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MEMORANDUM **NOTE DE SERVICE**

To / À: Distribution

From / De: Steve Cox-Rogers

Security Classification - Classification de sécurité **UNCLASSIFIED**
Our file - Notre référence
Your File - Votre référence
Date **Feb 23, 2012**

Subject / Object: **SKEENA SOCKEYE SUB-STOCK RUN-TIMING AND ABUNDANCE EVALUATED USING TYEE TEST FISHERY DNA: 2000-2010**

Overview

This memo provides estimates of Skeena sockeye sub-stock timing and abundance entering Area ¾ estimated using genetic (mDNA) samples collected from the Skeena River Tyee Test Fishery from 2000-2010. The genetic samples represent proportionate daily catch sampling conducted at Tyee from mid-June through early September each year. Logistic and cost constraints precluded analyzing all collected samples, and so ~25% to 35% (n = 500 to 1000) of each annual collection was sub-sampled based on weekly test fishery sockeye CPUE (Week 71 = July 1-7, Week 72 = July 8-15 etc). Stock composition analysis of the weekly samples was conducted by DFO's Molecular Genetics Lab in Nanaimo.

The stock composition results were expanded to abundance (by stock) using post-season estimates of weekly aggregate-stock sockeye escapement past the Tyee Test fishery from 2000-2010. Expressed proportionally, these data provide "timing" by stock entering (escaping) into the Skeena River each year. However, escapement timing at Tyee does not represent annual run-timing into Area ¾ because of catch removals in the marine fishery. To correct for this bias, reconstructed weekly sockeye harvest rates for the Area ¾ marine fishery from 2000-2010 (Cox-Rogers and Splisted 2010, with updates) were applied to backward-lagged test fishery escapements (by stock) to estimate incoming Area ¾ abundance. The results were then smoothed and plotted for timing interpretation.

Results

- The "Data" tab on the Excel spreadsheet "TyeeSxtimingDNA2000-2010Feb12.xls" provides the weekly and annual Tyee Test fishery mDNA stock composition results from 2000-2010. Subsequent expansion to reconstructed Area ¾ abundance/timing by sub-stock for each year is also on this tab.

- The "Graphs" tab on the Excel spreadsheet "TyeeSxtimingDNA2000-2010Feb12.xls" summarizes just the 2000-2010 Area ¾ smoothed entry timing proportions by stock

calculated on the "Data" tab. Also calculated are the annual, average and normal curve timings by stock that are subsequently plotted in **Figures 1 thru 20** in this memo.

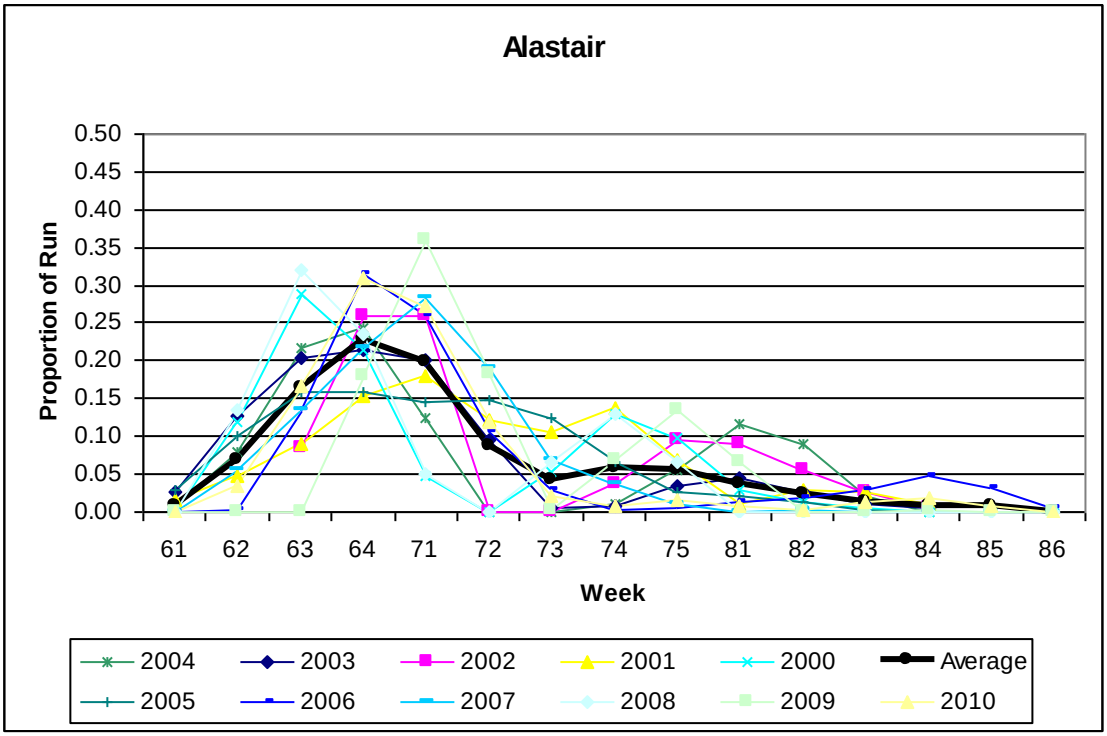
- **Figure 21** shows the most recent mDNA genetic relationships (dendrogram) for north coast sockeye stocks. (source Terry Beacham, DFO, pers comm.).

