	Year	Date	Hypural Length	Fork Length	Number Sampled For				
							Sex	Otoliths	Myzobots	Phialoma	Parasites
Alastair Lake	Southend Ck.	1	1982	Sept. 8	82	0	82	0	0	0	0
			1983	Sept. 8	100	0	100	0	0	0	0
			1987	Sept. 17	75	75	75	75	75	0	75
			1988	Sept. 14	75	75	75	75	75	0	75
			1989	Sept. 9	78	78	78	78	0	78	0
			1994	Sept. 20	100	100	100	100	0	25	100
Lakelse Lake	Schubuckhand Ck.	2	1983	Aug. 24	50	0	50	0	0	0	0
			1988	Aug. 23	77	77	77	77	77	0	77
			1989	Aug. 18	60	0	60	0	0	0	0
			1989	Aug. 24	50	0	50	0	0	0	0
			1987	Sept. 3	83	83	83	83	83	83	83
	Williams Ck.	3	1988	Aug. 22	68	68	68	68	68	0	98
			1989	Aug. 22	51	0	51	51	0	3	0
			1994	Aug. 25	100	100	100	100	0	100	100
			1994	Aug. 25	100	100	100	100	0	100	100
			1994	Oct. 18	77	77	77	77	77	77	77
McDonald Lake	Katum Channel	4	1994	Sept. 19	75	75	75	75	75	0	75
			1988	Sept. 15	63	63	63	63	63	1	128
			1994	Sept. 16	99	99	99	0	0	99	0
Morice Lake	Nanika R.	6	1988	Sept. 19	75	75	75	75	75	0	75
			1994	Sept. 15	63	63	63	63	63	1	128
			1994	Sept. 16	99	99	99	0	0	99	0
Swan Lake	Club Ck.	7	1988	Sept. 18	100	100	100	89	100	0	100
			1994	Sept. 13	100	100	100	100	100	60	100
Babine Lake	Lower Babine R.	8	1987	Sept. 21	99	99	99	99	99	99	100
			1994	Oct. 11	100	100	100	100	0	24	100
	Upper Babine R.	9	1987	Sept. 23	98	98	98	88	88	98	98
			1994	Oct. 3	100	100	100	100	100	0	100
	Fulton Fence	10	1982	Sept. 9	100	0	100	0	0	0	0
			1983	Sept.	100	0	100	0	0	0	0
			1990	Sept. 7	100	0	100	100	0	0	100
			1990	Oct. 2	100	0	100	100	0	0	100
	Fulton Channel 1	11	1985	Sept. 25	50	0	50	22	0	0	50
			1990	Sept. 28	100	0	99	99	0	0	100
	Fulton Channel 2	12	1985	Sept. 24	150	0	150	109	0	0	150
			1987	Sept. 11	93	93	93	93	93	83	93
			1990	Sept. 10	100	0	100	100	0	0	100
			1994	Sept. 27	0	0	0	0	0	0	100
	Fulton R.	13	1985	Sept. 26	100	0	100	82	0	0	50
			1985	Oct. 2	100	0	100	100	0	0	50
			1987	Sept. 10	100	100	100	100	100	100	100
			1990	Sept. 12	100	0	100	99	0	0	99
Tachok Ck.	Tachok Ck.	14	1985	Aug.	0	0	0	0	0	0	50
			1984	Aug.	0	0	0	0	0	0	100
	Pierre Ck.	15	1985	Aug.	0	0	0	0	0	0	98
			1987	Aug. 18	100	100	100	98	100	100	100
	Twain Ck.	16	1988	Aug. 19	79	79	79	79	79	0	79
			1994	Aug. 11	0	0	0	0	0	0	69
	Pinkut Fence	17	1985	Aug.	0	0	0	0	0	0	103
			1987	Aug. 18	100	100	100	100	100	100	100
	Pinkut Channel	18	1988	Aug. 19	100	100	100	100	100	0	100
			1983	Sept. 21	100	0	100	0	0	0	0
			1990	Aug. 27	101	0	101	0	0	0	0
			1990	Oct. 5	100	0	100	99	0	0	100
Pinkut R.	Pinkut R.	19	1985	Sept. 25	100	0	100	0	0	0	100
			1987	Aug. 25	100	0	100	0	0	0	100
			1990	Sept. 17	100	0	100	98	100	100	100
			1994	Sept. 10	100	0	100	0	0	0	100
			1995	Sept. 23	100	0	100	0	0	0	100
Four Mile Ck.	Four Mile Ck.	20	1982	Aug. 20	50	0	50	0	0	0	0
			1987	Aug. 26	89	89	89	89	89	89	89
			1990	Sept. 18	100	0	100	100	0	0	100
			1994	Sept. 20	75	75	75	75	75	0	75
			1998	Aug. 20	78	78	78	78	78	78	78
Shass Ck.	Shass Ck.	21	1987	Aug. 27	78	78	78	78	78	78	78
			1988	Sept. 26	76	76	76	76	76	0	76
			1994	Sept. 14	99	99	100	100	0	100	100
			1994	Sept. 22	79	79	79	79	79	79	79
L. Tahlo Ck.	L. Tahlo Ck.	23	1987	Sept. 29	85	85	85	85	85	0	85
			1988	Sept. 29	85	85	85	85	85	0	85
			1994	Sept. 14	90	90	90	77	82	0	90
			1994	Sept. 9	75	75	75	75	75	75	74
Motase Lake	Motase Ck.	24	1987	Sept. 9	75	75	75	75	75	75	74
Bear Lake	Azukdotz Ck.	25	1988	Aug. 21	71	71	71	71	71	0	71
	Salix Ck.	26	1987	Sept. 1	81	81	81	81	81	81	81
		26	1994	Sept. 10	35	7	35	35	0	5	35
Sustut Lake	Sustut Weir	27	1993	Aug. 10 - Sept. 2	93	93	93	93	93	0	93
Johanson Lake	Johanson Ck.	28	1993	Aug. 10 - Aug. 31	60	60	60	60	60	0	60
Sustut River	Sustut Fence	29	1996	Aug.	0	0	50	0	0	50	0

Table 1B. Summary of sockeye salmon collections from the Skeena River test fishery 1987-1997.

Collection Location	Fishery Type	Year	Date	Number Sampled For						
				Hypural Length	Fork Length	Sex	Age	Parasites	Myxobolus	Philonema	Allozymes
Tyee Pt.	Gillnet	1987	Jun. 11 - Aug. 23	2036	2036	2036	1881	1470	1491	1470
Tyee Pt.	Gillnet	1988	Jun. 14- Aug. 25	1358	1358	1358	1241	886	1360	886
Aberdeen	Seine	1988	Jun. 14- Aug. 25	1476	1476	1476	1382	935	935	935
Tyee Pt.	Gillnet	1989	Jun. 14- Aug. 25	1248	1248	1248	1125	1248	1248	1248
Tyee Pt.	Gillnet	1990	Jun. 16- Aug. 28	1207	1207	1207	1128	1200	1200	1200
Tyee Pt.	Gillnet	1991	Jun. 12- Aug. 25	1316	1316	1316	1237	1316	1316	1316
Tyee Pt.	Gillnet	1992	Jun. 19- Sep. 4	1835	1835	1835	1721	947	947	947
Tyee Pt.	Gillnet	1993	Jun. 9 - Aug. 25	1449	1449	1449	1361	766	766	766
Tyee Pt.	Gillnet	1994	Jun. 14- Aug. 27	1338	1338	1338	1200	358	358	358
Tyee Pt.	Gillnet	1995	Jun. 14- Aug. 20	3729	3729	3703	3395	1371	1371	1371
Tyee Pt.	Gillnet	1996	Jun. 13 - Aug. 28	3469	3469	3469	3037	1500	1500	1500
Tyee Pt.	Gillnet	1997	Jun. 14- Aug. 23	1916	1916	1913	1792	0	365	365

Table 2. Enzymes and tissues used to investigate genetic variation. Tissues: E = eye; H = heart; L = liver; M = skeletal muscle. Buffers: AC = amine-citrate (Clayton and Tretiak 1972); RW = Tris, citric acid, lithium hydroxide, and boric acid (Ridgway et al. 1970); MF = Tris, boric acid), and EDTA, pH 8.5 (Markert and Faulhaber 1965).

Enzyme name	E.C. No.	Locus	Tissue	Buffer
Aconitate hydratase	4.2.1.3	<i>sAH</i> *	L	AC
		<i>mAH-1,2</i> *	H,M,E	AC
		<i>mAH-3</i> *	H,M,E	AC
		<i>mAH-4</i> *	H,M,E	AC
Adenosine deaminase	3.5.4.4	<i>ADA-2</i> *	M	AC
Alanine aminotransferase	2.6.1.2	<i>ALAT</i> *	M	MF
Aspartate aminotransferase	2.6.1.1	<i>mAAT-1</i> *	M	AC
		<i>SAAT-1,2</i> *	H	AC
		<i>SAAT-3</i> *	E	AC
Dipeptidase	3.4.*.*	<i>PEPA</i> *	E	MF
Glyceraldehyde-3-phosphate dehydrogenase	1.2.1.12	<i>GAPDH-4</i> *	E	AC
Glycerol-3-phosphate dehydrogenase	1.1.1.8	<i>G3PDH-1,2</i> *	M	AC
Glucose-6-phosphate isomerase	5.3.1.9	<i>GPI-B1,2</i> *	M	MF
Isocitrate dehydrogenase (NADP+)	1.1.142	<i>mIDHP-1</i> *	M	AC
		<i>mIDHP-2</i> *	M	AC
		<i>sIDHP-1</i> *	L	AC
		<i>sIDHP-2</i> *	L	AC
		<i>LDH-A1</i> *	M	MF
Lactate dehydrogenase	1.1.1.27	<i>LDH-A2</i> *	M	MF
		<i>LDH-B1</i> *	H	AC
		<i>LDH-B2</i> *	L	RW
		<i>LDH-C</i> *	E	MF
		<i>sMDH-A1,2</i> ,*	L	AC
Malate dehydrogenase	1.1.137	<i>sMDH-B1,2</i> ,*	M	AC
		<i>ME</i> *	M	AC
		<i>SMEP-1</i> *	M	AC
Mannose-6-phosphate isomerase	5.3.1.8	<i>MPI</i> *	H	AC
Dipeptidase	3.4.*.*	<i>PEPA</i> *	M,E	MF
Peptidase-C		<i>PEPC</i> *	E	MF
Leucyl-tryosine peptidase		<i>PEP-LT</i> *	M	MF
Phosphoglucomutase	5.4.2.2	<i>PGM-1</i> *	H	AC
		<i>PGM-2</i> *	M	MF
		<i>PGD</i> H*	M	AC
Phosphogluconate dehydrogenase	1.1.1.44	<i>PGDH</i> *	M	AC
Superoxide dismutase	1.15.1.1	<i>sSOD</i> *	L	RW

Table 3. Age and sex composition of samples from sockeye salmon spawning locations. Numbers in parentheses

Table 4. Mean post-ovipositional hypopural length distributions by sex and age in samples from sockeye salmon spawning locations. Standard deviations are given in parentheses.

Lake	Collection location	Year	N	HL (SD)	Males	Females	Age 1.3	Age 2.2	Age 2.3	
Allsteel L.	Southeastern Ck.	1987	4	423 (36.63)	10	444 (27.67)	19	498 (31.28)	38	487 (23.44)
Allsteel L.	Southeastern Ck.	1988	5	456 (23.29)	1	470 (-)	20	518 (16.26)	24	488 (15.06)
Allsteel L.	Southeastern Ck.	1989	1	465 (-)	-	-	-	456 (14.82)	8	458 (16.90)
Lake Erie L.	Schubuckhead Ck.	1988	2	520 (14.14)	6	468 (27.92)	11	444 (31.98)	11	446 (27.39)
Lake Erie L.	Schubuckhead Ck.	1989	1	465 (-)	-	-	-	476 (16.91)	25	522 (28.40)
Lake Erie L.	Williams Ck.	1987	22	430 (47.02)	16	441 (20.23)	20	507 (26.97)	16	443 (18.88)
Lake Erie L.	Williams Ck.	1988	42	438 (40.80)	27	443 (18.88)	14	491 (21.31)	-	-
Lake Erie L.	Williams Ck.	1989	1	375 (-)	-	-	-	-	-	-
McDonald L.	Klismakalum L. Kallum Ch.	1987	1	545 (-)	1	410 (-)	47	494 (53.80)	1	415 (-)
McDonald L.	Klismakalum L. Kallum Ch.	1988	38	380 (23.32)	12	430 (14.92)	9	462 (66.76)	14	472 (18.68)
McDonald L.	Klismakalum L. Kallum Ch.	1989	83	441 (47.10)	59	445 (25.49)	151	515 (31.96)	102	491 (22.46)
McDonald L.	Nanika R.	1986	1	405 (-)	3	425 (13.23)	2	510 (07.07)	1	500 (-)
McDonald L.	Nanika R.	1987	2	400 (49.60)	1	445 (-)	10	461 (48.89)	22	445 (45.56)
McDonald L.	Nanika R.	1988	2	400 (49.60)	3	425 (13.23)	2	510 (07.07)	3	500 (45.56)
McDonald L.	Nanika R.	1989	1	405 (-)	1	410 (-)	47	468 (36.31)	11	421 (33.59)
Swan Lk.	Club Ck.	1988	36	448 (26.06)	32	446 (22.75)	10	495 (22.75)	32	452 (30.42)
Swan Lk.	Club Ck.	1989	11	425 (24.74)	14	450 (26.31)	22	465 (33.63)	47	467 (26.08)
Babine L.	Lababine R.	1987	2	413 (31.82)	-	-	61	532 (18.03)	36	513 (23.42)
Babine L.	Lababine R.	1988	18	405 (46.84)	16	439 (31.95)	31	503 (17.97)	30	482 (17.31)
U. Babine R.	U. Babine R.	1989	20	408 (44.96)	18	439 (31.95)	92	522 (22.52)	66	500 (25.78)
Fulton Ch. 1	Fulton F. (late)	1990	24	378 (58.73)	23	415 (30.43)	18	522 (34.72)	24	499 (22.42)
Fulton Ch. 1	Fulton F. (late)	1990	35	408 (45.89)	24	445 (46.20)	14	507 (37.70)	27	501 (29.25)
Fulton Ch. 2	Fulton F. (early)	1990	35	408 (45.89)	24	445 (46.20)	14	507 (37.70)	27	501 (29.25)
Fulton Ch. 2	Fulton F. (early)	1991	35	408 (45.89)	24	445 (46.20)	14	507 (37.70)	27	501 (29.25)
Fulton R.	Fulton R.	1991	27	426 (34.44)	5	419 (27.02)	30	516 (20.91)	32	505 (18.25)
Fulton R.	Fulton R.	1992	26	412 (38.26)	6	416 (16.25)	22	516 (15.08)	37	480 (18.88)
mean 27	mean 27	1992	40	418 (38.84)	11	417 (20.66)	52	511 (19.38)	69	482 (22.87)
mean 28	mean 28	1993	35	408 (45.89)	24	445 (46.20)	14	507 (37.70)	27	501 (29.25)
mean 28	mean 28	1993	35	408 (45.89)	24	445 (46.20)	14	507 (37.70)	27	501 (29.25)
mean 29	mean 29	1994	26	412 (38.26)	6	416 (16.25)	22	516 (15.08)	37	480 (18.88)
mean 29	mean 29	1994	48	418 (38.84)	11	417 (20.66)	52	511 (19.38)	69	482 (22.87)
mean 30	mean 30	1995	30	404 (45.89)	24	445 (46.20)	14	507 (37.70)	27	501 (29.25)
mean 30	mean 30	1995	30	404 (45.89)	24	445 (46.20)	14	507 (37.70)	27	501 (29.25)
mean 31	mean 31	1996	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 31	mean 31	1996	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 32	mean 32	1997	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 32	mean 32	1997	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 33	mean 33	1998	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 33	mean 33	1998	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 34	mean 34	1999	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 34	mean 34	1999	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 35	mean 35	2000	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 35	mean 35	2000	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 36	mean 36	2001	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 36	mean 36	2001	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 37	mean 37	2002	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 37	mean 37	2002	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 38	mean 38	2003	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 38	mean 38	2003	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 39	mean 39	2004	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 39	mean 39	2004	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 40	mean 40	2005	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 40	mean 40	2005	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 41	mean 41	2006	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 41	mean 41	2006	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 42	mean 42	2007	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 42	mean 42	2007	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 43	mean 43	2008	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 43	mean 43	2008	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 44	mean 44	2009	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 44	mean 44	2009	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 45	mean 45	2010	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 45	mean 45	2010	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 46	mean 46	2011	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 46	mean 46	2011	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 47	mean 47	2012	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 47	mean 47	2012	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 48	mean 48	2013	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 48	mean 48	2013	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 49	mean 49	2014	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 49	mean 49	2014	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 50	mean 50	2015	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 50	mean 50	2015	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 51	mean 51	2016	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 51	mean 51	2016	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 52	mean 52	2017	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 52	mean 52	2017	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 53	mean 53	2018	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 53	mean 53	2018	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 54	mean 54	2019	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 54	mean 54	2019	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 55	mean 55	2020	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 55	mean 55	2020	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 56	mean 56	2021	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 56	mean 56	2021	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 57	mean 57	2022	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 57	mean 57	2022	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 58	mean 58	2023	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 58	mean 58	2023	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 59	mean 59	2024	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 59	mean 59	2024	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 60	mean 60	2025	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 60	mean 60	2025	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 61	mean 61	2026	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 61	mean 61	2026	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 62	mean 62	2027	28	412 (38.26)	21	476 (24.17)	14	514 (15.08)	41	532 (15.88)
mean 62	mean 62	2027	28	412 (38.26)	21	476 (2				

Table 4. (cont'd)