- **Table 1** compares the timing peaks and spread information calculated in this analysis with those reported in Table 2 of Cox-Rogers et al (2004) and Cox-Rogers and Splilsted (2010).

Conclusions

- The estimated peak dates of run entry for most Skeena sockeye sub-stocks, based on updated 2000-2010 DNA analysis, are not substantially different from past tagging assessments and the peak dates currently being used to assess stock impacts. The DNA data does suggest slightly wider "spreads" about the peaks for most stocks than currently assumed, and some apparent skewness/bi-modal variability to the timings may not be appropriately captured with the current practice of fitting normal curve approximations to the data. However, it is not clear how much of the shape variation is real or simply an artifact of sample size issues given the small number of DNA samples actually analyzed for some stocks in certain weeks (e.g. the tails of the test fishery). This, coupled with the fact that many non-Babine stocks are present in small proportions at Tyee in the first place, means the derived timings for the larger stocks are probably ok, but will always be uncertain for the smaller ones. Examining a higher proportion of the collected DNA samples might help reduce some of this uncertainty (currently $20/fish).

- The results presented in this analysis represent simple point-estimate evaluations of sub-stock timing and abundance for each year and for comparisons among years. Stock composition variances (standard errors) for the mDNA data are available and could be used to address stock composition uncertainty within and among weeks and years, but this step has yet to be completed.



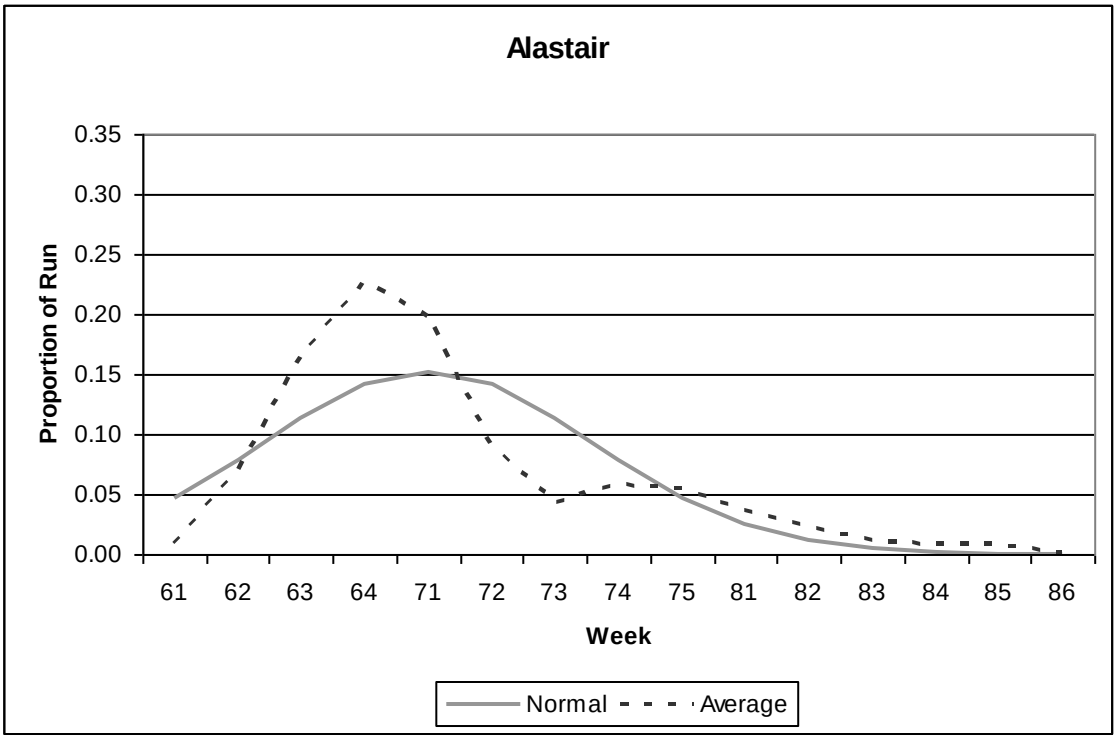
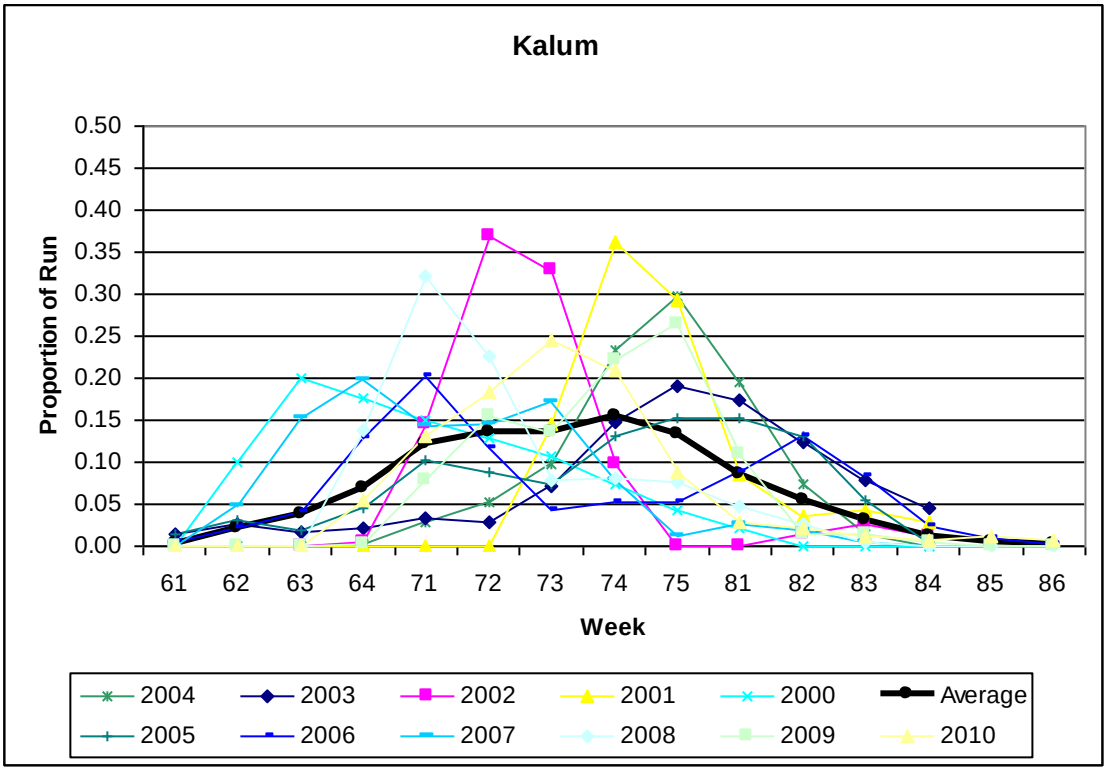


Figure 1. Estimated weekly timing proportions for **Alastair Lake** sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 64 to 71 (late JuneJune/early July, bottom graph).