Lake	Collection Location	Age 1.2						Age 1.3						Age 2.2						Age 2.3					
		Year	Male		Female																				
			N	HL (SD)	N	HL (SD)	N	HL (SD)	N	HL (SD)	N	HL (SD)	N	HL (SD)	N	HL (SD)	N	HL (SD)	N	HL (SD)	N	HL (SD)			
Babine L.	Pierre	1987	30	409 (39.30)	18	430 (19.81)	17	518 (17.14)	14	497 (22.50)	-	-	-	-	1	470 (-)	-	-	-	-	1	465 (-)			
		1988	24	440 (24.98)	54	439 (17.91)	1	500 (-)	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
		mean	54	422 (38.83)	72	437 (18.68)	18	517 (17.16)	14	497 (22.50)	-	-	-	-	1	470 (-)	-	-	-	-	1	465 (-)			
	Twain	1987	27	404 (34.69)	25	431 (16.14)	17	510 (19.40)	25	493 (17.69)	-	-	-	-	2	445 (00.00)	-	-	-	-	-	-			
		1988	30	415 (29.37)	55	438 (19.64)	3	498 (44.81)	6	474 (31.69)	-	-	-	-	4	460 (28.48)	-	-	-	-	-	-			
		mean	57	409 (32.17)	80	435 (18.72)	20	508 (23.52)	31	489 (21.73)	-	-	-	-	6	455 (21.91)	-	-	-	-	-	-			
Pinkut F. (late)	Pinkut Ch.	1990	54	399 (35.22)	24	410 (23.13)	8	451 (42.80)	13	483 (35.50)	-	-	-	-	-	-	-	-	-	-	-	-			
		1987	61	395 (51.44)	24	428 (28.86)	5	464 (57.48)	5	477 (18.57)	-	-	-	-	-	-	-	-	-	-	-	-			
		1990	40	383 (33.98)	28	414 (18.54)	5	471 (29.45)	12	484 (19.87)	-	-	-	-	-	-	-	-	-	-	-	-			
		1987	44	410 (37.09)	18	413 (30.16)	1	435 (-)	3	500 (21.79)	-	-	-	-	-	-	-	-	-	-	-	-			
		1990	44	399 (33.17)	35	412 (31.90)	4	475 (29.44)	13	495 (38.94)	-	-	-	-	-	-	-	-	-	-	-	-			
		mean	243	398 (33.87)	129	415 (28.78)	23	462 (39.87)	46	487 (29.88)	-	-	-	-	-	-	-	-	-	-	-	-			
Four Mile Ck.		1987	8	388 (28.18)	8	438 (15.76)	19	513 (20.82)	34	489 (25.64)	4	423 (29.88)	7	440 (29.44)	-	-	-	-	1	460 (-)	-	-			
		1988	28	415 (39.71)	30	439 (29.71)	4	491 (33.26)	2	495 (00.00)	5	422 (35.11)	5	438 (35.11)	-	-	-	-	1	465 (-)	-	-			
		mean	36	409 (38.52)	38	439 (27.21)	23	510 (24.07)	36	490 (24.93)	9	422 (30.83)	12	439 (30.38)	-	-	-	-	2	463 (03.54)	-	-			
	Shass	1987	23	397 (20.58)	7	423 (18.00)	22	497 (22.50)	20	494 (22.78)	-	-	-	-	-	-	-	-	-	-	-	-			
Morrison R.		1988	41	434 (37.12)	23	456 (15.57)	2	520 (07.07)	8	508 (18.20)	-	-	-	-	-	-	-	-	-	-	-	-			
		1994	16	403 (35.17)	14	441 (29.03)	16	504 (41.16)	42	487 (16.77)	-	-	-	-	-	-	-	-	1	520 (-)	-	-			
		mean	57	425 (38.90)	37	450 (22.48)	18	506 (39.04)	50	490 (18.04)	-	-	-	-	-	-	-	-	1	520 (-)	-	-			
	L. Tahlo Ck	1987	58	418 (39.17)	18	432 (16.15)	1	543 (-)	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
		1988	14	441 (27.12)	13	438 (31.38)	26	513 (28.50)	31	498 (17.65)	-	-	-	-	-	-	-	-	-	-	-	-			
		1994	6	394 (18.55)	1	440 (-)	42	514 (19.27)	27	496 (17.49)	-	-	-	-	-	-	-	-	-	-	-	-			
		mean	78	420 (37.67)	32	435 (23.16)	69	514 (23.15)	58	497 (17.44)	-	-	-	-	-	-	-	-	-	-	-	-			
Motase L.	Motase Ck.	1987	1	455 (-)	4	464 (20.57)	18	532 (14.05)	28	515 (20.64)	8	458 (39.98)	7	457 (19.78)	5	547 (13.51)	6	525 (08.94)	-	-	-	-			
Bear L.	Azoklotz Ck.	1988	20	461 (32.44)	29	451 (23.18)	7	536 (12.39)	7	516 (28.68)	2	450 (28.28)	3	455 (26.46)	2	493 (38.89)	-	-	-	-	-	-	-		
	Salix Ck.	1987	8	438 (37.01)	12	460 (14.06)	32	534 (20.49)	23	522 (22.31)	-	-	-	-	-	-	-	-	1	515 (-)	-	-			
		1994	-	-	1	475 (-)	2	505 (28.00)	3	455 (39.68)	-	-	-	-	1	450 (-)	-	-	-	-	-	-			
		mean	28	454 (34.93)	42	454 (21.09)	41	532 (20.50)	33	515 (31.19)	2	450 (28.28)	4	454 (21.75)	2	493 (38.89)	-	-	-	-	-	-	-		
Sustut L.	Sustut Weir	1993	11	490 (23.23)	12	459 (15.81)	22	535 (12.60)	21	509 (24.10)	-	-	-	-	5	472 (15.22)	11	529 (13.42)	5	517 (23.26)	-	-			
Johanson L.	Johanson Ck.	1993	3	478 (20.82)	10	484 (21.51)	1	584 (-)	-	-	-	-	-	-	8	510 (35.08)	6	476 (19.62)	18	535 (18.32)	12	525 (15.86)	-		

Table 5. Prevalence of the brain parasite, *Myxobolus arcticus*, in samples from sockeye salmon spawning locations.

Lake	Collection Location	Year	Number Examined	Number Infected	Proportion Infected
Alastair L.	Southend Ck.	1987	75	2	0.03
		1988	75	0	0.00
Lakelse L.	Schulbuckhand Ck.	1988	77	7	0.09
		1987	83	14	0.17
	Williams Ck.	1988	98	4	0.04
		1994	77	0	0.00
McDonell L.		1987	87	0	0.00
		1988	75	2	0.03
		1994	100	0	0.00
Morice L.	Nanika R.	1988	75	0	0.00
		1994	63	0	0.00
Swan L.	Club Ck	1988	100	99	0.99
		1994	100	100	1.00
Babine L.	L.Babine R.	1987	99	0	0.00
		1987	98	0	0.00
	U.Babine R.	1994	100	1	0.01
		1987	93	0	0.00
	Fulton Ch. 2	1987	100	0	0.00
		1987	100	0	0.00
	Pierre Ck.	1987	100	0	0.00
		1988	79	0	0.00
	Twain Ck.	1987	100	0	0.00
		1988	100	0	0.00
	Pinkut Ch.	1987	100	0	0.00
		1987	100	0	0.00
	Pinkut R.	1987	100	1	0.01
		1987	89	0	0.00
	Four Mile Ck.	1988	75	1	0.01
		1987	78	0	0.00
	Shass Ck.	1988	76	0	0.00
		1987	79	0	0.00
	L. Tahlo Ck.	1988	85	0	0.00
		1987	82	0	0.00
Motase L.	Motase Ck.	1987	75	1	0.01
Bear L.	Azuklotz Ck.	1988	71	0	0.00
	Salix Ck.	1987	81	0	0.00
Sustut R.	Sustut Weir	1993	93	87	0.94
		1993	60	60	1.00

Table 6. Prevalence of the parasite, *Philonema oncorhynchi*, in samples from sockeye salmon spawning locations.

Lake	Collection Location	Year	Number Examined	Number Infected	Proportion Infected
Alastair L.	Southend Ck.	1989	78	0	0.00
		1994	25	0	0.00
Lakelse L.	Williams Ck.	1987	83	0	0.00
		1989	3	0	0.00
		1994	100	0	0.00
Kitsumkalum L.	Kalum Ch.	1994	13	13	1.00
McDonell Ck.		1987	87	87	1.00
		1994	100	81	0.81
Morice L.	Nanika R.	1994	1	1	1.00
		1996	99	90	0.91
Swan L.	Club Ck.	1994	60	59	0.98
Babine L.	L.Babine R.	1987	99	98	0.99
		1994	24	15	0.63
	U.Babine R.	1987	98	98	1.00
		Fulton Ch. 2	93	93	1.00
	Fulton R.	1987	100	100	1.00
		Pierre Ck.	100	91	0.91
	Twain Ck.	1987	100	100	1.00
		Pinkut Ch.	100	100	1.00
	Pinkut R.	1987	100	100	1.00
		Four Mile Ck.	89	89	1.00
	Shass Ck.	1987	78	78	1.00
		Morrison R.	100	100	1.00
	L. Tahlo Ck.	1987	79	79	1.00
		1994	90	90	1.00
Motase L.	Motase Ck.	1987	75	75	1.00
Bear L.	Salix Ck.	1987	81	81	1.00
		1994	5	5	1.00
Sustut R.	Sustut Weir	1996	50	41	0.82

Table 7. Summary of allozyme allele frequencies in samples from sockeye salmon spawning locations.

Lake	Collection Location	Site #	Year	S4AT-1,2*			ALAT*				PEPC*			PGM-1*				
				(N)	*100	*83	*67	(N)	*100	*91	*95	*108	(N)	*100	*105	(N)	*100	*NULL
Alastair L.	Southend Ck.	1	1987	75	0.827	0.173	0.000	73	0.596	0.226	0.178	0.000	73	0.842	0.158	75	0.120	0.880
			1988	75	0.887	0.253	0.060	75	0.547	0.220	0.233	0.000	75	1.000	0.000	75	0.133	0.867
			1994	100	0.910	0.090	0.000	100	0.495	0.275	0.230	0.000	100	1.000	0.000	100	0.175	0.825
Lakelse L.	Schulbuckhand Ck. Williams Ck.	2	1988	77	0.994	0.006	0.000	77	0.565	0.370	0.019	0.045	77	0.994	0.006	77	0.007	0.993
			1987	80	1.000	0.000	0.000	81	0.481	0.457	0.062	0.000	81	0.722	0.278	82	0.031	0.969
			1988	98	1.000	0.000	0.000	88	0.418	0.541	0.026	0.015	98	1.000	0.000	88	0.010	0.990
			1994	100	1.000	0.000	0.000	100	0.500	0.435	0.030	0.035	100	0.995	0.005	100	0.005	0.995
Kitsumkalum L.	Kalam Ch.	1994	4	77	1.000	0.000	0.000	77	0.617	0.299	0.084	0.000	77	1.000	0.000	77	0.046	0.954
McDonell L.		5	1987	87	1.000	0.000	0.000	81	0.309	0.562	0.130	0.000	85	0.818	0.182	87	0.316	0.684
			1988	75	1.000	0.000	0.000	75	0.273	0.647	0.080	0.000	75	0.920	0.080	75	0.300	0.700
			1994	100	1.000	0.000	0.000	100	0.270	0.660	0.070	0.000	100	0.975	0.025	100	0.270	0.730
Morne L.	Nanika R.	1988	6	75	1.000	0.000	0.000	74	0.128	0.764	0.108	0.000	75	0.900	0.100	75	0.167	0.833
Swan L.	Club Ck.	7	1988	100	1.000	0.000	0.000	100	0.300	0.600	0.030	0.070	100	1.000	0.000	100	0.020	0.980
			1994	100	1.000	0.000	0.000	100	0.335	0.600	0.025	0.040	100	0.990	0.010	100	0.010	0.990
Babine L.	L. Babine R.	8	1987	97	1.000	0.000	0.000	82	0.476	0.457	0.061	0.006	88	0.894	0.106	88	0.240	0.760
			1994	100	1.000	0.000	0.000	100	0.395	0.510	0.060	0.035	100	0.890	0.110	100	0.205	0.795
	U. Babine R.	9	1987	98	1.000	0.000	0.000	94	0.438	0.457	0.085	0.021	98	0.694	0.306	98	0.148	0.852
			1994	100	1.000	0.000	0.000	100	0.370	0.540	0.050	0.040	100	0.915	0.085	100	0.175	0.825
	Fulton F. (early)	1990	10	0	.	.	.	100	0.390	0.515	0.085	0.010	0	.	.	100	0.165	0.835
	Fulton F. (late)	1990	0	.	.	.	.	100	0.380	0.545	0.060	0.015	0	.	.	100	0.155	0.845
	Fulton Ch. 1	1985	11	50	1.000	0.000	0.000	0	.	.	.	.	0	.	.	50	0.210	0.790
	1990	0	.	.	.	.	.	100	0.410	0.480	0.085	0.025	0	.	.	100	0.195	0.805
	Fulton Ch. 2	1985	12	146	1.000	0.000	0.000	0	.	.	.	.	0	.	.	145	0.121	0.879
	1987	93	1.000	0.000	0.000	90	0.383	0.500	0.094	0.022	93	0.786	0.204	93	0.188	0.812		
Tacheck Ck.	Fulton R. (early)	1990	0	.	.	.	.	100	0.385	0.565	0.030	0.020	0	.	.	100	0.140	0.860
			1994	100	1.000	0.000	0.000	100	0.440	0.520	0.035	0.005	100	0.925	0.075	100	0.245	0.755
	Fulton R. (late)	1985	13	48	1.000	0.000	0.000	0	.	.	.	.	0	.	.	47	0.202	0.798
	Fulton R.	1985	49	1.000	0.000	0.000	0	.	.	.	.	1	.	.	49	0.184	0.816	
	1987	100	1.000	0.000	0.000	98	0.413	0.418	0.168	0.000	100	0.830	0.170	100	0.150	0.850		
	1990	0	.	.	.	.	.	99	0.444	0.485	0.056	0.015	0	.	.	99	0.232	0.768
	Tacheck Ck.	1985	14	50	1.000	0.000	0.000	10	0.350	0.500	0.100	0.050	10	1.000	0.000	50	0.290	0.710
	Pierre Ck.	1984	15	94	1.000	0.000	0.000	0	.	.	.	.	0	.	.	100	0.220	0.780
	1985	92	1.000	0.000	0.000	85	0.388	0.518	0.088	0.008	83	0.989	0.011	94	0.207	0.793		
	1987	100	1.000	0.000	0.000	94	0.489	0.428	0.085	0.000	98	0.684	0.316	100	0.190	0.810		
Twain Ck.	1988	79	1.000	0.000	0.000	79	0.487	0.437	0.076	0.000	79	0.930	0.070	79	0.202	0.798		
			1994	68	1.000	0.000	0.000	69	0.488	0.428	0.087	0.000	68	0.853	0.147	68	0.318	0.684
	1985	16	103	1.000	0.000	0.000	0	.	.	.	.	0	.	.	103	0.214	0.786	
	1987	99	1.000	0.000	0.000	95	0.458	0.483	0.079	0.000	99	0.687	0.313	100	0.195	0.805		
	1988	100	1.000	0.000	0.000	100	0.445	0.490	0.065	0.000	100	0.910	0.090	100	0.190	0.810		
	Pinkul F. (early)	1990	17	0	.	.	.	100	0.405	0.520	0.050	0.025	0	.	.	100	0.190	0.810
	Pinkul F. (late)	1990	0	.	.	.	.	100	0.270	0.640	0.060	0.030	0	.	.	100	0.175	0.825
	Pinkul Ch.	1985	18	100	1.000	0.000	0.000	0	.	.	.	.	0	.	.	100	0.225	0.775
	1987	100	1.000	0.000	0.000	97	0.345	0.552	0.103	0.000	100	0.800	0.200	100	0.230	0.770		
	1990	0	.	.	.	.	.	99	0.354	0.596	0.040	0.010	0	.	.	100	0.250	0.750
Pinkul R.	1994	100	1.000	0.000	0.000	100	0.335	0.590	0.060	0.015	100	0.900	0.100	100	0.220	0.780		
			1987	98	1.000	0.000	0.000	0	.	.	.	.	0	.	.	95	0.232	0.768
	1987	100	1.000	0.000	0.000	99	0.333	0.606	0.056	0.005	100	0.700	0.300	100	0.220	0.780		
	1990	0	.	.	.	.	.	100	0.355	0.580	0.050	0.015	0	.	.	100	0.154	0.855
	Four Mile Ck.	1987	20	87	1.000	0.000	0.000	88	0.488	0.472	0.063	0.000	89	0.826	0.174	87	0.161	0.839
Grizzly Ck.	1988	75	1.000	0.000	0.000	75	0.447	0.427	0.120	0.007	74	0.959	0.041	75	0.227	0.773		
			1987	78	1.000	0.000	0.000	77	0.481	0.494	0.045	0.000	78	0.699	0.301	78	0.224	0.776
	Morrison R.	1988	22	76	1.000	0.000	0.000	75	0.420	0.467	0.100	0.013	76	0.914	0.086	76	0.164	0.836
	1994	100	1.000	0.000	0.000	100	0.400	0.535	0.055	0.010	100	0.955	0.045	100	0.150	0.850		
L.Tahlo Ck.	1987	23	79	1.000	0.000	0.000	79	0.449	0.513	0.038	0.000	79	0.797	0.203	79	0.158	0.842	
			1988	85	1.000	0.000	0.000	85	0.488	0.441	0.071	0.000	85	0.947	0.053	85	0.129	0.871
	1994	90	1.000	0.000	0.000	90	0.400	0.533	0.061	0.006	90	0.922	0.078	90	0.150	0.850		
Molase L.	Molase Ck.	1994	24	74	1.000	0.000	0.000	46	0.402	0.446	0.120	0.033	74	0.703	0.297	74	0.304	0.696
Bear L.	Azuklotz Ck. Saix Ck.	1988	25	71	1.000	0.000	0.000	71	0.303	0.549	0.148	0.000	71	0.944	0.056	71	0.120	0.880
Sustut L.	Sustut R.	1993	29	93	1.000	0.000	0.000	93	0.167	0.538	0.296	0.000	93	0.995	0.005	93	0.204	0.796
	Johanson L.	Johanson R.	1993	28	60	1.000	0.000	0.000	60	0.108	0.550	0.342	0.000	59	1.000	0.000	60	0.233	0.767

Table 7. (cont'd)