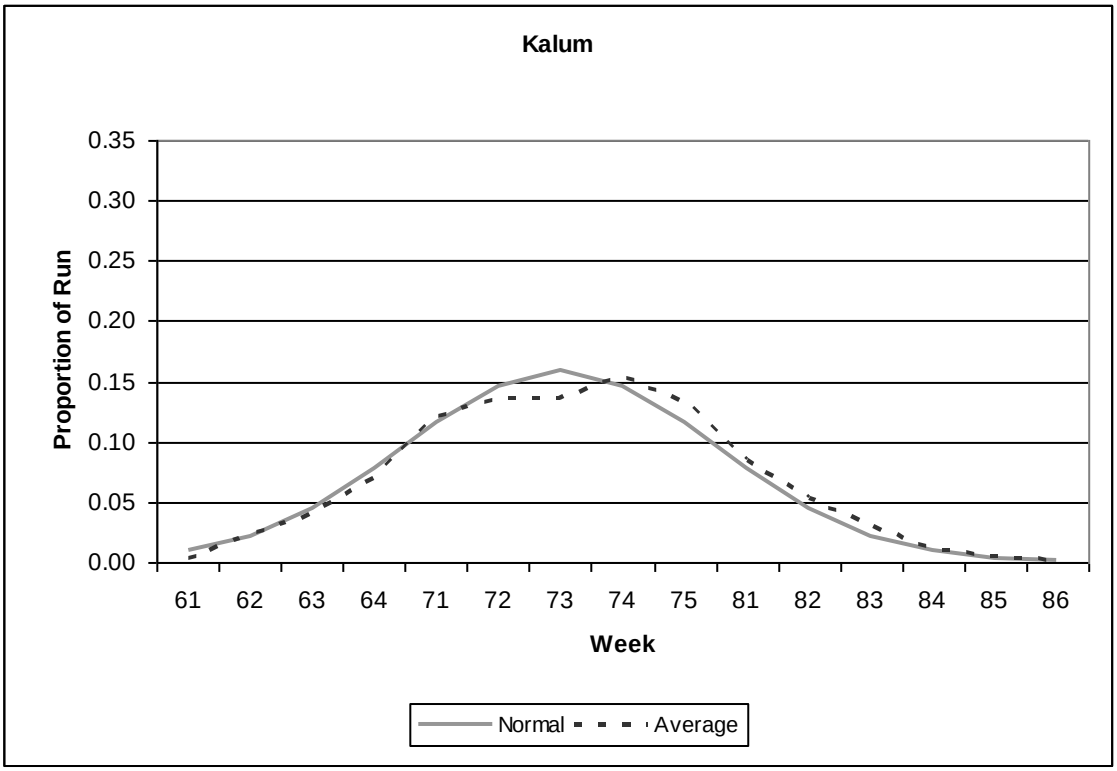
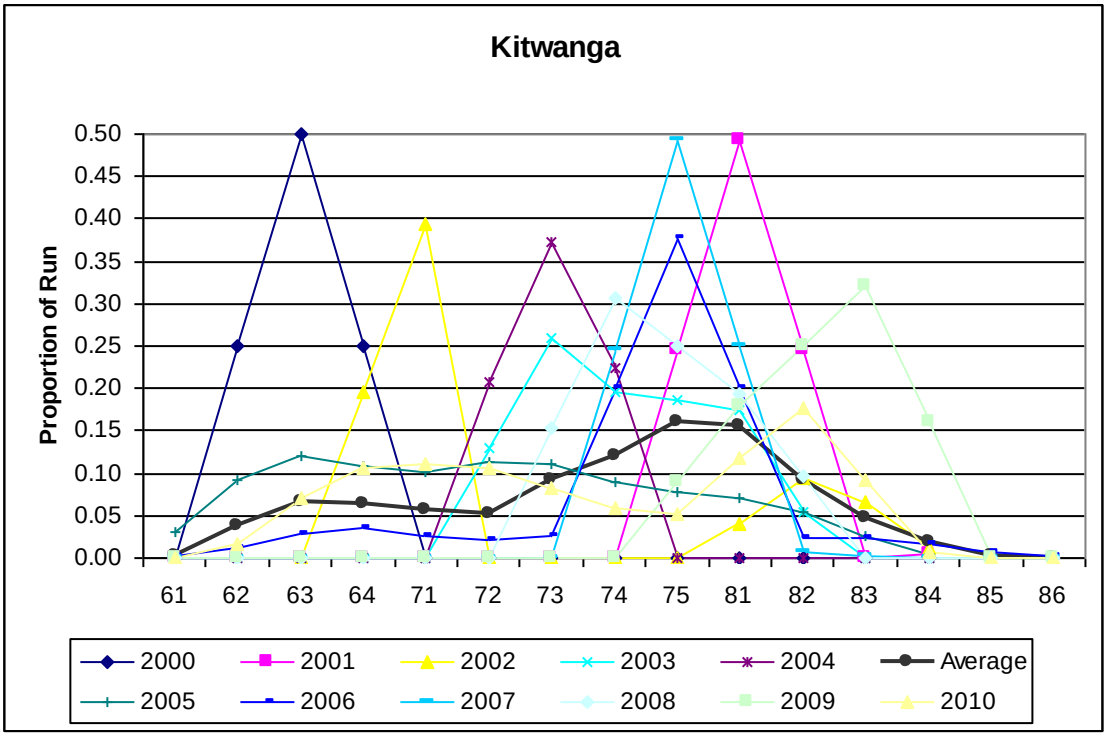


Figure 2. Estimated weekly timing proportions for **Kalum Lake** sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 73 (third week July, bottom graph).



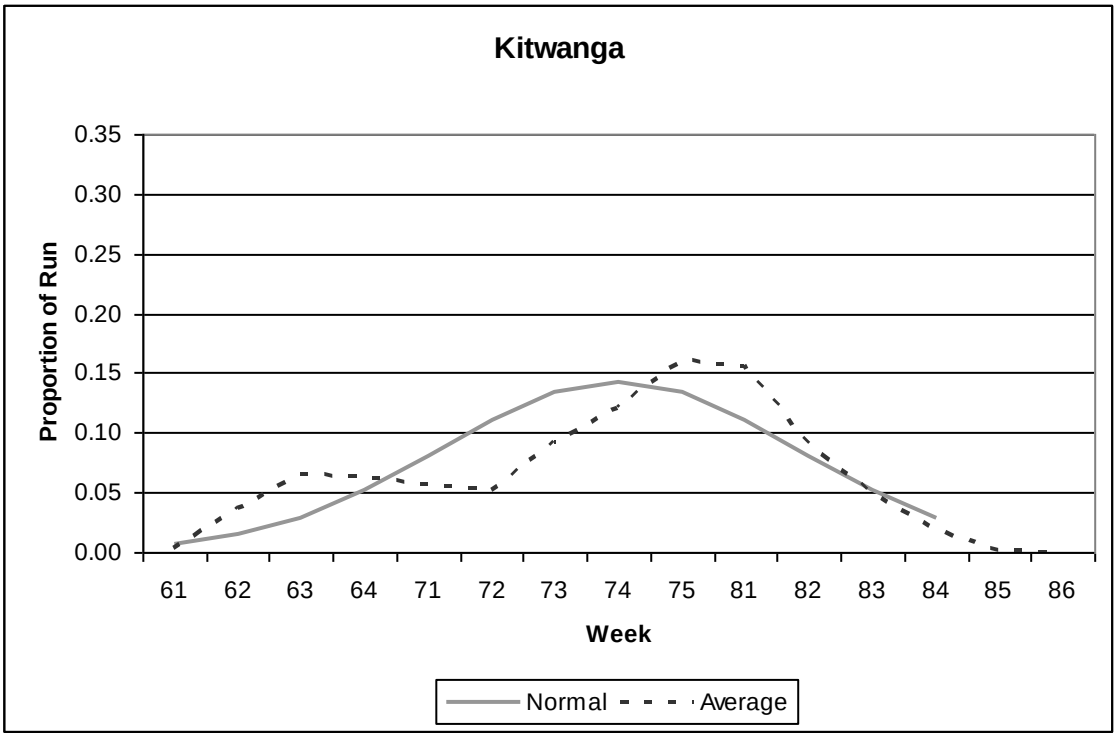
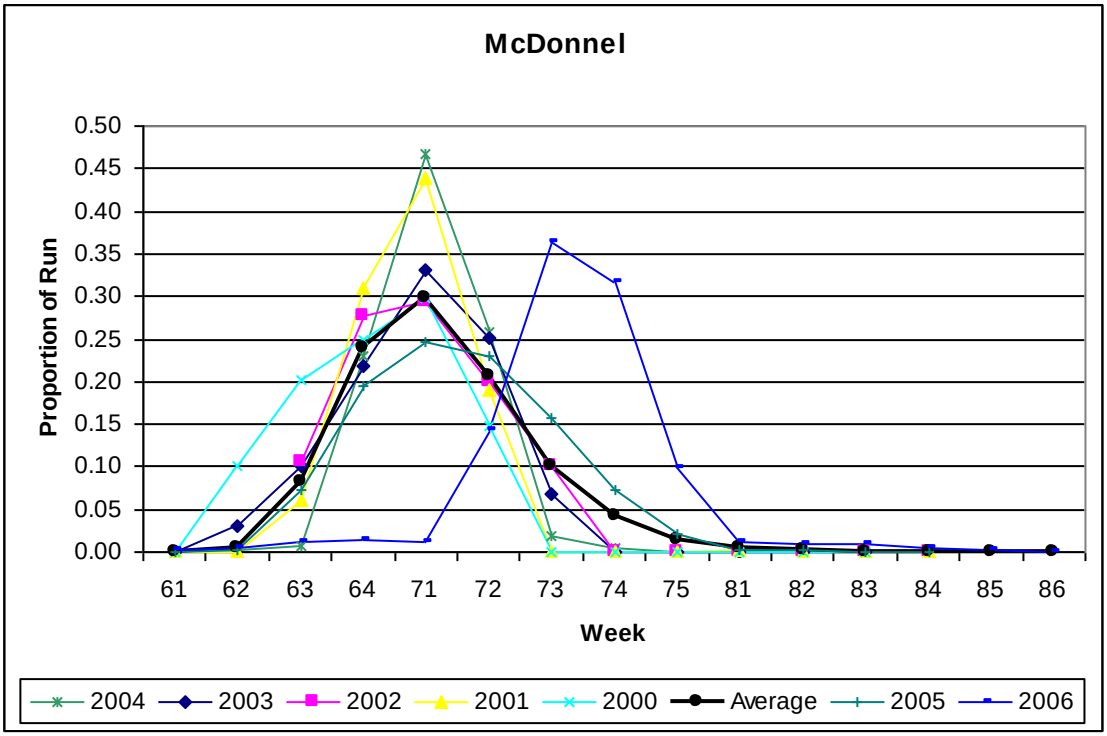