Lake	Collection Location	Site #	PGM-2*			sAAT-3*			GPI-B1,2*			sDHP-2*					
			(N)	*100	*135	*166	(N)	*100	*117	(N)	*100	*132	*20	(N)	*100	*118	
Alastair L.	Southend Ck.	1987 1	75	0.640	0.360	0.000	72	1.000	0.000	75	1.000	0.000	0.000	75	1.000	0.000	
		1988	75	0.620	0.380	0.000	75	1.000	0.000	75	1.000	0.000	0.000	75	0.973	0.027	
		1994	100	0.585	0.415	0.000	100	1.000	0.000	100	1.000	0.000	0.000	100	0.960	0.040	
Lakelse L.	Schubuckhand Ck. Williams Ck.	1988 2	77	0.778	0.221	0.000	77	1.000	0.000	77	1.000	0.000	0.000	77	0.994	0.006	
		1987 3	83	0.813	0.187	0.000	72	1.000	0.000	83	1.000	0.000	0.000	83	1.000	0.000	
		1988	98	0.786	0.214	0.000	98	1.000	0.000	98	1.000	0.000	0.000	98	0.984	0.036	
		1994	100	0.775	0.225	0.000	100	1.000	0.000	100	1.000	0.000	0.000	100	0.965	0.035	
Kitsumkalum L.	Katum Ch.	1994 4	77	0.877	0.123	0.000	77	1.000	0.000	77	1.000	0.000	0.000	77	1.000	0.000	
McDonell L.		1987 5	87	0.851	0.149	0.000	72	0.944	0.056	87	1.000	0.000	0.000	87	1.000	0.000	
		1988	75	0.833	0.167	0.000	75	1.000	0.000	75	1.000	0.000	0.000	75	0.960	0.040	
		1994	100	0.825	0.175	0.000	100	0.965	0.035	100	0.970	0.030	0.000	100	1.000	0.000	
Morce L.	Nanika R.	1988 6	75	0.967	0.033	0.000	75	1.000	0.000	75	1.000	0.000	0.000	75	0.873	0.127	
Swan L.	Club Ck.	1988 7	100	0.860	0.140	0.000	100	1.000	0.000	100	0.995	0.005	0.000	100	0.965	0.035	
		1994	100	0.860	0.140	0.000	100	1.000	0.000	100	1.000	0.000	0.000	100	1.000	0.000	
Babine L.	L. Babine R.	1987 8	89	0.808	0.192	0.000	91	1.000	0.000	98	1.000	0.000	0.000	99	1.000	0.000	
		1994	100	0.785	0.215	0.000	100	1.000	0.000	100	0.985	0.015	0.000	100	1.000	0.000	
	U. Babine R.	1987 9	98	0.781	0.209	0.010	91	1.000	0.000	98	1.000	0.000	0.000	98	1.000	0.000	
		1994	100	0.830	0.170	0.000	100	1.000	0.000	100	0.980	0.020	0.000	100	1.000	0.000	
	Fulton F. (early)	1990 10	100	0.750	0.250	0.000	0	.	.	0	.	.	.	0	.	.	
	Fulton F. (late)	1990	100	0.775	0.225	0.000	0	.	.	0	.	.	.	0	.	.	
	Fulton Ch. 1	1985 11	50	0.840	0.160	0.000	0	.	.	48	1.000	0.000	0.000	0	.	.	
	Fulton Ch. 2	1985 12	144	0.747	0.253	0.000	0	.	.	150	1.000	0.000	0.000	0	.	.	
		1987	93	0.823	0.177	0.000	75	1.000	0.000	91	1.000	0.000	0.000	93	1.000	0.000	
		1990	100	0.815	0.185	0.000	0	.	.	0	.	.	.	0	.	.	
Tacheck Ck.	Fulton R. (early)	1985 13	47	0.777	0.223	0.000	100	1.000	0.000	100	0.985	0.015	0.000	100	0.960	0.040	
	Fulton R. (late)	1985	49	0.798	0.204	0.000	0	.	.	49	1.000	0.000	0.000	0	.	.	
	Fulton R.	1987	100	0.765	0.235	0.000	100	1.000	0.000	94	1.000	0.000	0.000	100	1.000	0.000	
		1990	99	0.747	0.253	0.000	0	.	.	0	.	.	.	0	.	.	
	Pierre Ck.	1985 14	50	0.800	0.200	0.000	0	.	.	50	1.000	0.000	0.000	0	.	.	
Twain Ck.	1984 15	100	0.735	0.265	0.000	0	.	.	96	1.000	0.000	0.000	0	.	.		
		1985	94	0.768	0.234	0.000	0	.	.	96	1.000	0.000	0.000	0	.	.	
		1987	100	0.780	0.220	0.000	95	1.000	0.000	98	1.000	0.000	0.000	100	1.000	0.000	
		1988	79	0.768	0.234	0.000	79	1.000	0.000	79	1.000	0.000	0.000	79	0.987	0.013	
		1994	68	0.772	0.228	0.000	68	1.000	0.000	69	1.000	0.000	0.000	69	1.000	0.000	
Pinkut F. (early)	1985 16	103	0.830	0.170	0.000	0	.	.	103	1.000	0.000	0.000	0	.	.		
	1987	100	0.735	0.265	0.000	93	1.000	0.000	91	1.000	0.000	0.000	100	1.000	0.000		
	1988	100	0.780	0.220	0.000	100	1.000	0.000	100	1.000	0.000	0.000	100	0.880	0.120		
		1990 17	100	0.735	0.265	0.000	0	.	.	0	.	.	.	0	.	.	
	Pinkut F. (late)	1990	100	0.765	0.235	0.000	0	.	.	0	.	.	.	0	.	.	
Pinkut Ch.	1985 18	100	0.675	0.325	0.000	0	.	.	100	1.000	0.000	0.000	0	.	.		
		1987	100	0.825	0.175	0.000	99	1.000	0.000	100	1.000	0.000	0.000	99	0.995	0.005	
		1990	100	0.775	0.225	0.000	0	.	.	0	.	.	.	0	.	.	
		1994	100	0.755	0.245	0.000	100	1.000	0.000	100	1.000	0.000	0.000	100	1.000	0.000	
	Pinkut R.	1985 19	95	0.779	0.221	0.000	0	.	.	95	1.000	0.000	0.000	0	.	.	
Four Mile Ck.	1987	100	0.750	0.250	0.000	90	1.000	0.000	100	1.000	0.000	0.000	99	1.000	0.000		
		1990	100	0.730	0.270	0.000	0	.	.	0	.	.	.	0	.	.	
		1987	89	0.753	0.247	0.000	88	1.000	0.000	82	1.000	0.000	0.000	89	1.000	0.000	
		1988	75	0.760	0.233	0.007	75	1.000	0.000	75	1.000	0.000	0.000	75	0.933	0.067	
	Grizzly Ck.	1987 21	78	0.744	0.256	0.000	77	1.000	0.000	75	1.000	0.000	0.000	78	1.000	0.000	
Morrison R.	1988 22	76	0.808	0.191	0.000	76	1.000	0.000	76	1.000	0.000	0.000	76	0.987	0.013		
		1994	100	0.775	0.225	0.000	100	1.000	0.000	100	1.000	0.000	0.000	100	1.000	0.000	
	L.Tahlo Ck.	1987 23	79	0.753	0.247	0.000	78	1.000	0.000	76	1.000	0.000	0.000	79	1.000	0.000	
		1988	85	0.776	0.224	0.000	85	1.000	0.000	80	0.887	0.075	0.038	85	0.982	0.018	
Motase L.	Motase Ck.	1994 24	74	0.899	0.101	0.000	74	1.000	0.000	69	1.000	0.000	0.000	74	1.000	0.000	
	Azuklitz Ck.	1988 25	71	0.845	0.063	0.092	71	1.000	0.000	70	0.943	0.057	0.000	71	0.944	0.056	
	Saix Ck.	1987 26	81	0.870	0.074	0.056	78	1.000	0.000	62	1.000	0.000	0.000	81	1.000	0.000	
Bear L.		1988	35	0.943	0.043	0.014	35	1.000	0.000	35	1.000	0.000	0.000	35	1.000	0.000	
	Sustut L.	Sustut R.	1993 29	93	0.903	0.097	0.000	93	1.000	0.000	93	1.000	0.000	0.000	93	1.000	0.000
	Johanson L.	Johanson R.	1993 28	60	0.900	0.100	0.000	59	1.000	0.000	60	1.000	0.000	0.000	60	1.000	0.000

Table 7. (cont'd)

Lake	Collection Location	Site #	Year	LDH-82*			PGDH*		ADA-2*			SAH*			G3POH-T*	
				(N)	*100	*115	*85	(N)	*100	*94	(N)	*100	*94	(N)	*100	*150
Alastair L.	Southend Ck.	1987	1	75	1.000	0.000	0.000	75	1.000	0.000	75	1.000	0.000	73	1.000	0.000
		1988		75	1.000	0.000	0.000	75	1.000	0.000	75	1.000	0.000	75	1.000	0.000
		1994	100	1.000	0.000	0.000		100	1.000	0.000	100	1.000	0.000	100	1.000	0.000
Lakelse L.	Schubuckhand Ck. Williams Ck.	1988	2	77	0.987	0.013	0.000	77	1.000	0.000	77	1.000	0.000	77	1.000	0.000
		1987	3	83	0.988	0.012	0.000	83	1.000	0.000	83	1.000	0.000	82	1.000	0.000
		1988		98	0.969	0.031	0.000	98	1.000	0.000	98	1.000	0.000	98	1.000	0.000
		1994	100	0.985	0.015	0.000		100	1.000	0.000	100	1.000	0.000	100	1.000	0.000
Kitsumkalum L.	Kalam Ch.	1994	4	77	0.987	0.013	0.000	77	1.000	0.000	77	1.000	0.000	77	1.000	0.000
McDonald L.		1987	5	87	0.874	0.126	0.000	86	1.000	0.000	87	1.000	0.000	86	1.000	0.000
		1988		75	0.900	0.100	0.000	75	1.000	0.000	75	1.000	0.000	75	1.000	0.000
		1994	100	0.920	0.080	0.000		100	1.000	0.000	100	1.000	0.000	100	1.000	0.000
Morice L.	Nanika R.	1988	6	75	0.860	0.000	0.120	74	0.932	0.068	75	1.000	0.000	75	1.000	0.000
		1994		126	0.921	0.000	0.079	126	1.000	0.000	126	1.000	0.000	126	1.000	0.000
Swan L.	Club Ck.	1988	7	100	0.975	0.025	0.000	100	1.000	0.000	100	1.000	0.000	100	1.000	0.000
		1994		100	0.960	0.040	0.000	100	1.000	0.000	100	1.000	0.000	100	1.000	0.000
Babine L.	L. Babine R.	1987	8	99	0.985	0.000	0.015	98	1.000	0.000	97	0.990	0.010	99	1.000	0.000
		1994		100	0.980	0.010	0.010	100	1.000	0.000	100	1.000	0.000	100	0.995	0.005
	U. Babine R.	1987	9	98	0.954	0.015	0.031	98	1.000	0.000	98	1.000	0.000	98	1.000	0.000
		1994		100	0.965	0.020	0.015	100	1.000	0.000	100	1.000	0.000	100	1.000	0.000
	Fulton F. (early)	1990	10	100	0.970	0.005	0.025	0	.	.	0	.	.	0	.	.
	Fulton F. (late)	1990		100	0.980	0.015	0.005	0	.	.	0	.	.	0	.	.
	Fulton Ch. 1	1985	11	50	0.970	0.010	0.020	0	.	.	50	1.000	0.000	0	.	.
		1990		100	0.980	0.000	0.020	0	.	.	0	.	.	0	.	.
	Fulton Ch. 2	1985	12	150	0.970	0.017	0.013	0	.	.	150	1.000	0.000	0	.	.
		1987		93	0.962	0.016	0.022	93	1.000	0.000	93	1.000	0.000	93	1.000	0.000
Fulton R. (early)	1990		100	0.970	0.010	0.020	0	.	.	0	.	.	0	.	.	
	Fulton R. (late)	1985	13	50	0.980	0.020	0.000	0	.	.	50	1.000	0.000	0	.	.
	Fulton R.	1987		50	0.980	0.020	0.000	0	.	.	50	1.000	0.000	0	.	.
		1990		100	0.975	0.005	0.020	100	1.000	0.000	98	0.995	0.005	100	1.000	0.000
Tacheck Ck.	1985	14	50	0.940	0.010	0.050	0	.	.	50	1.000	0.000	0	.	.	
	Pierre Ck.	1984	15	95	0.968	0.016	0.016	0	.	.	96	1.000	0.000	0	.	.
Twain Ck.	1985		86	0.953	0.010	0.036	0	.	.	96	1.000	0.000	0	.	.	
		1987		100	0.975	0.020	0.005	96	1.000	0.000	100	1.000	0.000	99	0.995	0.005
		1988		79	0.975	0.013	0.013	79	1.000	0.000	79	1.000	0.000	79	1.000	0.000
		1989		69	0.978	0.000	0.022	69	1.000	0.000	69	1.000	0.000	69	1.000	0.000
		1990		103	0.971	0.010	0.019	0	.	.	102	1.000	0.000	0	.	.
		1991		100	0.985	0.000	0.015	97	1.000	0.000	98	1.000	0.000	99	1.000	0.000
Pinkut F. (early)	1988		100	0.970	0.005	0.025	100	0.970	0.030	100	1.000	0.000	100	1.000	0.000	
	Pinkut F. (late)	1990	17	100	0.975	0.010	0.015	0	.	.	0	.	.	0	.	.
	Pinkut Ch.	1985	18	100	0.965	0.010	0.025	0	.	.	0	.	.	0	.	.
		1987		99	0.960	0.000	0.040	100	1.000	0.000	100	0.995	0.005	100	1.000	0.000
Pinkut R.	1990		100	0.960	0.005	0.035	0	.	.	0	.	.	0	.	.	
		1994		100	0.980	0.010	0.010	100	1.000	0.000	100	1.000	0.000	100	1.000	0.000
		1985	19	100	0.975	0.000	0.025	0	.	.	96	1.000	0.000	0	.	.
		1987		100	0.960	0.015	0.005	99	1.000	0.000	0	.	.	96	1.000	0.000
Four Mile Ck.	1987	20	89	0.944	0.022	0.034	89	1.000	0.000	88	1.000	0.000	89	1.000	0.000	
		1988		75	0.960	0.007	0.033	75	1.000	0.000	75	1.000	0.000	75	1.000	0.000
		1989		78	0.987	0.006	0.006	78	1.000	0.000	78	1.000	0.000	77	1.000	0.000
Grizzly Ck.	1987	21	76	0.974	0.013	0.013	76	1.000	0.000	76	1.000	0.000	76	1.000	0.000	
	Morrison R.	1988	22	100	0.995	0.005	0.000	100	1.000	0.000	100	1.000	0.000	100	1.000	0.000
		1994		79	0.975	0.013	0.013	79	1.000	0.000	78	1.000	0.000	79	1.000	0.000
L.Tahlo Ck.	1987	23	85	0.982	0.000	0.018	85	1.000	0.000	85	1.000	0.000	85	1.000	0.000	
		1988		90	0.978	0.006	0.017	90	1.000	0.000	90	1.000	0.000	90	1.000	0.000
		1994		90	0.978	0.006	0.017	90	1.000	0.000	90	1.000	0.000	90	1.000	0.000
Mctase L.	Mctase Ck.	1994	24	74	0.926	0.074	0.000	74	1.000	0.000	73	1.000	0.000	72	1.000	0.000
Bear L.	Azukdotz Ck.	1988	25	71	0.859	0.141	0.000	71	1.000	0.000	71	1.000	0.000	71	1.000	0.000
	Safix Ck.	1987	26	81	0.846	0.154	0.000	74	1.000	0.000	77	1.000	0.000	78	1.000	0.000
		1988		35	0.800	0.200	0.000	35	1.000	0.000	35	1.000	0.000	35	0.986	0.014
Sustut L.	Sustut R.	1993	29	93	0.871	0.129	0.000	93	1.000	0.000	93	1.000	0.000	93	1.000	0.000
Johanson L.	Johanson R.	1993	28	60	0.958	0.042	0.000	60	1.000	0.000	60	1.000	0.000	60	1.000	0.000

Table 7. (cont'd)

Lake	Collection Location	Year	Site #	mIDHP-1*		sIDHP-1*		LDH-B1*		LDH-C*		sMDH-A1,2*	
				(N)	*100 *'64	(N)	*100 *'82	(N)	*100 *'123	(N)	*100 *'82	(N)	*100 *'147
Alastair L.	Southend Ck.	1987	1	75	1.000 0.000	75	1.000 0.000	75	1.000 0.000	66	1.000 0.000	75	1.000 0.000
		1988		75	1.000 0.000	75	0.993 0.007	75	1.000 0.000	75	1.000 0.000	75	1.000 0.000
		1994		100	1.000 0.000	100	0.925 0.075	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000
Lakelse L.	Schubuckhand Ck. Williams Ck.	1988	2	77	1.000 0.000	77	1.000 0.000	77	1.000 0.000	77	1.000 0.000	77	1.000 0.000
		1987	3	83	1.000 0.000	83	1.000 0.000	83	1.000 0.000	72	0.988 0.014	83	1.000 0.000
		1988		98	1.000 0.000	98	1.000 0.000	98	1.000 0.000	98	1.000 0.000	98	1.000 0.000
		1994		100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000
Kitsumkalum L.	Katum Ch.	1994	4	77	1.000 0.000	77	1.000 0.000	77	1.000 0.000	77	1.000 0.000	77	1.000 0.000
McDonell L.		1987	5	87	1.000 0.000	87	1.000 0.000	87	1.000 0.000	78	1.000 0.000	87	1.000 0.000
		1988		75	1.000 0.000	75	1.000 0.000	75	1.000 0.000	75	1.000 0.000	75	1.000 0.000
		1994		100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000
Morice L.	Nanika R.	1988	6	75	1.000 0.000	75	1.000 0.000	75	1.000 0.000	75	1.000 0.000	75	1.000 0.000
		1994		126	1.000 0.000	126	1.000 0.000	126	1.000 0.000	126	1.000 0.000	126	1.000 0.000
Swan L.	Club Ck.	1988	7	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000
		1994		100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000
Babine L.	L. Babine R.	1987	8	99	1.000 0.000	99	1.000 0.000	98	1.000 0.000	83	1.000 0.000	99	1.000 0.000
		1994		100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000
	U. Babine R.	1987	9	98	1.000 0.000	98	1.000 0.000	98	1.000 0.000	87	1.000 0.000	98	1.000 0.000
		1994		100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	99	1.000 0.000
	Fulton F. (early)	1990	10	0	.	0	.	0	.	0	.	0	.
	Fulton F. (late)	1990		0	.	0	.	0	.	0	.	0	.
	Fulton Ch. 1	1985	11	0	.	0	.	0	.	0	.	0	.
	1990		0	.	0	.	0	.	0	.	0	.	0
	Fulton Ch. 2	1985	12	0	.	0	.	0	.	0	.	0	.
	1987		93	1.000 0.000	93	1.000 0.000	93	1.000 0.000	79	1.000 0.000	93	1.000 0.000	
Tacheek Ck.	1990		0	.	0	.	0	.	0	.	0	.	0
	Fulton R. (early)	1985	13	0	.	0	.	0	.	0	.	0	.
	Fulton R. (late)	1985		0	.	0	.	0	.	0	.	0	.
	Fulton R.	1987		100	1.000 0.000	100	1.000 0.000	100	0.995 0.005	80	0.988 0.013	100	1.000 0.000
	1990		0	.	0	.	0	.	0	.	0	.	0
	Tacheek Ck.	1985	14	0	.	0	.	0	.	0	.	0	.
	Pierre Ck.	1984	15	0	.	0	.	0	.	0	.	0	.
	1985		0	.	0	.	0	.	0	.	0	.	0
	1987		100	1.000 0.000	99	1.000 0.000	100	1.000 0.000	64	1.000 0.000	100	1.000 0.000	
	1988		79	1.000 0.000	79	1.000 0.000	79	0.994 0.006	79	1.000 0.000	79	1.000 0.000	
Twain Ck.	1994		69	0.993 0.007	68	1.000 0.000	68	1.000 0.000	68	1.000 0.000	69	1.000 0.000	
	1985	16	0	.	0	.	0	.	0	.	0	.	0
	1987		94	1.000 0.000	99	1.000 0.000	100	1.000 0.000	80	1.000 0.000	100	1.000 0.000	
Pinkut F.	1988		100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	
	(early)	1990	17	0	.	0	.	0	.	0	.	0	.
	(late)	1990		0	.	0	.	0	.	0	.	0	.
Pinkut Ch.	1985	18	0	.	0	.	0	.	0	.	0	.	0
	1987		100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	86	1.000 0.000	99	1.000 0.000	
	1990		0	.	0	.	0	.	0	.	0	.	0
	1994		100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	
	1985	19	0	.	0	.	0	.	0	.	0	.	0
	1987		100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	99	1.000 0.000	100	1.000 0.000	
	1990		0	.	0	.	0	.	0	.	0	.	0
	Four Mile Ck.	1987	20	89	1.000 0.000	89	1.000 0.000	87	1.000 0.000	60	0.983 0.017	89	1.000 0.000
	1988		75	1.000 0.000	75	1.000 0.000	75	1.000 0.000	75	1.000 0.000	75	0.993 0.007	
	Grizzly Ck.	1987	21	78	1.000 0.000	78	1.000 0.000	78	1.000 0.000	45	1.000 0.000	78	1.000 0.000
Morrison R.	1988	22	76	1.000 0.000	76	1.000 0.000	76	1.000 0.000	76	1.000 0.000	76	1.000 0.000	
	1994		100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	
	L.Tahlo Ck.	1987	23	79	1.000 0.000	79	1.000 0.000	79	1.000 0.000	79	1.000 0.000	78	1.000 0.000
	1988		85	1.000 0.000	85	1.000 0.000	85	1.000 0.000	85	1.000 0.000	85	1.000 0.000	
Motase L.	Motase Ck.	1994	24	74	1.000 0.000	74	1.000 0.000	74	1.000 0.000	74	1.000 0.000	74	1.000 0.000
	Azukdotz Ck.	1988	25	71	1.000 0.000	71	1.000 0.000	71	1.000 0.000	71	1.000 0.000	71	1.000 0.000
Bear L.	Salix Ck.	1987	26	81	1.000 0.000	81	1.000 0.000	81	1.000 0.000	77	1.000 0.000	81	1.000 0.000
	1988		35	1.000 0.000	35	1.000 0.000	34	1.000 0.000	35	1.000 0.000	35	1.000 0.000	
Sustut L.	Sustut R.	1993	29	93	1.000 0.000	93	1.000 0.000	93	1.000 0.000	93	1.000 0.000	93	1.000 0.000
Johanson L.	Johanson R.	1993	28	60	1.000 0.000	59	1.000 0.000	60	1.000 0.000	59	1.000 0.000	60	1.000 0.000