Figure 3. Estimated weekly timing proportions for **Kitwancool (Kitwanga) Lake** sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 74 (fourth week July, bottom graph).



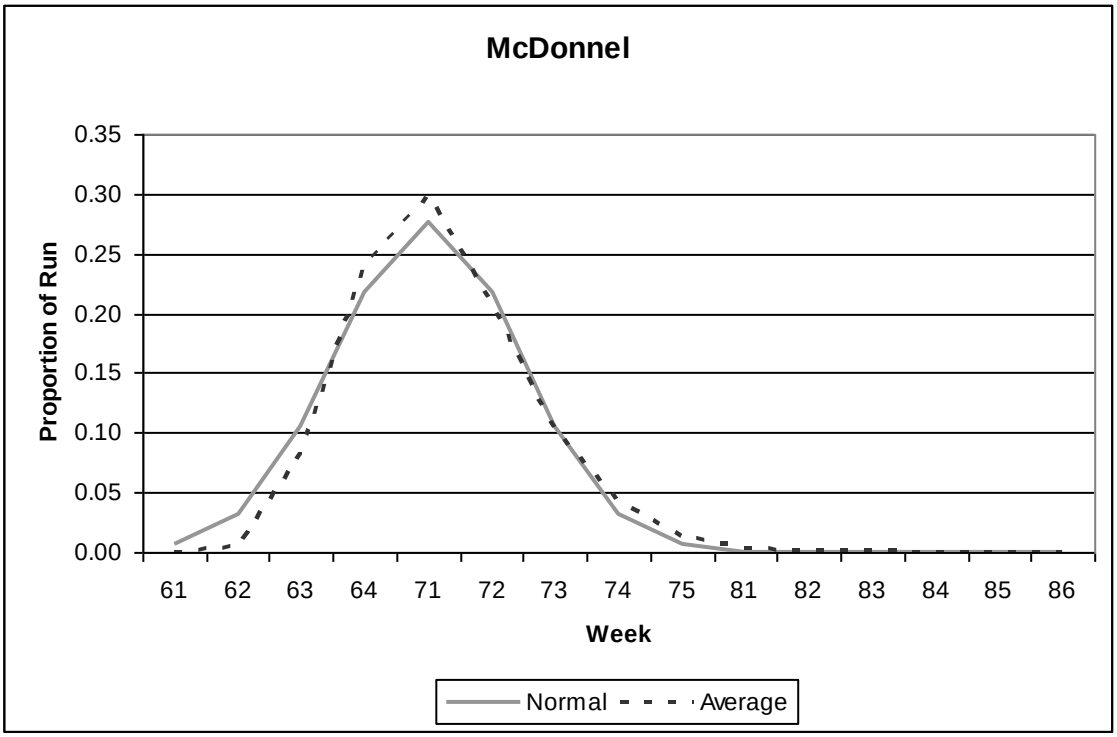
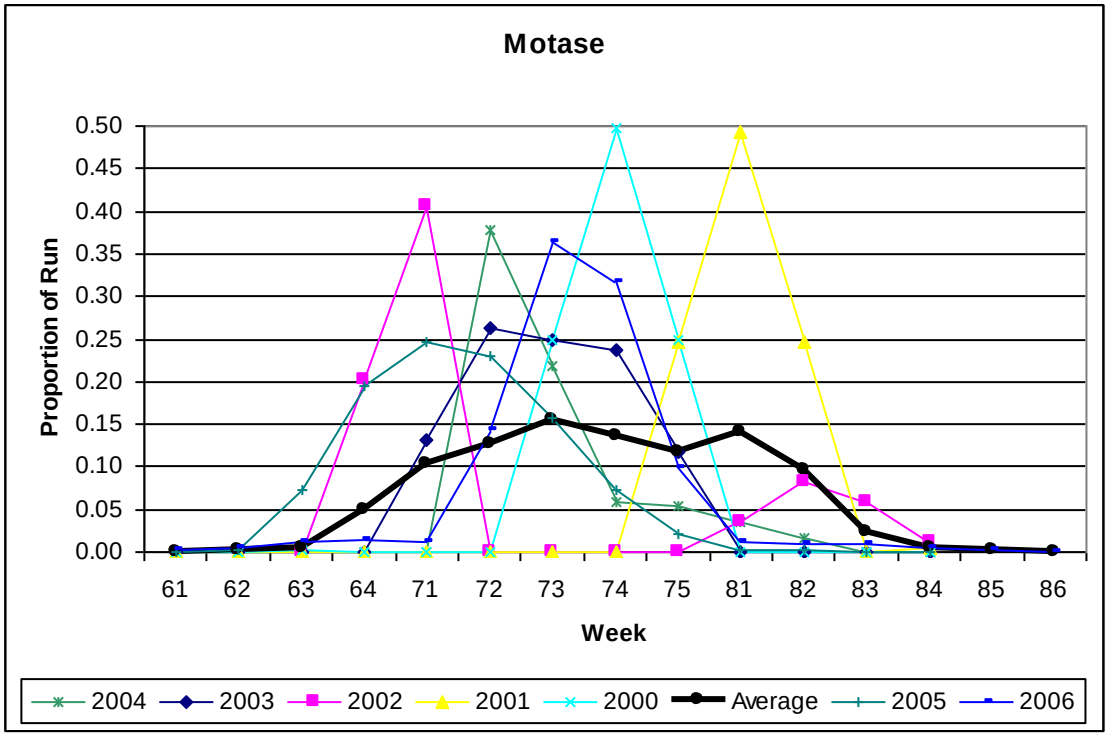


Figure 4. Estimated weekly timing proportions for **McDonnel Lake** sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 71 (first week July, bottom graph).