Table 7. (cont'd)

Lake	Collection Location	Site #	sMDH-B1.2*		MPI*		PEPA*		sSOD*		G3POH-3.4*		mDHP-2*	
			(N)	*100 *85	(N)	*100 *95	(N)	*100 *106	(N)	*100 *145	(N)	*100	(N)	*100
Alastair L.	Southend Ck.	1987 1	75	1.000 0.000	75	1.000 0.000	73	1.000 0.000	75	1.000 0.000	74	1.000	75	1.000
		1988	75	1.000 0.000	75	1.000 0.000	75	1.000 0.000	75	1.000 0.000	75	1.000	75	1.000
		1994	100	0.990 0.010	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000	100	1.000
Laketse L.	Schubuckhand Ck. Williams Ck.	1988 2	77	1.000 0.000	77	1.000 0.000	77	1.000 0.000	77	1.000 0.000	77	1.000	77	1.000
		1987 3	83	1.000 0.000	83	1.000 0.000	81	1.000 0.000	83	1.000 0.000	82	1.000	83	1.000
		1988	98	1.000 0.000	98	1.000 0.000	98	1.000 0.000	98	1.000 0.000	98	1.000	98	1.000
		1994	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000	100	1.000
Kitsumkalum L.	Katum Ch.	1994 4	77	1.000 0.000	77	1.000 0.000	77	1.000 0.000	77	1.000 0.000	77	1.000	77	1.000
McDonald L.		1987 5	87	1.000 0.000	87	1.000 0.000	85	1.000 0.000	87	1.000 0.000	87	1.000	87	1.000
		1988	75	1.000 0.000	75	1.000 0.000	75	1.000 0.000	74	1.000 0.000	75	1.000	75	1.000
		1994	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000	100	1.000
Morice L.	Nanika R.	1988 6	75	1.000 0.000	75	1.000 0.000	75	0.987 0.013	75	1.000 0.000	75	1.000	75	1.000
		1994	126	1.000 0.000	126	1.000 0.000	126	1.000 0.000	126	1.000 0.000	126	1.000	126	1.000
Swan L.	Club Ck.	1988 7	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000	100	1.000
		1994	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000	100	1.000
Babine L.	L. Babine R.	1987 8	99	1.000 0.000	98	1.000 0.000	99	1.000 0.000	99	1.000 0.000	99	1.000	99	1.000
		1994	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000	100	1.000
	U. Babine R.	1987 9	98	1.000 0.000	98	1.000 0.000	98	1.000 0.000	98	1.000 0.000	98	1.000	98	1.000
		1994	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000	100	1.000
	Fulton F. (early)	1990 10	0	.	0	.	99	1.000 0.000	0	.	0	.	0	.
	Fulton F. (late)	1990	0	.	0	.	100	1.000 0.000	0	.	0	.	0	.
	Fulton Ch. 1	1985 11	0	.	0	.	0	.	50	1.000 0.000	0	.	0	.
	1990	0	.	0	.	0	.	0	.	0	.	0	.	
	Fulton Ch. 2	1985 12	0	.	0	.	0	.	149	1.000 0.000	0	.	0	.
	1987	93	1.000 0.000	93	1.000 0.000	93	1.000 0.000	93	1.000 0.000	93	1.000	93	1.000	
Fulton R.	1985 13	0	.	0	.	0	.	49	1.000 0.000	0	.	0	.	
	Fulton R. (late)	1985	0	.	0	.	0	.	50	1.000 0.000	0	.	0	.
	Fulton R.	1987	99	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	99	1.000	100	1.000
	1990	0	.	0	.	0	.	0	.	0	.	0	.	
Tacheek Ck.	1985 14	0	.	0	.	10	1.000 0.000	50	1.000 0.000	0	.	0	.	
	Pierre Ck.	1984 15	0	.	0	.	0	.	0	.	0	.	0	.
Twain Ck.	1985	0	.	0	.	93	1.000 0.000	94	1.000 0.000	0	.	0	.	
	1987	100	1.000 0.000	99	1.000 0.000	98	1.000 0.000	98	1.000 0.000	99	1.000	100	1.000	
	1988	79	1.000 0.000	79	1.000 0.000	79	1.000 0.000	79	1.000 0.000	79	1.000	79	1.000	
	1994	69	1.000 0.000	68	1.000 0.000	68	1.000 0.000	69	1.000 0.000	68	1.000	69	1.000	
	1985 16	1	1.000 0.000	0	.	0	.	103	1.000 0.000	0	.	0	.	
Pinkut F.	1987	99	1.000 0.000	99	1.000 0.000	99	1.000 0.000	99	1.000 0.000	99	1.000	94	1.000	
	1988	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000	100	1.000	
	1990 17	0	.	0	.	97	1.000 0.000	0	.	0	.	0	.	
	1990	0	.	0	.	100	1.000 0.000	0	.	0	.	0	.	
Pinkut F.	1985 18	0	.	0	.	0	.	100	1.000 0.000	0	.	0	.	
	1987	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	94	1.000	100	1.000	
	1990	0	.	0	.	98	1.000 0.000	0	.	0	.	0	.	
	1994	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000	100	1.000	
Pinkut R.	1985 19	0	.	0	.	0	.	100	1.000 0.000	0	.	0	.	
	1987	100	1.000 0.000	99	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000	100	1.000	
Four Mile Ck.	1989	0	.	0	.	99	1.000 0.000	0	.	0	.	0	.	
	1988	75	1.000 0.000	75	1.000 0.000	74	1.000 0.000	89	1.000 0.000	89	1.000	89	1.000	
Grizzly Ck.	1987 21	78	1.000 0.000	78	1.000 0.000	78	1.000 0.000	78	1.000 0.000	78	1.000	78	1.000	
	1988 22	76	1.000 0.000	76	1.000 0.000	76	1.000 0.000	76	1.000 0.000	76	1.000	76	1.000	
L.Tahlo Ck.	1994	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000 0.000	100	1.000	100	1.000	
	1987 23	79	1.000 0.000	79	1.000 0.000	79	1.000 0.000	79	1.000 0.000	75	1.000	79	1.000	
	1988	85	1.000 0.000	85	1.000 0.000	85	1.000 0.000	85	1.000 0.000	85	1.000	85	1.000	
Motase L.	Motase Ck.	1994 24	74	1.000 0.000	74	1.000 0.000	74	1.000 0.000	74	1.000 0.000	72	1.000	74	1.000
	Azukdotz Ck.	1988 25	71	1.000 0.000	71	1.000 0.000	71	1.000 0.000	71	1.000 0.000	71	1.000	71	1.000
Bear L.	Sofix Ck.	1987 26	81	1.000 0.000	81	1.000 0.000	77	1.000 0.000	79	1.000 0.000	71	1.000	81	1.000
	1988	35	1.000 0.000	34	1.000 0.000	35	1.000 0.000	35	1.000 0.000	35	1.000	35	1.000	
Sustut L.	Sustut R.	1993 29	93	1.000 0.000	93	1.000 0.000	93	1.000 0.000	93	1.000 0.000	93	1.000	93	1.000
	Johanson L.	1993 28	60	0.992 0.008	60	1.000 0.000	59	1.000 0.000	60	1.000 0.000	59	1.000	60	1.000

Table 7. (cont'd)

Lake	Collection Location	Site #	LDH-A1*		LDH-A2*		ME*		sMEP-1*		MAAT-1*		PEP-LT*			
			(N)	*100	(N)	*100	(N)	*100	(N)	*100	(N)	*100	(N)	*100	(N)	*100
Alastair L.	Southend Ck.	1987 1	75	1.000	75	1.000	75	1.000	75	1.000	0	.	.	0	.	.
		1988	75	1.000	75	1.000	75	1.000	75	1.000	0	.	.	0	.	.
		1994	100	1.000	100	1.000	100	1.000	100	1.000	100	0.990	0.010	100	0.995	0.005
Lakelse L.	Schubuckhand Ck.	1988 2	77	1.000	77	1.000	77	1.000	77	1.000	0	.	.	0	.	.
	Williams Ck.	1987 3	83	1.000	83	1.000	83	1.000	83	1.000	0	.	.	0	.	.
		1988	98	1.000	98	1.000	98	1.000	98	1.000	0	.	.	0	.	.
		1994	100	1.000	100	1.000	100	1.000	100	1.000	100	0.895	0.105	100	1.000	0.000
Kitsumkalum L.	Katum Ch.	1994 4	77	1.000	77	1.000	77	1.000	77	1.000	77	0.935	0.065	77	1.000	0.000
McDonald L.		1987 5	87	1.000	87	1.000	87	1.000	87	1.000	0	.	.	0	.	.
		1988	75	1.000	75	1.000	75	1.000	75	1.000	0	.	.	0	.	.
		1994	100	1.000	100	1.000	100	1.000	100	1.000	100	0.870	0.330	100	0.995	0.005
Morice L.	Nanika R.	1988 6	74	1.000	74	1.000	75	1.000	75	1.000	0	.	.	0	.	.
		1994	126	1.000	126	1.000	126	1.000	126	1.000	126	0.892	0.008	126	0.952	0.048
Swan L.	Club Ck.	1988 7	100	1.000	100	1.000	100	1.000	100	1.000	0	.	.	0	.	.
		1994	100	1.000	100	1.000	100	1.000	100	1.000	100	0.735	0.265	100	0.995	0.005
Babine L.	L. Babine R.	1987 8	99	1.000	99	1.000	99	1.000	99	1.000	0	.	.	0	.	.
		1994	100	1.000	100	1.000	100	1.000	100	1.000	100	0.935	0.065	100	0.920	0.080
	U. Babine R.	1987 9	98	1.000	98	1.000	98	1.000	98	1.000	0	.	.	0	.	.
		1994	100	1.000	100	1.000	100	1.000	100	1.000	100	0.950	0.050	100	0.965	0.035
	Fulton F. (early)	1990 10	0	.	0	.	0	.	0	.	100	0.955	0.045	95	0.968	0.026
	Fulton F. (late)	1990	0	.	0	.	0	.	0	.	100	0.845	0.055	100	0.975	0.025
	Fulton Ch. 1	1985 11	0	.	0	.	0	.	0	.	0	.	.	0	.	.
		1990	0	.	0	.	0	.	0	.	100	0.920	0.080	0	.	.
	Fulton Ch. 2	1985 12	0	.	0	.	0	.	0	.	0	.	.	0	.	.
		1987	93	1.000	93	1.000	93	1.000	93	1.000	0	.	.	0	.	.
Fulton R.		1990	0	.	0	.	0	.	0	.	100	0.985	0.015	86	0.948	0.052
		1994	100	1.000	100	1.000	100	1.000	100	1.000	100	0.980	0.020	100	1.000	0.000
	Fulton R. (early)	1985 13	0	.	0	.	0	.	0	.	0	.	.	0	.	.
	Fulton R. (late)	1985	0	.	0	.	0	.	0	.	0	.	.	0	.	.
	Fulton R.	1987	100	1.000	100	1.000	100	1.000	100	1.000	0	.	.	0	.	.
Tacheek Ck.		1990	0	.	0	.	0	.	0	.	99	0.949	0.051	86	0.971	0.029
	Pierre Ck.	1985 14	0	.	0	.	0	.	0	.	0	.	.	0	.	.
		1984 15	0	.	0	.	0	.	0	.	0	.	.	0	.	.
Twain Ck.		1985	0	.	0	.	0	.	0	.	0	.	.	0	.	.
		1987	100	1.000	100	1.000	100	1.000	100	1.000	0	.	.	0	.	.
		1988	79	1.000	79	1.000	79	1.000	79	1.000	0	.	.	0	.	.
		1994	69	1.000	69	1.000	69	1.000	69	1.000	69	0.971	0.029	69	1.000	0.000
		1985 16	0	.	0	.	0	.	0	.	0	.	.	0	.	.
Pinkut F.		1990 17	0	.	0	.	0	.	0	.	100	0.955	0.045	91	0.962	0.038
		1990	0	.	0	.	0	.	0	.	100	0.880	0.020	96	0.953	0.036
		1985 18	0	.	0	.	0	.	0	.	0	.	.	0	.	.
Pinkut R.		1987	100	1.000	100	1.000	100	1.000	100	1.000	0	.	.	0	.	.
		1990	0	.	0	.	0	.	0	.	100	0.960	0.040	87	0.971	0.029
		1994	100	1.000	100	1.000	100	1.000	100	1.000	100	0.970	0.030	100	0.985	0.015
		1985 19	0	.	0	.	0	.	0	.	0	.	.	0	.	.
		1987	100	1.000	100	1.000	100	1.000	100	1.000	0	.	.	0	.	.
Four Mile Ck.		1990	0	.	0	.	0	.	0	.	100	0.990	0.010	85	0.971	0.024
		1987 20	89	1.000	89	1.000	89	1.000	89	1.000	0	.	.	0	.	.
		1988	75	1.000	75	1.000	75	1.000	75	1.000	0	.	.	0	.	.
Grizzly Ck.		1987 21	78	1.000	78	1.000	78	1.000	78	1.000	0	.	.	0	.	.
	Morrison R.	1988 22	76	1.000	76	1.000	76	1.000	76	1.000	0	.	.	0	.	.
L.Tahlo Ck.		1994	100	1.000	100	1.000	100	1.000	100	1.000	100	0.945	0.055	100	0.970	0.030
		1987 23	79	1.000	79	1.000	79	1.000	79	1.000	0	.	.	0	.	.
		1988	85	1.000	85	1.000	85	1.000	85	1.000	0	.	.	0	.	.
		1994	90	1.000	90	1.000	90	1.000	90	1.000	90	0.800	0.100	90	1.000	0.000
McIase L.	McIase Ck.	1994 24	74	1.000	74	1.000	74	1.000	74	1.000	0	.	.	0	.	.
Bear L.	Azukdotz Ck.	1988 25	71	1.000	71	1.000	71	1.000	71	1.000	0	.	.	0	.	.
	Safix Ck.	1987 26	81	1.000	81	1.000	81	1.000	81	1.000	0	.	.	0	.	.
		1988	35	1.000	35	1.000	35	1.000	35	1.000	35	0.871	0.129	35	1.000	0.000
Sustut L.	Sustut R.	1993 29	93	1.000	93	1.000	93	1.000	93	1.000	93	0.849	0.151	93	1.000	0.000
Johanson L.	Johanson R.	1993 28	60	1.000	60	1.000	60	1.000	60	1.000	60	0.933	0.067	60	1.000	0.000

Table 7. (cont'd)

Lake	Collection Location	Site #	Year	mAH-1,2*			AH-3*		AH-4*		
				(N)	*100	*75	*133	(N)	*100	(N)	
Alastair L.	Southend Ck.	1	1987	0	.	.	.	0	.	0	
			1988	0	.	.	.	0	.	0	
			1994	100	0.840	0.130	0.030	100	1.000	100	1.000
Laketse L.	Schulbuckhand Ck. Williams Ck.	2	1988	0	.	.	.	0	.	0	
			1987	0	.	.	.	0	.	0	
			1988	0	.	.	.	0	.	0	
			1994	100	0.830	0.070	0.000	100	1.000	100	1.000
Kitsumkalum L.	Katum Ch.	1994	4	77	0.708	0.195	0.097	77	1.000	77	1.000
McDonell L.		5	1987	0	.	.	.	0	.	0	
			1988	0	.	.	.	0	.	0	
			1994	100	0.890	0.110	0.000	100	1.000	100	1.000
Morice L.	Nanika R.	6	1988	0	.	.	.	0	.	0	
			1994	124	0.847	0.129	0.024	126	1.000	126	1.000
Swan L.	Club Ck.	7	1988	0	.	.	.	0	.	0	
			1994	100	1.000	0.000	0.000	100	1.000	100	1.000
Babine L.	L. Babine R.	8	1987	0	.	.	.	0	.	0	
			1994	100	0.855	0.145	0.000	100	1.000	100	1.000
	U. Babine R.	9	1987	0	.	.	.	0	.	0	
			1994	100	0.860	0.140	0.000	100	1.000	100	1.000
	Fulton F. (early)	1990	10	0	.	.	.	0	.	0	
	Fulton F. (late)	1990	0	.	.	.	.	0	.	0
	Fulton Ch. 1	1985	11	0	.	.	.	0	.	0	
	1990	0	.	.	.	.	.	0	.	0
	Fulton Ch. 2	1985	12	0	.	.	.	0	.	0	
	1987	0	.	.	.	.	.	0	.	0
	1990	0	.	.	.	.	.	0	.	0
	1994	99	0.919	0.071	0.010	.	.	100	1.000	100	1.000
	Fulton R. (early)	1985	13	0	.	.	.	0	.	0	
	Fulton R. (late)	1985	0	.	.	.	.	0	.	0
	Fulton R.	1987	0	.	.	.	.	0	.	0
	1990	0	.	.	.	.	.	0	.	0
	Tacheck Ck.	1985	14	0	.	.	.	0	.	0	
	Pierre Ck.	1984	15	0	.	.	.	0	.	0	
	1985	0	.	.	.	.	.	0	.	0
	1987	0	.	.	.	.	.	0	.	0
	1988	0	.	.	.	.	.	0	.	0
	1994	68	0.809	0.132	0.059	.	.	68	1.000	68	1.000
Twain Ck.	Twain Ck.	16	1985	0	.	.	.	0	.	0	
			1987	0	.	.	.	0	.	0	
			1988	0	.	.	.	0	.	0	
	Pinkut F. (early)	1990	17	0	.	.	.	0	.	0	
	Pinkut F. (late)	1990	0	.	.	.	.	0	.	0
	Pinkut Ch.	1985	18	0	.	.	.	0	.	0	
	1987	0	.	.	.	.	.	0	.	0
	1990	0	.	.	.	.	.	0	.	0
	1994	100	0.740	0.225	0.035	.	.	100	1.000	100	1.000
	Pinkut R.	1985	19	0	.	.	.	0	.	0	
Four Mile Ck.	1987	0	.	.	.	.	.	0	.	0
	1988	0	.	.	.	.	.	0	.	0
	Grizzly Ck.	1987	21	0	.	.	.	0	.	0	
	Morrison R.	1988	22	0	.	.	.	0	.	0	
	1994	100	0.870	0.115	0.015	.	.	100	1.000	100	1.000
L.Tahlo Ck.	1987	23	0	.	.	.	.	0	.	0
	1988	0	.	.	.	.	.	0	.	0
	1994	90	0.844	0.122	0.033	.	.	90	1.000	90	1.000
	Motase L.	Motase Ck.	1994	24	0	.	.	.	0	.	0
Bear L.	Azukdotz Ck.	1988	25	0	.	.	.	0	.	0	
	Salix Ck.	1987	26	0	.	.	.	0	.	0	
	1988	34	0.928	0.074	0.000	.	.	35	1.000	35	1.000
Sustut L.	Sustut R.	1993	29	0	.	.	.	0	.	0	
Johanson L.	Johanson R.	1993	28	0	.	.	.	0	.	0	

Table 8. Distribution of electrophoretically detectable gene diversity among sockeye salmon collections screened at 31 loci.

Locus	Relative gene diversity					
	Absolute gene diversity		Among years		Among sites	
	Total	Within site	Within sites	within sites	within lakes	Among lakes
Most variable loci						
ALAT*	0.5854	0.5468	0.946	0.001	0.005	0.048
PGM-2*	0.3197	0.3073	0.961	0.000	0.002	0.037
PGM-1*	0.2739	0.2618	0.953	0.003	0.003	0.041
PEPC*	0.1981	0.1976	0.906	0.097	-0.020	0.017
LDH-B2*	0.0887	0.0841	0.948	0.000	0.000	0.052
Average across all 31 loci			0.943	0.018	-0.001	0.040

Table 9. Genetic distances (above diagonal) and F_{st} estimates (below diagonal) for pairwise comparison among sockeye salmon populations inhabiting different Skeena lakes. Replicate samples from different years and sites within lakes were pooled. Bold font indicates that F_{st} estimates are statistically greater than zero.

Nursery Lake	Alastair	Lakelse	Kitsumkalum	McDonell	Morice	Swan	Babine	Motase	Bear	Sustut	Johanson
Alastair	0	0.03	0.04	0.04	0.06	0.05	0.03	0.05	0.06	0.05	0.05
Lakelse	0.08	0	0.01	0.03	0.04	0.01	0.01	0.03	0.02	0.04	0.04
Kitsumkalum	0.07	0.03	0	0.03	0.05	0.02	0.02	0.04	0.03	0.03	0.03
McDonell	0.11	0.08	0.11	0	0.03	0.03	0.01	0.01	0.02	0.02	0.02
Morice	0.20	0.13	0.19	0.05	0	0.03	0.02	0.04	0.03	0.04	0.03
Swan	0.13	0.03	0.09	0.07	0.07	0	0.02	0.04	0.02	0.03	0.03
Babine	0.07	0.03	0.06	0.02	0.07	0.04	0	0.01	0.02	0.03	0.03
Motase	0.11	0.11	0.12	0.04	0.11	0.14	0.03	0	0.02	0.03	0.04
Bear	0.13	0.06	0.1	0.03	0.04	0.03	0.04	0.06	0	0.02	0.03
Sustut	0.13	0.11	0.14	0.03	0.06	0.08	0.06	0.08	0.03	0	<.01
Johanson	0.13	0.14	0.18	0.04	0.07	0.11	0.07	0.09	0.05	<.01	0

Table 10. Number of polymorphic loci, average heterozygosity and variant alleles within sockeye salmon populations inhabiting different lakes.

Population (lake)	Sample size per locus			Polymorphic loci		Average Heterozygosity	Variant alleles	
	mean	min.	max.	number	percent		number	percent ¹
Alastair	249	241	250	9	27.3	0.064	12	54.6
Lakelse	357	347	358	9	27.3	0.041	10	45.5
Kitsumkalum	77	77	77	4	12.1	0.029	5	22.7
McDonell	260	247	262	8	24.2	0.055	9	40.9
Morice	201	200	201	9	27.3	0.039	10	45.5
Swan	200	200	200	7	21.2	0.034	9	40.9
Babine	2091	1915	2109	7	21.2	0.056	12	54.6
Motase	73	46	74	5	15.2	0.068	7	31.8
Bear	184	167	187	8	24.2	0.047	11	50.0
Johanson	60	59	60	5	15.2	0.039	6	27.3
Sustut	93	93	93	5	15.2	0.045	6	27.3

¹ Number of variant alleles in population expressed as a percentage of the number of variant alleles in all Skeena samples pooled.

Table 11A. Results of stock composition analysis within the Babine group using test mixtures of known composition (simulations). N=150 for each mixture. G, denotes the use of five genetic markers; P*, the parasites *Philonema oncorhynchi* and *Myxobolus arcticus*; and A, freshwater age. True proportion is 1.00 for all entries in bold type along the diagonal. Standard deviations in parentheses.

Mixture Composition	Traits Used	Babine Group										Babine Total	Other Stocks
		L. Babine	U. Babine	Fulton	Pierre	Twain	Pinkut	Four Mile	Shass	Morrison	Tahlo		
L. Babine	GP*A	0.549 (0.204)	0.060 (0.091)	0.050 (0.086)	0.088 (0.121)	0.028 (0.057)	0.057 (0.095)	0.007 (0.017)	0.085 (0.094)	0.022 (0.043)	0.013 (0.035)	0.959	0.041
U. Babine	GP*A	0.031 (0.024)	0.602 (0.213)	0.147 (0.178)	0.000 (0.000)	0.005 (0.018)	0.120 (0.137)	0.000 (0.000)	0.046 (0.068)	0.022 (0.046)	0.015 (0.034)	0.961	0.040
Fulton	GP*A	0.001 (0.008)	0.099 (0.126)	0.408 (0.245)	0.000 (0.001)	0.030 (0.073)	0.125 (0.139)	0.002 (0.009)	0.059 (0.074)	0.098 (0.106)	0.149 (0.175)	0.969	0.031
Pierre	GP*A	0.031 (0.069)	0.000 (0.002)	0.005 (0.019)	0.638 (0.174)	0.054 (0.084)	0.008 (0.028)	0.019 (0.036)	0.059 (0.081)	0.018 (0.042)	0.103 (0.129)	0.936	0.064
Twain	GP*A	0.000 (0.000)	0.003 (0.014)	0.017 (0.041)	0.004 (0.025)	0.665 (0.207)	0.032 (0.072)	0.062 (0.080)	0.159 (0.149)	0.021 (0.045)	0.104 (0.115)	0.966	0.034
Pinkut	GP*A	0.000 (0.000)	0.051 (0.084)	0.055 (0.094)	0.000 (0.000)	0.009 (0.037)	0.688 (0.186)	0.000 (0.000)	0.096 (0.118)	0.050 (0.066)	0.040 (0.070)	0.989	0.011
Four Mile	GP*A	0.000 (0.000)	0.004 (0.014)	0.003 (0.012)	0.000 (0.001)	0.062 (0.086)	0.012 (0.037)	0.754 (0.121)	0.019 (0.036)	0.021 (0.036)	0.052 (0.081)	0.926	0.074
Shass	GP*A	0.000 (0.000)	0.008 (0.032)	0.010 (0.030)	0.003 (0.015)	0.064 (0.116)	0.065 (0.103)	0.000 (0.001)	0.789 (0.143)	0.008 (0.021)	0.042 (0.076)	0.988	0.012
Morrison	GP*A	0.000 (0.000)	0.011 (0.027)	0.048 (0.082)	0.000 (0.000)	0.002 (0.016)	0.019 (0.039)	0.007 (0.019)	0.007 (0.024)	0.738 (0.164)	0.124 (0.146)	0.955	0.045
Tahlo	GP*A	0.000 (0.000)	0.002 (0.010)	0.029 (0.055)	0.001 (0.008)	0.031 (0.059)	0.023 (0.048)	0.000 (0.000)	0.050 (0.070)	0.106 (0.130)	0.721 (0.180)	0.962	0.038

Table 11B. Results of stock composition analysis within the Skeena River using test mixtures of known composition (simulations). N=150 for each mixture.
G_i denotes the use of five genetic markers; P_i, the parasites *Phitomene oncorhynchi* and *Myxobolus arcticus*; P, *M. arcticus* only; and A, freshwater age.
True proportion is 1.00 for all entries in bold type along the diagonal. Standard deviations in parentheses.

Mixture Composition	Trats Used	Alastair	Schubuckhand	Williams	Kitsunakatum	McDonell	Monice	Swan	Bathine	McInase	Bear	Sustut Johnson	Lakeside Group
Alastair	GPA	0.669 (0.030)	0.006 (0.016)	0.020 (0.026)	0.00 (0.000)	0.000 (0.000)	0.003 (0.005)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.001)	0.028 (0.030)
	GP*	0.848 (0.043)	0.010 (0.021)	0.030 (0.036)	0.00 (0.000)	0.000 (0.000)	0.001 (0.004)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.002)	0.040 (0.042)
	GP	0.846 (0.040)	0.010 (0.020)	0.022 (0.035)	0.00 (0.000)	0.001 (0.003)	0.002 (0.004)	0.021 (0.007)	0.000 (0.000)	0.002 (0.006)	0.002 (0.007)	0.002 (0.003)	0.004 (0.015)
	G	0.944 (0.045)	0.003 (0.012)	0.007 (0.016)	0.020 (0.035)	0.000 (0.000)	0.000 (0.002)	0.001 (0.006)	0.017 (0.028)	0.001 (0.003)	0.002 (0.005)	0.007 (0.015)	0.010 (0.022)
Schubuckhand	GPA	0.008 (0.018)	0.211 (0.095)	0.071 (0.091)	0.00 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.892 (0.018)
	GP*	0.020 (0.028)	0.226 (0.083)	0.053 (0.057)	0.00 (0.000)	0.000 (0.000)	0.002 (0.005)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.979 (0.020)
	GP	0.004 (0.010)	0.088 (0.080)	0.039 (0.049)	0.00 (0.000)	0.000 (0.005)	0.001 (0.006)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.327 (0.059)
	G	0.008 (0.018)	0.331 (0.115)	0.128 (0.051)	0.053 (0.074)	0.002 (0.006)	0.000 (0.001)	0.000 (0.000)	0.014 (0.026)	0.000 (0.002)	0.003 (0.011)	0.001 (0.004)	0.859 (0.109)
Williams	GPA	0.007 (0.016)	0.083 (0.079)	0.110 (0.081)	0.00 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.993 (0.016)
	GP*	0.014 (0.022)	0.275 (0.078)	0.040 (0.084)	0.00 (0.000)	0.000 (0.000)	0.004 (0.012)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.892 (0.024)
	GP	0.005 (0.012)	0.070 (0.086)	0.061 (0.083)	0.026 (0.043)	0.002 (0.009)	0.001 (0.004)	0.007 (0.011)	0.023 (0.033)	0.000 (0.003)	0.003 (0.005)	0.001 (0.002)	0.831 (0.051)
	G	0.008 (0.016)	0.073 (0.083)	0.041 (0.084)	0.021 (0.037)	0.001 (0.006)	0.000 (0.002)	0.035 (0.032)	0.016 (0.030)	0.002 (0.008)	0.002 (0.007)	0.004 (0.008)	0.814 (0.077)
Kitsunakatum	GPA	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
	GP*	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
	GP	0.024 (0.034)	0.027 (0.040)	0.001 (0.022)	0.031 (0.052)	0.005 (0.020)	0.000 (0.002)	0.000 (0.000)	0.008 (0.023)	0.000 (0.000)	0.004 (0.014)	0.000 (0.000)	0.027 (0.040)
	G	0.011 (0.023)	0.032 (0.051)	0.000 (0.021)	0.014 (0.072)	0.002 (0.010)	0.000 (0.000)	0.015 (0.034)	0.004 (0.028)	0.000 (0.000)	0.001 (0.007)	0.020 (0.021)	0.032 (0.031)
McDonell	GPA	0.003 (0.006)	0.002 (0.007)	0.005 (0.010)	0.012 (0.022)	0.001 (0.010)	0.003 (0.005)	0.002 (0.004)	0.003 (0.006)	0.014 (0.027)	0.001 (0.005)	0.003 (0.004)	0.000 (0.000)
	GP*	0.005 (0.009)	0.022 (0.009)	0.005 (0.013)	0.021 (0.021)	0.002 (0.010)	0.002 (0.005)	0.002 (0.004)	0.002 (0.003)	0.018 (0.037)	0.003 (0.016)	0.004 (0.013)	0.000 (0.000)
	GP	0.008 (0.017)	0.001 (0.006)	0.006 (0.022)	0.008 (0.015)	0.022 (0.077)	0.002 (0.008)	0.003 (0.003)	0.059 (0.024)	0.010 (0.001)	0.001 (0.007)	0.003 (0.005)	0.007 (0.023)
	G	0.006 (0.016)	0.000 (0.003)	0.006 (0.021)	0.010 (0.020)	0.032 (0.084)	0.002 (0.014)	0.001 (0.004)	0.035 (0.047)	0.013 (0.032)	0.000 (0.003)	0.043 (0.004)	0.008 (0.021)
Monice	GPA	0.001 (0.003)	0.001 (0.002)	0.003 (0.008)	0.000 (0.001)	0.000 (0.001)	0.002 (0.001)	0.002 (0.001)	0.009 (0.015)	0.004 (0.006)	0.000 (0.005)	0.000 (0.000)	0.003 (0.008)
	GP*	0.003 (0.003)	0.002 (0.006)	0.003 (0.017)	0.000 (0.001)	0.002 (0.005)	0.000 (0.001)	0.002 (0.001)	0.002 (0.015)	0.013 (0.020)	0.001 (0.024)	0.002 (0.007)	0.001 (0.016)
	GP	0.002 (0.002)	0.000 (0.001)	0.001 (0.004)	0.005 (0.005)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.018 (0.024)	0.002 (0.001)	0.001 (0.005)	0.000 (0.000)	0.011 (0.016)
	G	0.001 (0.002)	0.000 (0.003)	0.001 (0.005)	0.006 (0.013)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.028)	0.001 (0.003)	0.000 (0.000)	0.011 (0.024)	0.002 (0.006)
Swan	GPA	0.000 (0.000)	0.000 (0.001)	0.000 (0.018)	0.001 (0.001)	0.000 (0.001)	0.002 (0.001)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.003 (0.008)
	GP*	0.003 (0.017)	0.000 (0.001)	0.002 (0.005)	0.000 (0.001)	0.002 (0.005)	0.000 (0.001)	0.002 (0.001)	0.002 (0.026)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.003 (0.017)
	GP	0.000 (0.000)	0.000 (0.000)	0.000 (0.004)	0.005 (0.005)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.031)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.003 (0.005)
	G	0.003 (0.008)	0.002 (0.009)	0.017 (0.035)	0.015 (0.027)	0.003 (0.016)	0.001 (0.005)	0.058 (0.061)	0.009 (0.023)	0.001 (0.004)	0.001 (0.005)	0.003 (0.010)	0.059 (0.074)
Bathine Group	GPA	0.000 (0.001)	0.001 (0.002)	0.000 (0.002)	0.018 (0.030)	0.002 (0.008)	0.000 (0.001)	0.002 (0.004)	0.000 (0.034)	0.003 (0.003)	0.004 (0.011)	0.000 (0.001)	0.010 (0.016)
	GP*	0.000 (0.000)	0.000 (0.000)	0.000 (0.001)	0.023 (0.038)	0.002 (0.006)	0.000 (0.001)	0.002 (0.002)	0.002 (0.034)	0.000 (0.003)	0.002 (0.003)	0.000 (0.000)	0.001 (0.002)
	GP	0.019 (0.027)	0.022 (0.041)	0.015 (0.037)	0.017 (0.035)	0.015 (0.021)	0.015 (0.022)	0.022 (0.034)	0.001 (0.028)	0.002 (0.034)	0.000 (0.014)	0.001 (0.002)	0.037 (0.052)
	G	0.021 (0.036)	0.014 (0.027)	0.029 (0.083)	0.011 (0.022)	0.015 (0.034)	0.015 (0.024)	0.022 (0.034)	0.015 (0.026)	0.009 (0.039)	0.001 (0.023)	0.012 (0.011)	0.003 (0.005)
McInase	GPA	0.000 (0.000)	0.000 (0.000)	0.000 (0.001)	0.010 (0.020)	0.010 (0.019)	0.019 (0.018)	0.028 (0.028)	0.000 (0.000)	0.001 (0.003)	0.004 (0.011)	0.000 (0.001)	0.001 (0.002)
	GP*	0.005 (0.015)	0.002 (0.007)	0.003 (0.013)	0.009 (0.020)	0.000 (0.004)	0.001 (0.005)	0.022 (0.034)	0.000 (0.000)	0.002 (0.005)	0.005 (0.014)	0.001 (0.002)	0.037 (0.052)
	GP	0.003 (0.007)	0.009 (0.015)	0.006 (0.024)	0.012 (0.035)	0.002 (0.008)	0.001 (0.005)	0.020 (0.034)	0.000 (0.000)	0.002 (0.005)	0.005 (0.014)	0.001 (0.003)	0.032 (0.057)
	G	0.003 (0.008)	0.005 (0.014)	0.004 (0.012)	0.008 (0.020)	0.013 (0.028)	0.001 (0.007)	0.039 (0.052)	0.001 (0.000)	0.002 (0.005)	0.005 (0.017)	0.002 (0.004)	0.035 (0.051)
Bear	GPA	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.022 (0.030)	0.004 (0.013)	0.000 (0.000)	0.000 (0.000)	0.033 (0.034)	0.013 (0.024)	0.027 (0.050)	0.000 (0.000)	0.000 (0.000)
	GP*	0.001 (0.000)	0.001 (0.000)	0.000 (0.000)	0.017 (0.026)	0.003 (0.011)	0.000 (0.000)	0.000 (0.000)	0.038 (0.044)	0.016 (0.024)	0.020 (0.051)	0.000 (0.000)	0.002 (0.004)
	GP	0.001 (0.001)	0.001 (0.003)	0.000 (0.005)	0.020 (0.024)	0.004 (0.012)	0.000 (0.000)	0.000 (0.000)	0.039 (0.044)	0.016 (0.024)	0.022 (0.055)	0.000 (0.000)	0.002 (0.004)
	G	0.001 (0.001)	0.001 (0.003)	0.002 (0.005)	0.008 (0.020)	0.013 (0.028)	0.001 (0.007)	0.000 (0.000)	0.040 (0.051)	0.015 (0.032)	0.020 (0.059)	0.000 (0.000)	0.001 (0.004)
Sustut/Johnson	GPA	0.001 (0.022)	0.000 (0.002)	0.001 (0.003)	0.002 (0.004)	0.002 (0.005)	0.014 (0.021)	0.002 (0.004)	0.016 (0.024)	0.002 (0.004)	0.002 (0.003)	0.001 (0.003)	0.001 (0.003)
	GP*	0.001 (0.003)	0.001 (0.002)	0.001 (0.003)	0.002 (0.004)	0.001 (0.005)	0.001 (0.004)	0.002 (0.004)	0.016 (0.024)	0.002 (0.004)	0.002 (0.003)	0.001 (0.003)	0.002 (0.004)
	GP	0.001 (0.001)	0.001 (0.003)	0.001 (0.005)	0.002 (0.007)	0.001 (0.004)	0.001 (0.003)	0.002 (0.005)	0.017 (0.020)	0.002 (0.005)	0.002 (0.005)	0.001 (0.003)	0.002 (0.004)
	G	0.001 (0.003)	0.001 (0.005)	0.002 (0.006)	0.005 (0.010)	0.001 (0.008)	0.001 (0.005)	0.003 (0.008)	0.018 (0.031)	0.002 (0.007)	0.002 (0.008)	0.001 (0.007)	0.003 (0.009)

Table 12. Sockeye salmon stock composition estimates for the Skeena River test fishery, 1987 to 1997. Standard deviations in parentheses.
The composition for all weeks combined was estimated after pooling subsamples from each week's catch.

Year	Stat Week	N	Alastair	Lakelse	Kitsumkalum	McDonell	Nanika	Swan	Babine G.	Motase	Bear	Sustut
1987	25&26	65	0.000 (0.000)	0.196 (0.201)	0.388 (0.236)	0.103 (0.094)	0.016 (0.023)	0.072 (0.036)	0.225 (0.184)	0.000 (0.027)	0.000 (0.056)	0.000 (0.000)
	27	100	0.000 (0.008)	0.090 (0.112)	0.000 (0.043)	0.114 (0.089)	0.024 (0.017)	0.122 (0.037)	0.645 (0.141)	0.005 (0.035)	0.000 (0.003)	0.000 (0.000)
	28	178	0.000 (0.042)	0.000 (0.047)	0.000 (0.021)	0.022 (0.068)	0.007 (0.012)	0.117 (0.025)	0.762 (0.085)	0.045 (0.038)	0.048 (0.037)	0.001 (0.012)
	29	188	0.000 (0.000)	0.000 (0.060)	0.192 (0.111)	0.082 (0.072)	0.011 (0.013)	0.091 (0.022)	0.625 (0.136)	0.000 (0.006)	0.000 (0.014)	0.000 (0.003)
	30	188	0.000 (0.009)	0.001 (0.080)	0.273 (0.113)	0.052 (0.058)	0.000 (0.007)	0.022 (0.014)	0.630 (0.117)	0.012 (0.020)	0.000 (0.012)	0.011 (0.009)
	31	191	0.000 (0.000)	0.085 (0.080)	0.000 (0.026)	0.050 (0.058)	0.000 (0.000)	0.000 (0.005)	0.841 (0.104)	0.024 (0.022)	0.000 (0.001)	0.000 (0.000)
	32	168	0.000 (0.000)	0.000 (0.014)	0.074 (0.082)	0.013 (0.034)	0.023 (0.014)	0.000 (0.000)	0.885 (0.095)	0.000 (0.015)	0.000 (0.003)	0.006 (0.006)
	33	113	0.001 (0.045)	0.000 (0.022)	0.000 (0.005)	0.000 (0.000)	0.000 (0.007)	0.009 (0.009)	0.991 (0.050)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
	34	91	0.000 (0.015)	0.000 (0.004)	0.266 (0.152)	0.065 (0.088)	0.029 (0.022)	0.000 (0.000)	0.601 (0.163)	0.039 (0.050)	0.000 (0.039)	0.000 (0.000)
	all weeks	834	0.000 (0.002)	0.033 (0.045)	0.034 (0.060)	0.098 (0.040)	0.015 (0.006)	0.032 (0.010)	0.773 (0.086)	0.012 (0.008)	0.003 (0.000)	0.001 (0.004)
1988 gillnet	27	72	0.073 (0.053)	0.199 (0.076)	0.157 (0.104)	0.000 (0.042)	0.032 (0.029)	0.088 (0.034)	0.335 (0.124)	0.086 (0.072)	0.000 (0.068)	0.031 (0.029)
	28	90	0.088 (0.051)	0.031 (0.034)	0.068 (0.075)	0.197 (0.126)	0.011 (0.018)	0.016 (0.022)	0.483 (0.153)	0.031 (0.075)	0.000 (0.042)	0.077 (0.035)
	29	90	0.013 (0.034)	0.000 (0.014)	0.000 (0.035)	0.001 (0.047)	0.000 (0.000)	0.056 (0.025)	0.930 (0.073)	0.000 (0.011)	0.000 (0.013)	0.000 (0.014)
	30	81	0.000 (0.006)	0.012 (0.030)	0.048 (0.095)	0.113 (0.105)	0.000 (0.000)	0.000 (0.005)	0.816 (0.158)	0.000 (0.000)	0.000 (0.037)	0.012 (0.013)
	31	94	0.000 (0.015)	0.000 (0.018)	0.130 (0.110)	0.078 (0.087)	0.006 (0.010)	0.011 (0.012)	0.728 (0.144)	0.000 (0.000)	0.047 (0.033)	0.000 (0.000)
	32	102	0.011 (0.016)	0.000 (0.005)	0.147 (0.107)	0.114 (0.093)	0.000 (0.000)	0.000 (0.000)	0.729 (0.159)	0.000 (0.000)	0.000 (0.008)	0.010 (0.009)
	33	98	0.019 (0.022)	0.000 (0.003)	0.182 (0.128)	0.033 (0.061)	0.008 (0.011)	0.000 (0.000)	0.748 (0.152)	0.000 (0.000)	0.000 (0.005)	0.010 (0.009)
	34	94	0.048 (0.022)	0.000 (0.016)	0.226 (0.111)	0.000 (0.021)	0.000 (0.000)	0.000 (0.000)	0.728 (0.118)	0.000 (0.000)	0.000 (0.019)	0.000 (0.000)
	35	40	0.000 (0.004)	0.000 (0.000)	0.425 (0.158)	0.231 (0.133)	0.000 (0.000)	0.000 (0.000)	0.344 (0.216)	0.000 (0.034)	0.000 (0.039)	0.000 (0.000)
	all weeks	478	0.015 (0.017)	0.011 (0.011)	0.086 (0.062)	0.122 (0.059)	0.010 (0.006)	0.015 (0.007)	0.726 (0.090)	0.000 (0.007)	0.015 (0.016)	0.020 (0.008)
1988 seine	25&26	77	0.312 (0.081)	0.175 (0.071)	0.000 (0.018)	0.033 (0.080)	0.112 (0.048)	0.011 (0.015)	0.272 (0.092)	0.030 (0.051)	0.036 (0.038)	0.021 (0.025)
	27	67	0.204 (0.064)	0.190 (0.069)	0.000 (0.025)	0.075 (0.066)	0.000 (0.011)	0.062 (0.037)	0.441 (0.117)	0.000 (0.000)	0.028 (0.026)	0.000 (0.026)
	28	91	0.014 (0.024)	0.111 (0.043)	0.001 (0.057)	0.135 (0.121)	0.002 (0.013)	0.044 (0.021)	0.638 (0.155)	0.000 (0.023)	0.058 (0.048)	0.000 (0.000)
	29	93	0.000 (0.000)	0.041 (0.028)	0.151 (0.104)	0.206 (0.127)	0.000 (0.007)	0.041 (0.023)	0.559 (0.171)	0.000 (0.033)	0.000 (0.003)	0.002 (0.010)
	30	97	0.034 (0.042)	0.000 (0.007)	0.198 (0.119)	0.073 (0.070)	0.000 (0.000)	0.000 (0.000)	0.695 (0.144)	0.000 (0.000)	0.000 (0.027)	0.000 (0.000)
	31	91	0.017 (0.015)	0.002 (0.008)	0.013 (0.083)	0.000 (0.005)	0.011 (0.011)	0.000 (0.000)	0.943 (0.091)	0.000 (0.000)	0.014 (0.025)	0.000 (0.000)
	32	88	0.018 (0.016)	0.000 (0.016)	0.006 (0.063)	0.000 (0.027)	0.000 (0.000)	0.030 (0.018)	0.907 (0.076)	0.000 (0.000)	0.041 (0.039)	0.000 (0.000)
	33	101	0.014 (0.013)	0.000 (0.000)	0.223 (0.119)	0.081 (0.064)	0.000 (0.010)	0.000 (0.000)	0.667 (0.131)	0.018 (0.035)	0.000 (0.016)	0.000 (0.000)
	34	84	0.010 (0.010)	0.018 (0.017)	0.028 (0.060)	0.095 (0.086)	0.000 (0.000)	0.000 (0.000)	0.849 (0.100)	0.000 (0.000)	0.000 (0.004)	0.000 (0.000)
	35	56	0.036 (0.023)	0.000 (0.000)	0.003 (0.057)	0.000 (0.001)	0.000 (0.000)	0.000 (0.008)	0.842 (0.066)	0.000 (0.000)	0.002 (0.033)	0.018 (0.017)
	all weeks	426	0.000 (0.007)	0.031 (0.016)	0.124 (0.061)	0.041 (0.048)	0.004 (0.005)	0.023 (0.003)	0.763 (0.083)	0.000 (0.004)	0.013 (0.012)	0.000 (0.002)
1989	24&25	47	0.327 (0.114)	0.265 (0.098)	0.016 (0.022)	0.240 (0.092)	0.059 (0.047)	0.000 (0.000)	0.035 (0.059)	0.000 (0.018)	0.000 (0.004)	0.036 (0.029)
	26	81	0.189 (0.061)	0.089 (0.058)	0.000 (0.040)	0.322 (0.130)	0.025 (0.022)	0.022 (0.025)	0.333 (0.122)	0.000 (0.022)	0.000 (0.000)	0.020 (0.021)
	27	134	0.046 (0.028)	0.118 (0.034)	0.000 (0.028)	0.176 (0.107)	0.000 (0.016)	0.045 (0.018)	0.577 (0.103)	0.040 (0.030)	0.000 (0.014)	0.000 (0.005)
	28	152	0.055 (0.032)	0.095 (0.036)	0.000 (0.035)	0.110 (0.080)	0.014 (0.011)	0.006 (0.006)	0.720 (0.093)	0.000 (0.000)	0.000 (0.001)	0.000 (0.000)
	29	155	0.011 (0.016)	0.053 (0.021)	0.038 (0.061)	0.016 (0.034)	0.000 (0.009)	0.008 (0.008)	0.886 (0.071)	0.000 (0.000)	0.008 (0.011)	0.000 (0.001)
	30	163	0.017 (0.021)	0.045 (0.026)	0.024 (0.045)	0.000 (0.028)	0.003 (0.004)	0.000 (0.000)	0.904 (0.062)	0.006 (0.006)	0.000 (0.000)	0.000 (0.000)
	31	164	0.000 (0.004)	0.035 (0.013)	0.045 (0.066)	0.000 (0.017)	0.000 (0.003)	0.000 (0.000)	0.920 (0.070)	0.000 (0.000)	0.000 (0.021)	0.000 (0.000)
	32	111	0.000 (0.008)	0.008 (0.012)	0.164 (0.101)	0.000 (0.017)	0.025 (0.018)	0.008 (0.009)	0.795 (0.106)	0.000 (0.011)	0.000 (0.000)	0.000 (0.000)
	33	110	0.000 (0.000)	0.000 (0.000)	0.199 (0.100)	0.003 (0.043)	0.000 (0.004)	0.000 (0.000)	0.798 (0.115)	0.000 (0.021)	0.000 (0.008)	0.000 (0.000)
	34	23	0.000 (0.000)	0.087 (0.062)	0.000 (0.088)	0.000 (0.000)	0.000 (0.005)	0.000 (0.000)	0.852 (0.144)	0.062 (0.068)	0.000 (0.001)	0.000 (0.000)
	all weeks	879	0.042 (0.013)	0.067 (0.014)	0.038 (0.035)	0.052 (0.040)	0.008 (0.005)	0.006 (0.003)	0.782 (0.058)	0.000 (0.005)	0.000 (0.003)	0.005 (0.003)
1990	25&26	53	0.341 (0.088)	0.000 (0.037)	0.000 (0.000)	0.000 (0.037)	0.116 (0.061)	0.000 (0.000)	0.440 (0.104)	0.072 (0.078)	0.030 (0.040)	0.000 (0.000)
	27	76	0.045 (0.031)	0.042 (0.031)	0.000 (0.026)	0.168 (0.120)	0.112 (0.044)	0.029 (0.026)	0.472 (0.119)	0.108 (0.061)	0.000 (0.011)	0.024 (0.020)
	28	84	0.002 (0.024)	0.001 (0.015)	0.068 (0.088)	0.000 (0.022)	0.109 (0.044)	0.000 (0.000)	0.805 (0.066)	0.015 (0.034)	0.000 (0.000)	0.000 (0.000)
	29	159	0.007 (0.007)	0.016 (0.015)	0.031 (0.046)	0.100 (0.063)	0.054 (0.022)	0.015 (0.011)	0.784 (0.081)	0.000 (0.018)	0.000 (0.000)	0.000 (0.000)
	30	152	0.016 (0.014)	0.000 (0.006)	0.000 (0.031)	0.000 (0.026)	0.068 (0.024)	0.006 (0.005)	0.889 (0.056)	0.021 (0.024)	0.000 (0.000)	0.000 (0.005)
	31	170	0.000 (0.000)	0.013 (0.015)	0.139 (0.069)	0.000 (0.014)	0.000 (0.005)	0.000 (0.000)	0.807 (0.073)	0.029 (0.025)	0.000 (0.005)	0.006 (0.006)
	32	153	0.009 (0.010)	0.011 (0.010)	0.054 (0.061)	0.000 (0.001)	0.018 (0.013)	0.000 (0.000)	0.856 (0.074)	0.000 (0.001)	0.053 (0.047)	0.000 (0.000)
	33	163	0.000 (0.008)	0.043 (0.018)	0.001 (0.038)	0.000 (0.024)	0.020 (0.015)	0.000 (0.000)	0.910 (0.081)	0.000 (0.014)	0.028 (0.032)	0.000 (0.000)
	34	89	0.000 (0.010)	0.009 (0.010)	0.167 (0.091)	0.000 (0.011)	0.000 (0.002)	0.000 (0.005)	0.732 (0.103)	0.063 (0.047)	0.000 (0.002)	0.009 (0.011)
	all weeks	709	0.023 (0.009)	0.010 (0.009)	0.053 (0.033)	0.000 (0.020)	0.042 (0.012)	0.005 (0.003)	0.831 (0.044)	0.031 (0.020)	0.001 (0.008)	0.003 (0.003)

Table 12. (cont'd)

Year	Stat Week	N	Alastair	Lakeisha	Kitsumkalum	McDoneill	Nanita	Swan	Babine G.	Motse	Bear	Sustut
1991	28	160	0.017 (0.022)	0.053 (0.025)	0.000 (0.023)	0.013 (0.060)	0.061 (0.023)	0.131 (0.025)	0.703 (0.073)	0.000 (0.000)	0.000 (0.003)	0.016 (0.015)
	29	152	0.000 (0.000)	0.020 (0.013)	0.000 (0.041)	0.060 (0.051)	0.101 (0.030)	0.064 (0.024)	0.670 (0.074)	0.054 (0.040)	0.007 (0.026)	0.024 (0.020)
	30	170	0.020 (0.014)	0.028 (0.015)	0.000 (0.028)	0.048 (0.055)	0.047 (0.022)	0.042 (0.018)	0.764 (0.068)	0.053 (0.033)	0.000 (0.025)	0.000 (0.007)
	31	152	0.000 (0.007)	0.024 (0.017)	0.048 (0.079)	0.122 (0.088)	0.037 (0.024)	0.016 (0.012)	0.744 (0.117)	0.000 (0.015)	0.000 (0.018)	0.010 (0.010)
	32	157	0.008 (0.006)	0.000 (0.000)	0.046 (0.059)	0.000 (0.015)	0.004 (0.009)	0.006 (0.008)	0.910 (0.068)	0.000 (0.008)	0.011 (0.027)	0.017 (0.012)
	33	165	0.000 (0.000)	0.000 (0.000)	0.155 (0.080)	0.000 (0.000)	0.018 (0.014)	0.000 (0.000)	0.813 (0.080)	0.014 (0.016)	0.000 (0.011)	0.000 (0.000)
	34	134	0.007 (0.008)	0.000 (0.000)	0.234 (0.087)	0.000 (0.002)	0.014 (0.013)	0.000 (0.000)	0.715 (0.091)	0.023 (0.025)	0.000 (0.028)	0.008 (0.008)
	all weeks	825	0.015 (0.007)	0.046 (0.011)	0.032 (0.026)	0.031 (0.007)	0.052 (0.011)	0.058 (0.010)	0.735 (0.045)	0.023 (0.016)	0.001 (0.013)	0.008 (0.005)
1992	26&27	42	0.068 (0.061)	0.032 (0.043)	0.085 (0.078)	0.000 (0.043)	0.203 (0.069)	0.000 (0.000)	0.534 (0.114)	0.000 (0.000)	0.039 (0.043)	0.040 (0.033)
	28	135	0.020 (0.018)	0.032 (0.018)	0.119 (0.063)	0.000 (0.026)	0.236 (0.044)	0.052 (0.024)	0.499 (0.081)	0.000 (0.014)	0.000 (0.002)	0.043 (0.023)
	29	119	0.023 (0.018)	0.014 (0.017)	0.049 (0.068)	0.089 (0.082)	0.131 (0.043)	0.031 (0.025)	0.823 (0.109)	0.000 (0.021)	0.000 (0.007)	0.040 (0.024)
	30	116	0.000 (0.008)	0.008 (0.009)	0.026 (0.047)	0.026 (0.081)	0.138 (0.040)	0.018 (0.015)	0.711 (0.098)	0.000 (0.017)	0.071 (0.048)	0.000 (0.002)
	31	84	0.013 (0.013)	0.001 (0.012)	0.107 (0.088)	0.095 (0.085)	0.123 (0.041)	0.012 (0.010)	0.820 (0.117)	0.024 (0.031)	0.005 (0.039)	0.000 (0.000)
	32	117	0.000 (0.002)	0.009 (0.008)	0.118 (0.099)	0.000 (0.026)	0.058 (0.021)	0.000 (0.004)	0.717 (0.126)	0.000 (0.010)	0.100 (0.063)	0.000 (0.000)
	33&34	127	0.004 (0.009)	0.014 (0.011)	0.070 (0.085)	0.036 (0.045)	0.003 (0.015)	0.007 (0.008)	0.832 (0.107)	0.018 (0.032)	0.017 (0.025)	0.000 (0.000)
	all weeks	450	0.012 (0.006)	0.005 (0.005)	0.084 (0.047)	0.060 (0.049)	0.138 (0.022)	0.018 (0.008)	0.633 (0.087)	0.009 (0.016)	0.023 (0.017)	0.021 (0.009)
1993	28	102	0.061 (0.040)	0.022 (0.021)	0.263 (0.083)	0.197 (0.078)	0.069 (0.040)	0.013 (0.019)	0.343 (0.117)	0.000 (0.028)	0.000 (0.019)	0.033 (0.025)
	27	73	0.005 (0.018)	0.000 (0.001)	0.064 (0.081)	0.152 (0.087)	0.056 (0.037)	0.025 (0.020)	0.684 (0.126)	0.000 (0.030)	0.034 (0.049)	0.000 (0.000)
	28	121	0.000 (0.005)	0.002 (0.009)	0.038 (0.067)	0.078 (0.100)	0.066 (0.026)	0.033 (0.019)	0.728 (0.128)	0.041 (0.039)	0.000 (0.039)	0.016 (0.014)
	29	103	0.015 (0.012)	0.004 (0.009)	0.007 (0.056)	0.000 (0.003)	0.014 (0.015)	0.008 (0.016)	0.913 (0.065)	0.000 (0.003)	0.006 (0.027)	0.032 (0.021)
	30	80	0.000 (0.000)	0.000 (0.000)	0.089 (0.120)	0.114 (0.117)	0.044 (0.035)	0.000 (0.009)	0.631 (0.171)	0.096 (0.065)	0.000 (0.004)	0.027 (0.020)
	31	141	0.009 (0.008)	0.005 (0.008)	0.308 (0.108)	0.000 (0.000)	0.002 (0.011)	0.000 (0.000)	0.688 (0.106)	0.000 (0.013)	0.000 (0.021)	0.008 (0.008)
	32	47	0.021 (0.019)	0.000 (0.000)	0.197 (0.153)	0.000 (0.076)	0.000 (0.000)	0.000 (0.000)	0.848 (0.185)	0.074 (0.059)	0.061 (0.086)	0.000 (0.000)
	all weeks	520	0.015 (0.007)	0.000 (0.003)	0.150 (0.062)	0.037 (0.041)	0.031 (0.012)	0.009 (0.006)	0.718 (0.075)	0.000 (0.018)	0.028 (0.021)	0.015 (0.008)
1994	all weeks	281	0.004 (0.010)	0.029 (0.014)	0.000 (0.034)	0.048 (0.051)	0.017 (0.010)	0.013 (0.007)	0.802 (0.062)	0.024 (0.018)	0.038 (0.025)	0.023 (0.013)
1995	28	130	0.021 (0.022)	0.065 (0.031)	0.015 (0.041)	0.138 (0.081)	0.047 (0.020)	0.144 (0.037)	0.557 (0.095)	0.000 (0.024)	0.000 (0.002)	0.014 (0.014)
	27	147	0.014 (0.018)	0.088 (0.031)	0.056 (0.058)	0.178 (0.100)	0.023 (0.016)	0.119 (0.027)	0.508 (0.130)	0.000 (0.014)	0.017 (0.017)	0.000 (0.000)
	28	148	0.000 (0.000)	0.021 (0.013)	0.000 (0.018)	0.101 (0.067)	0.061 (0.021)	0.083 (0.022)	0.690 (0.077)	0.000 (0.000)	0.052 (0.041)	0.011 (0.013)
	29	157	0.020 (0.018)	0.030 (0.014)	0.004 (0.048)	0.000 (0.005)	0.077 (0.027)	0.064 (0.019)	0.805 (0.051)	0.000 (0.001)	0.000 (0.000)	0.000 (0.000)
	30	151	0.000 (0.004)	0.000 (0.004)	0.018 (0.061)	0.001 (0.036)	0.030 (0.014)	0.013 (0.010)	0.932 (0.078)	0.000 (0.002)	0.000 (0.002)	0.000 (0.002)
	31	148	0.000 (0.007)	0.021 (0.014)	0.155 (0.078)	0.000 (0.022)	0.001 (0.005)	0.014 (0.010)	0.781 (0.088)	0.000 (0.000)	0.028 (0.026)	0.000 (0.000)
	32	153	0.000 (0.000)	0.013 (0.009)	0.087 (0.076)	0.000 (0.019)	0.021 (0.014)	0.007 (0.008)	0.873 (0.078)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
	33	122	0.000 (0.000)	0.008 (0.008)	0.111 (0.075)	0.000 (0.025)	0.000 (0.002)	0.000 (0.000)	0.877 (0.080)	0.000 (0.000)	0.000 (0.025)	0.005 (0.006)
	all weeks	841	0.004 (0.004)	0.025 (0.007)	0.033 (0.032)	0.058 (0.031)	0.034 (0.007)	0.046 (0.008)	0.778 (0.048)	0.000 (0.001)	0.018 (0.011)	0.004 (0.004)
1996	25	61	0.071 (0.046)	0.053 (0.041)	0.075 (0.073)	0.174 (0.128)	0.003 (0.022)	0.011 (0.015)	0.562 (0.163)	0.030 (0.039)	0.000 (0.024)	0.021 (0.018)
	26	120	0.048 (0.027)	0.042 (0.025)	0.117 (0.079)	0.012 (0.058)	0.000 (0.007)	0.024 (0.015)	0.758 (0.108)	0.000 (0.015)	0.000 (0.014)	0.000 (0.000)
	27	128	0.023 (0.021)	0.020 (0.022)	0.000 (0.040)	0.402 (0.128)	0.055 (0.029)	0.020 (0.024)	0.437 (0.128)	0.000 (0.004)	0.000 (0.000)	0.043 (0.029)
	28	138	0.003 (0.007)	0.008 (0.011)	0.000 (0.011)	0.181 (0.106)	0.028 (0.022)	0.031 (0.018)	0.730 (0.100)	0.010 (0.041)	0.000 (0.009)	0.033 (0.020)
	29	138	0.012 (0.011)	0.003 (0.005)	0.000 (0.028)	0.028 (0.078)	0.045 (0.026)	0.038 (0.020)	0.874 (0.081)	0.000 (0.011)	0.000 (0.029)	0.000 (0.010)
	30	135	0.000 (0.000)	0.000 (0.000)	0.000 (0.014)	0.088 (0.076)	0.009 (0.012)	0.003 (0.010)	0.899 (0.075)	0.000 (0.013)	0.000 (0.000)	0.000 (0.003)
	31	158	0.000 (0.000)	0.002 (0.056)	0.000 (0.018)	0.000 (0.000)	0.024 (0.011)	0.074 (0.064)	0.000 (0.000)	0.000 (0.012)	0.000 (0.000)	0.000 (0.000)
	32	160	0.000 (0.000)	0.002 (0.005)	0.080 (0.078)	0.051 (0.048)	0.000 (0.000)	0.022 (0.011)	0.845 (0.083)	0.000 (0.011)	0.000 (0.011)	0.001 (0.007)
	33	118	0.000 (0.000)	0.000 (0.000)	0.000 (0.024)	0.000 (0.011)	0.000 (0.002)	0.015 (0.013)	0.981 (0.044)	0.000 (0.003)	0.000 (0.006)	0.004 (0.010)
	34	91	0.011 (0.013)	0.001 (0.008)	0.000 (0.018)	0.128 (0.087)	0.000 (0.000)	0.043 (0.023)	0.818 (0.084)	0.000 (0.000)	0.000 (0.026)	0.000 (0.003)
	all weeks	788	0.018 (0.006)	0.003 (0.005)	0.000 (0.013)	0.088 (0.041)	0.003 (0.005)	0.024 (0.007)	0.858 (0.039)	0.000 (0.001)	0.000 (0.000)	0.009 (0.006)
1997	all weeks	221	0.000 (0.009)	0.014 (0.012)	0.118 (0.067)	0.000 (0.002)	0.078 (0.021)	0.020 (0.029)	0.736 (0.073)	0.000 (0.000)	0.007 (0.015)	0.027 (0.027)

Table 13. Sockeye salmon spawning escapements estimated from stock composition analysis of test fishery samples and Babine fence count.

Year	Total Skeena R. Escapement	Spawning Ground Escapement										Sustut/ Johanson
		Alastair	Lakelse	Kitsumkalum	McDonell	Morice	Swan	Babine fence count	Motase	Bear		
1987	1619873	0	46147	47545	137042	19162	41686	1307852	15329	3832		1277
1988	1813411	22556	16541	99244	183452	13692	21124	1408879	0	20539		27385
1989	1400281	52113	83133	47150	64521	8786	6771	1132316	0	0		5491
1990	1149967	24839	10799	57237	0	40106	4918	978646	29602	955		2865
1991	1497834	19100	58573	40746	39473	59176	68033	1176318	26174	1138		9104
1992	1710806	16562	6901	115937	82812	169248	20559	1233785	11038	28208		25755
1993	2279663	29487	0	294866	72734	55254	16819	1737426	0	46342		26736
1994	1269098	4629	33560	0	56705	17706	14022	1052905	24996	40619		23955
1995	2158905	7992	49952	65936	115888	59953	83381	1737009	0	31740		7053
1996	2420192	46912	7819	0	224133	6970	57245	2056205	0	0		20909
1997	1421954	0	19051	160572	0	91597	24198	1086610	0	8220		31707

Table 14. Comparison of estimated Babine contributions (as a percentage of total Skeena sockeye salmon return) based on visual enumeration versus stock composition of test fishery samples.

Year	Babine fence count	Non-Babine escapement (BC16 database)	% Babine computed from:			Implied % non-Babine ^c	
			visual enumeration	test fishery stock ID (group 1) ^a	test fishery stock ID (group 2) ^b	observed (group 1)	observed (group 2)
1987	1307852	16276	98.8	77.3	88.3	4.2	9.4
1988	1408879	8664	99.4	72.6	84.8	1.6	3.4
1989	1132316	27678	97.6	78.2	83.4	8.8	12.3
1990	978646	32920	96.6	83.1	86.2	16.5	21.0
1991	1176318	77050	93.4	73.5	78.9	18.2	24.5
1992	1233785	76152	93.8	63.3	70.2	10.6	14.5
1993	1737426	69590	96.0	71.8	75.5	10.2	12.3
1994	1052905	22366	97.9	80.2	87.5	8.6	14.9
1995	1737009	81175	95.3	77.8	83.6	16.4	23.8
1996	2056205	81545	96.0	85.8	94.4	24.0	66.9
1997	1086610	54455	95.0	73.6	73.6	14.0	14.0

^a Test fishery stock ID percentages for "group 1" include Babine only.

^b Test fishery stock ID percentages for "group 2" include Babine, McDonell and Motase (see Discussion).

^c Percentage of the non-Babine escapement accounted for if stock ID estimates are correct.

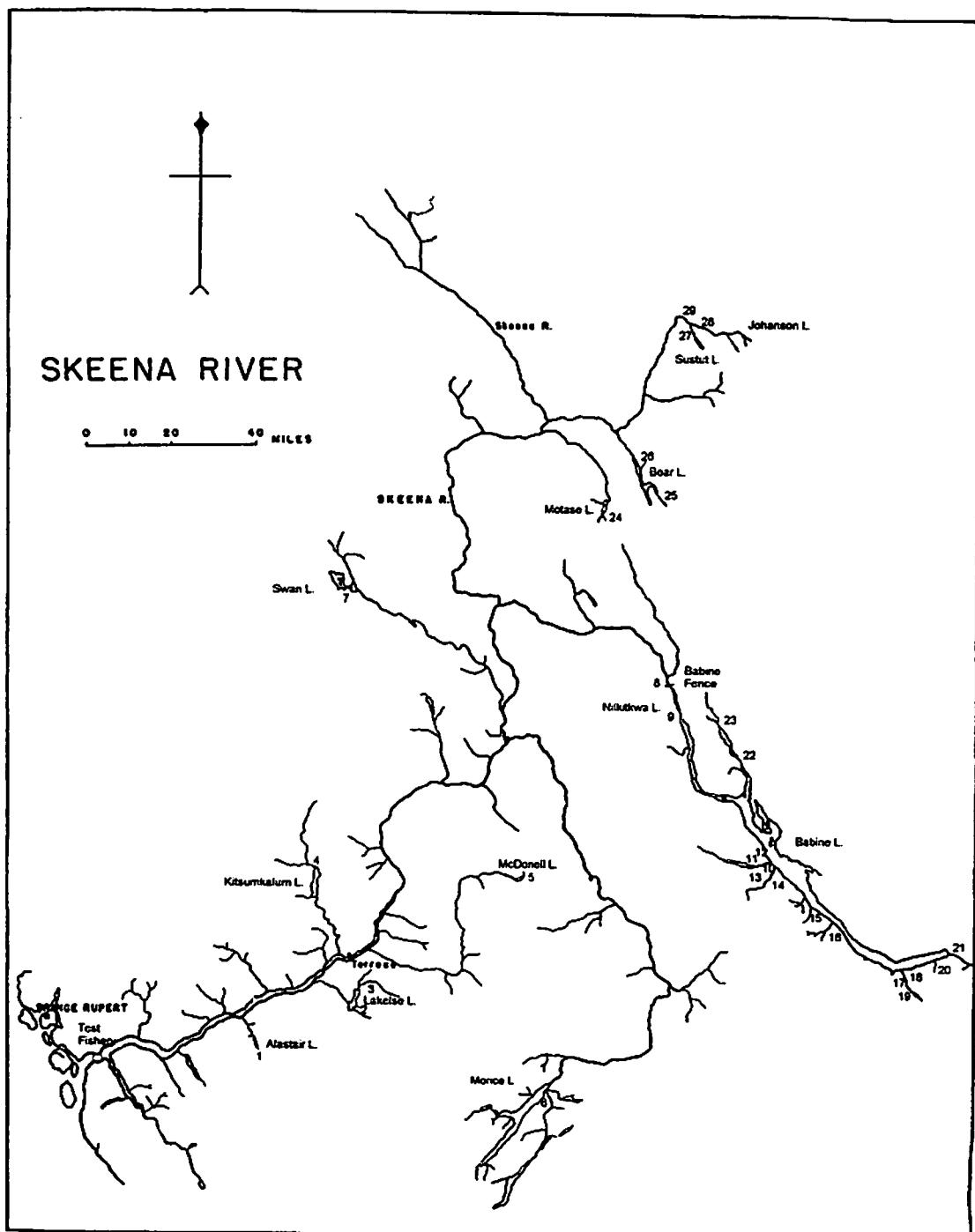


Figure 1. Map of the Skeena River showing location of test fishery, principal sockeye salmon stocks, and spawning sites that were sampled. Numbers correspond to collection locations in Table 1A.

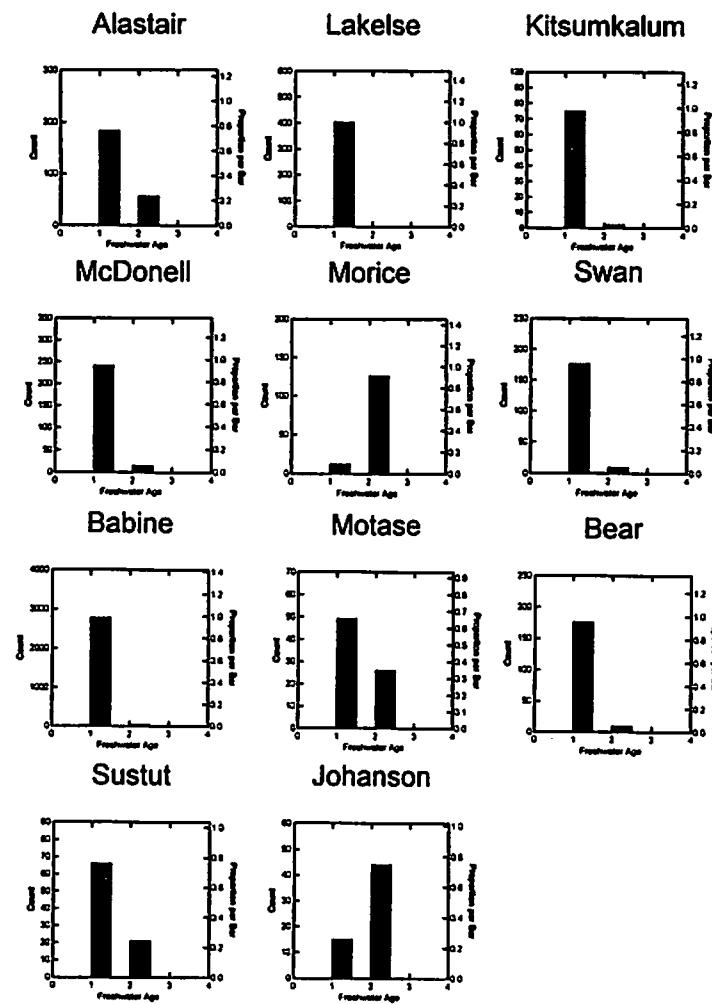


Figure 2. Variation in freshwater age composition among Skeena River sockeye salmon populations.

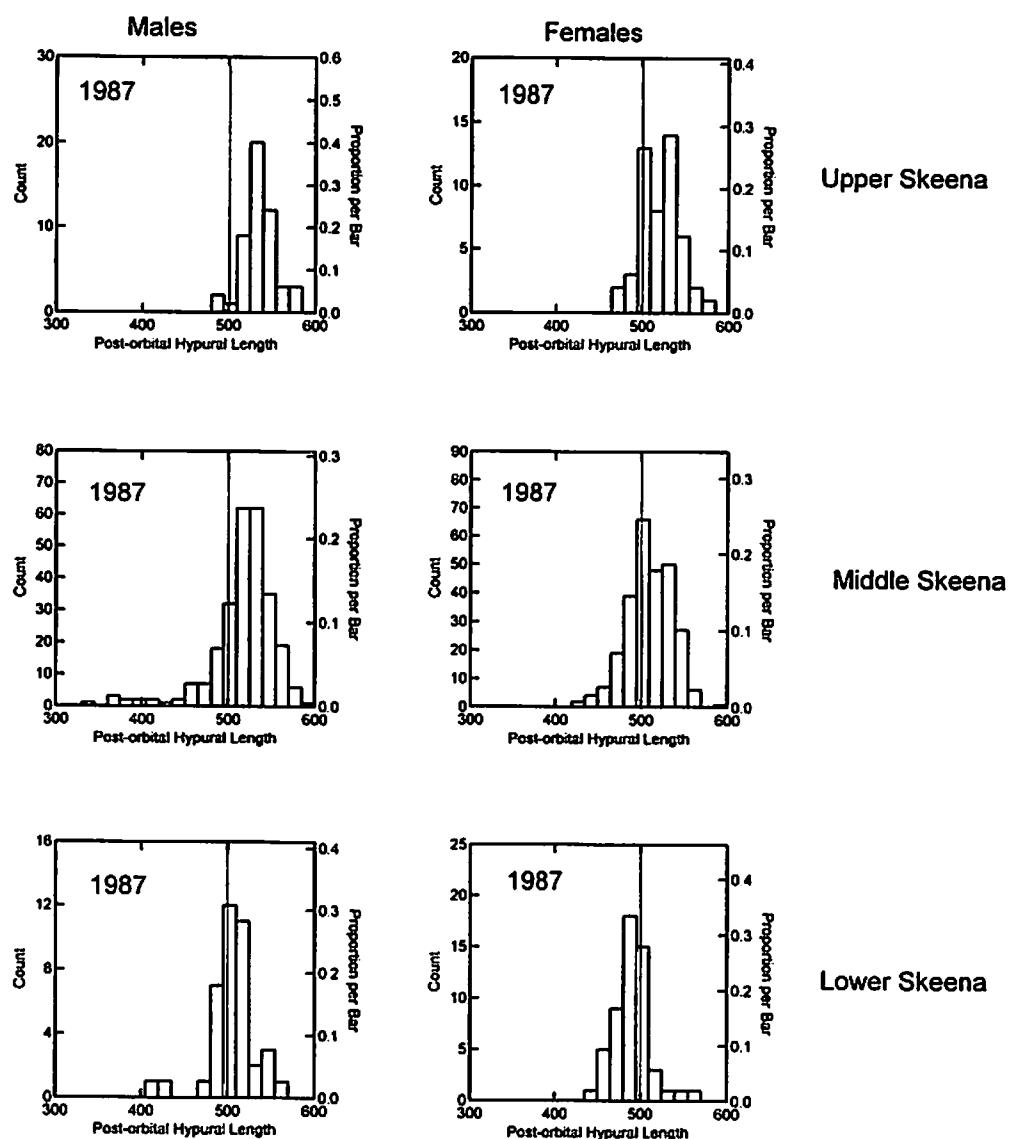


Figure 3. Variation in mean post-orbital hypural length by sex, age and year, in samples from sockeye salmon spawning locations pooled into upper, middle and lower Skeena stock groupings.

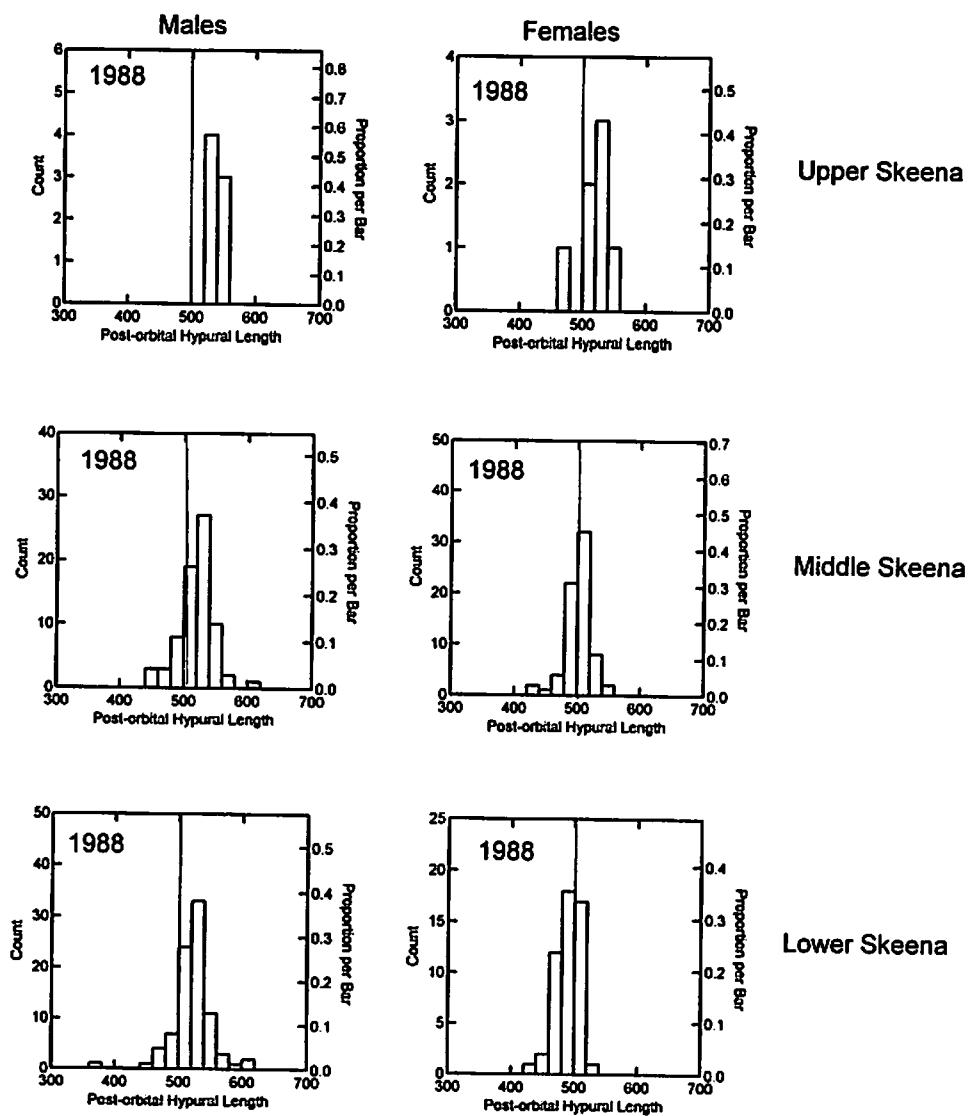


Figure 3. (cont'd)

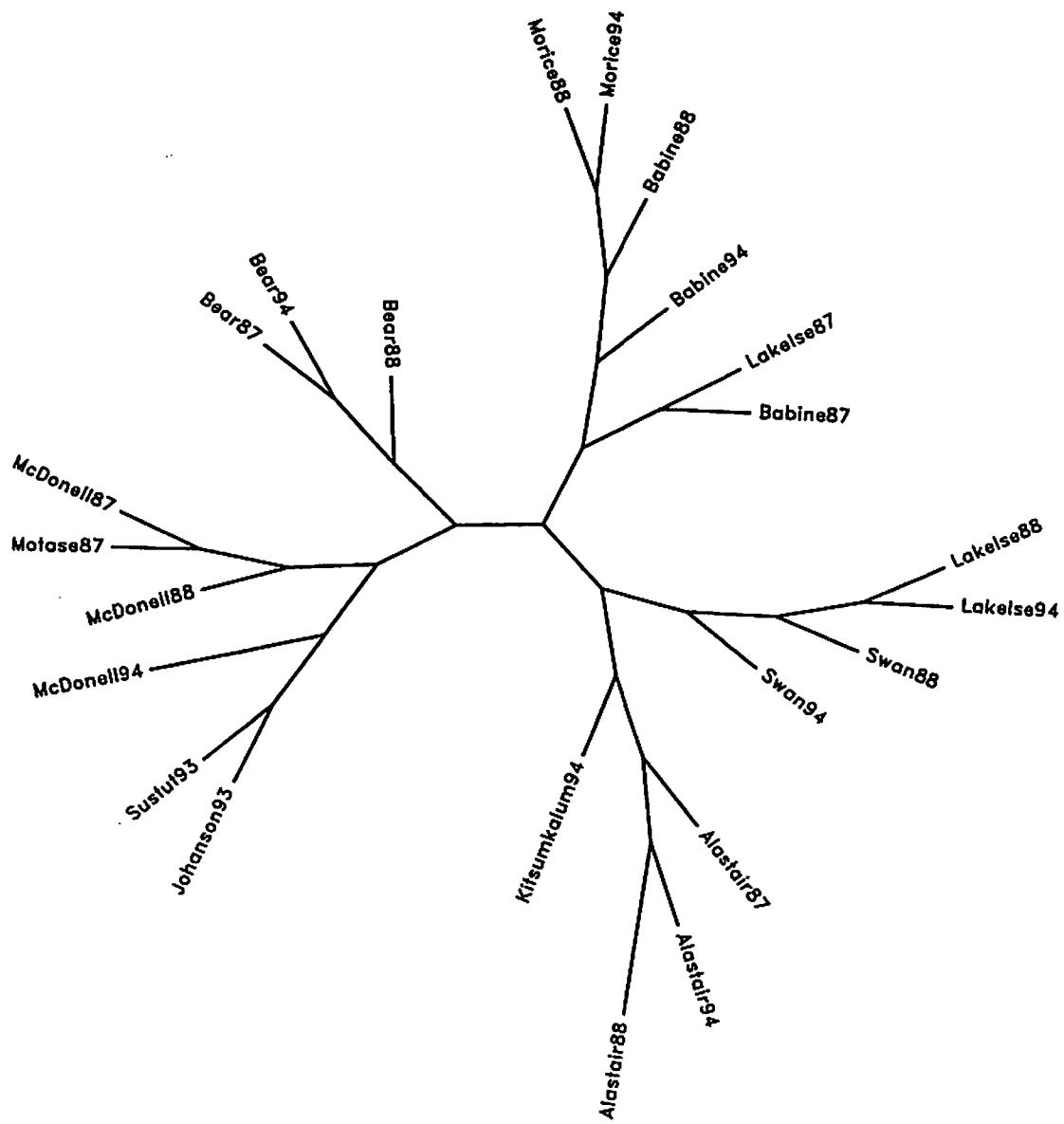


Figure 4. Phylogenetic relationships among Skeena River sockeye salmon collections inferred from allozyme variation at 31 nonselected loci.

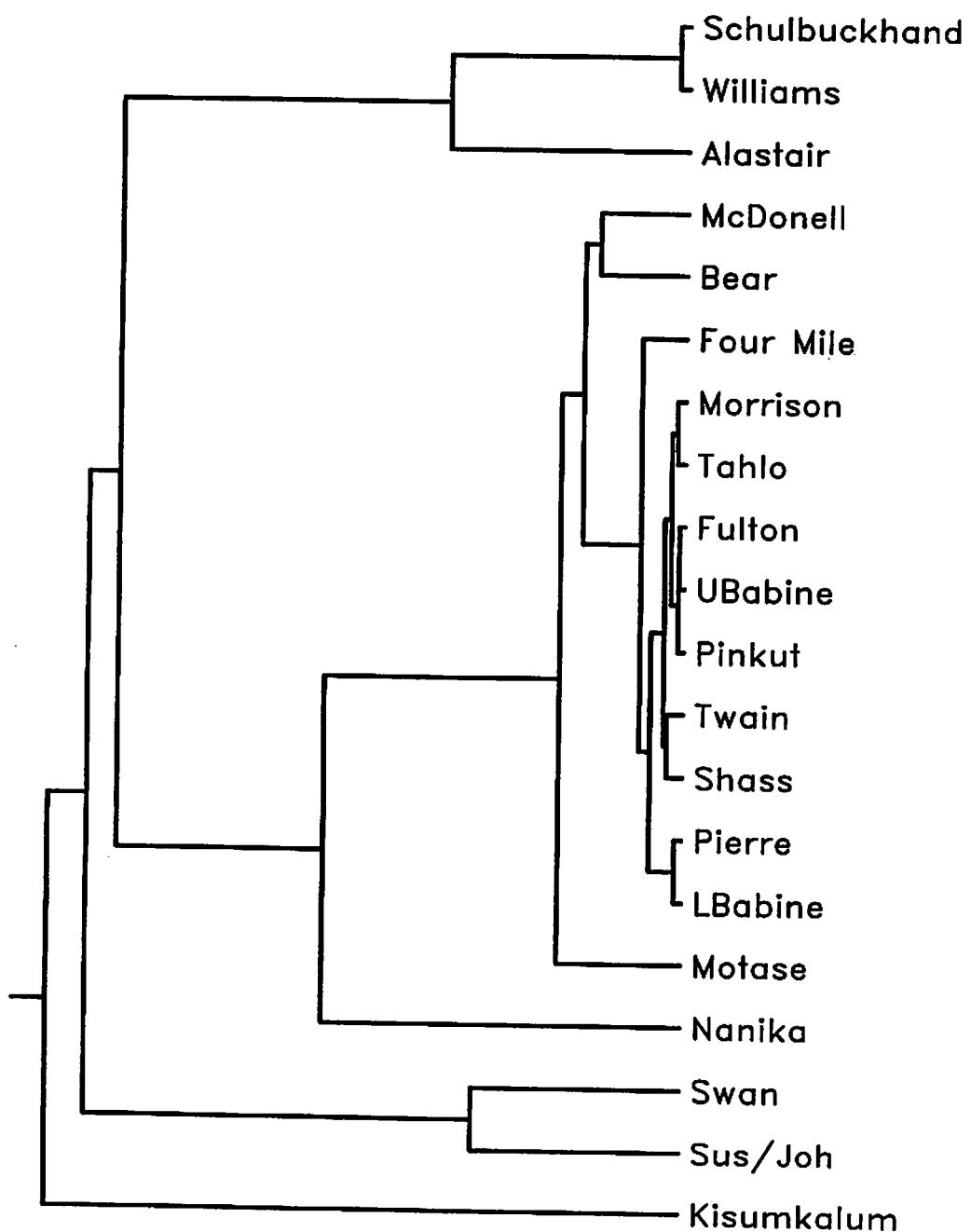


Figure 5. Similarity dendrogram illustrating the potential for differentiating Skeena River sockeye populations using genetic, parasite, and age composition data in combination.

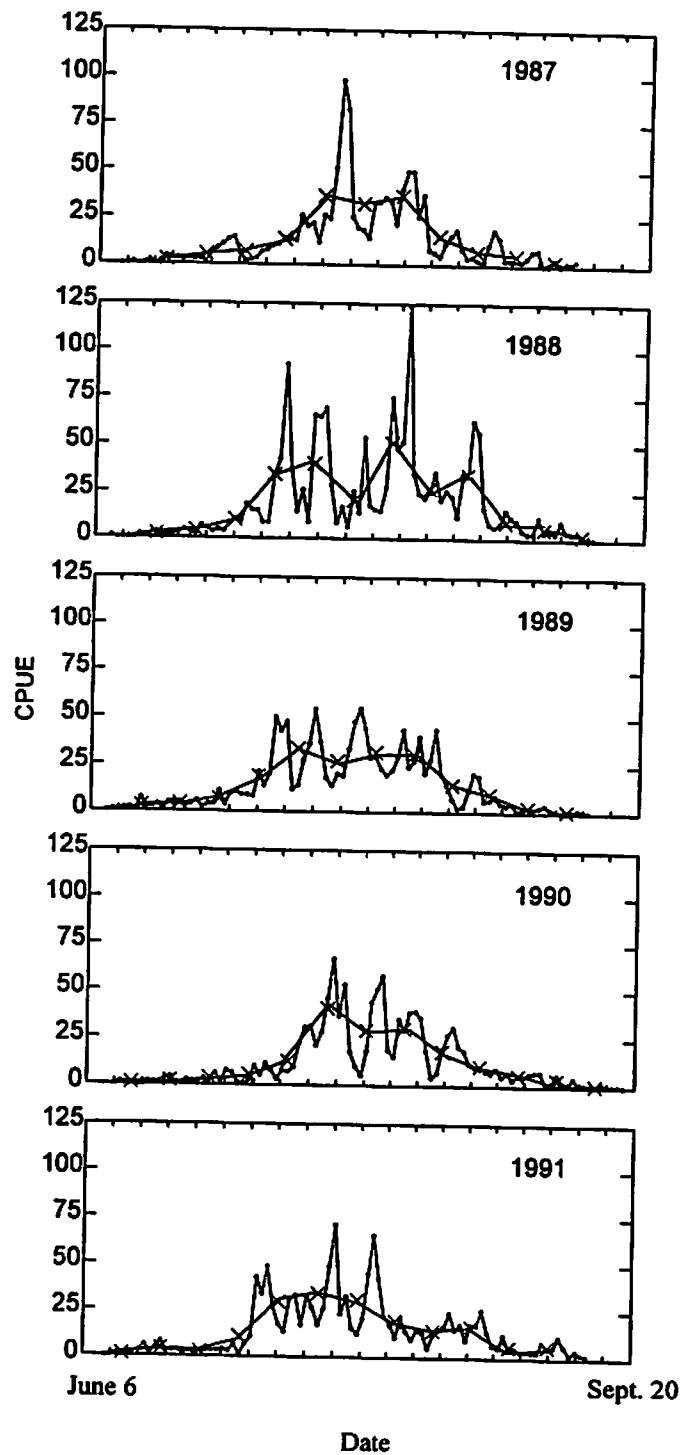


Figure 6. Daily and weekly catch per unit effort (CPUE) in the Skeena River test fishery 1987-1997.

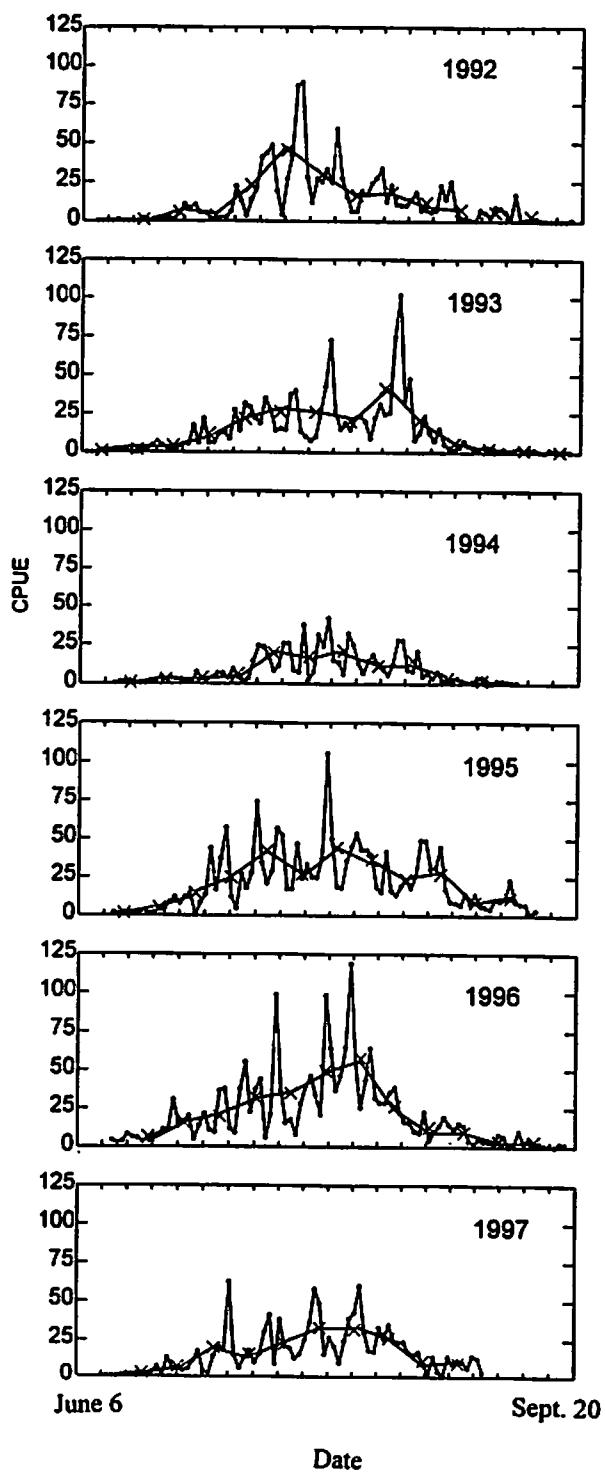


Figure 6. (cont'd)

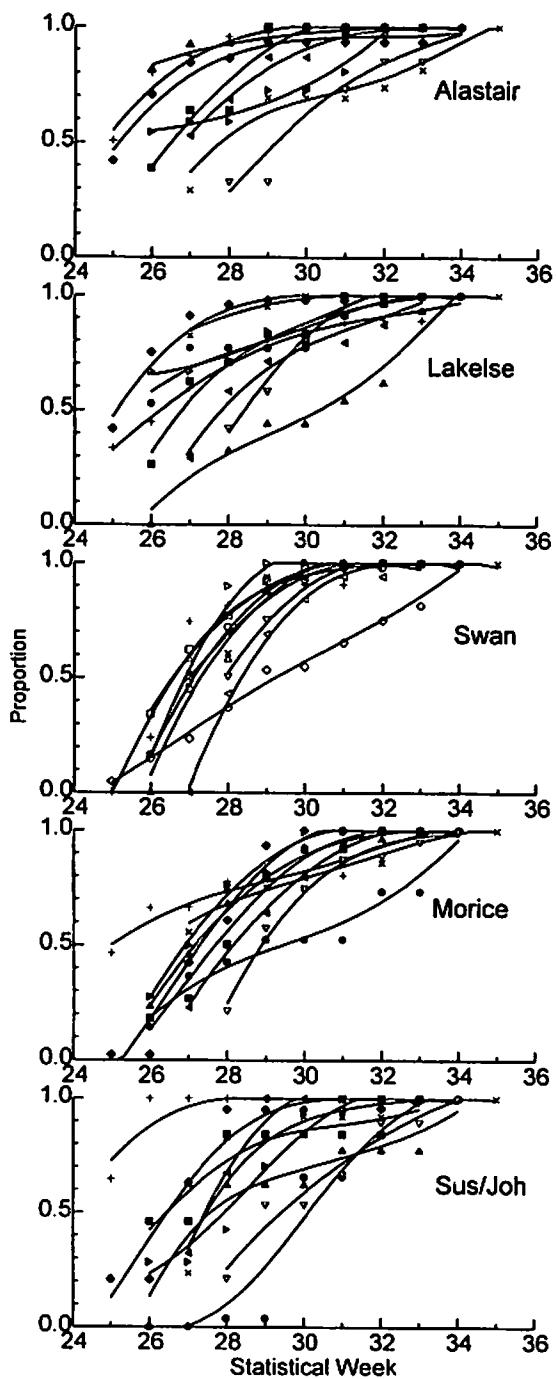


Figure 7. Cumulative stock-specific run timing curves past the Skeena River test fishery, 1987-1996.

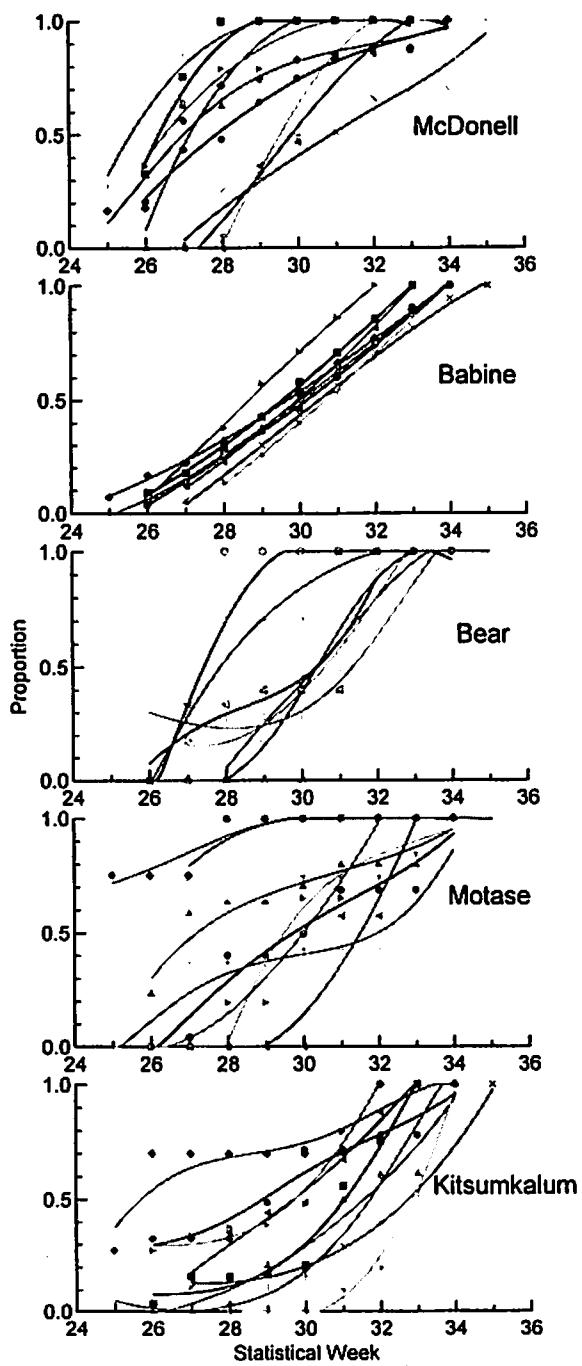


Figure 7. (cont'd)