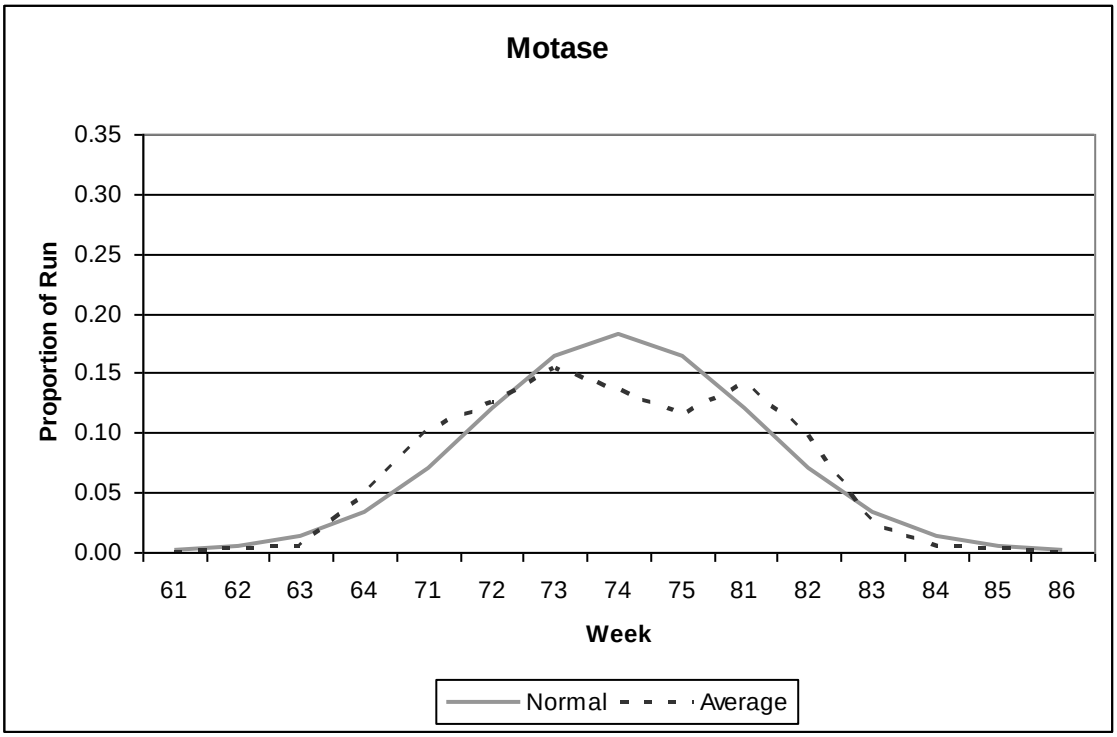
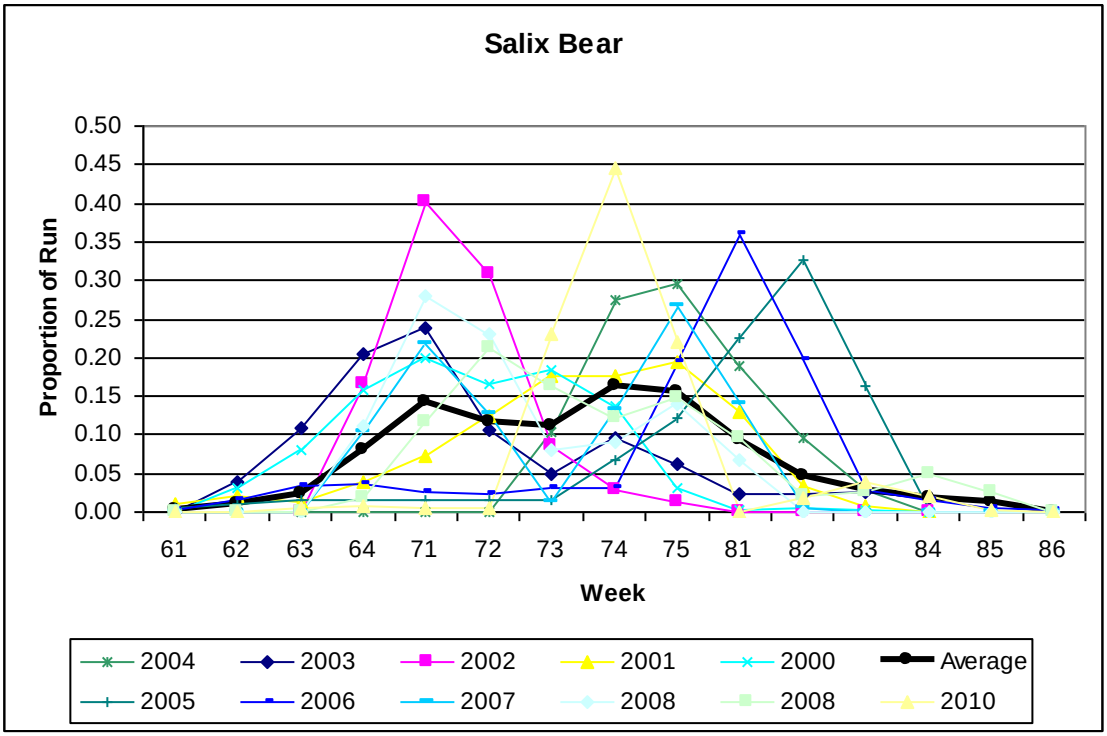


Figure 5. Estimated weekly timing proportions for **Motase Lake** sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 74 (fourth week July, bottom graph).



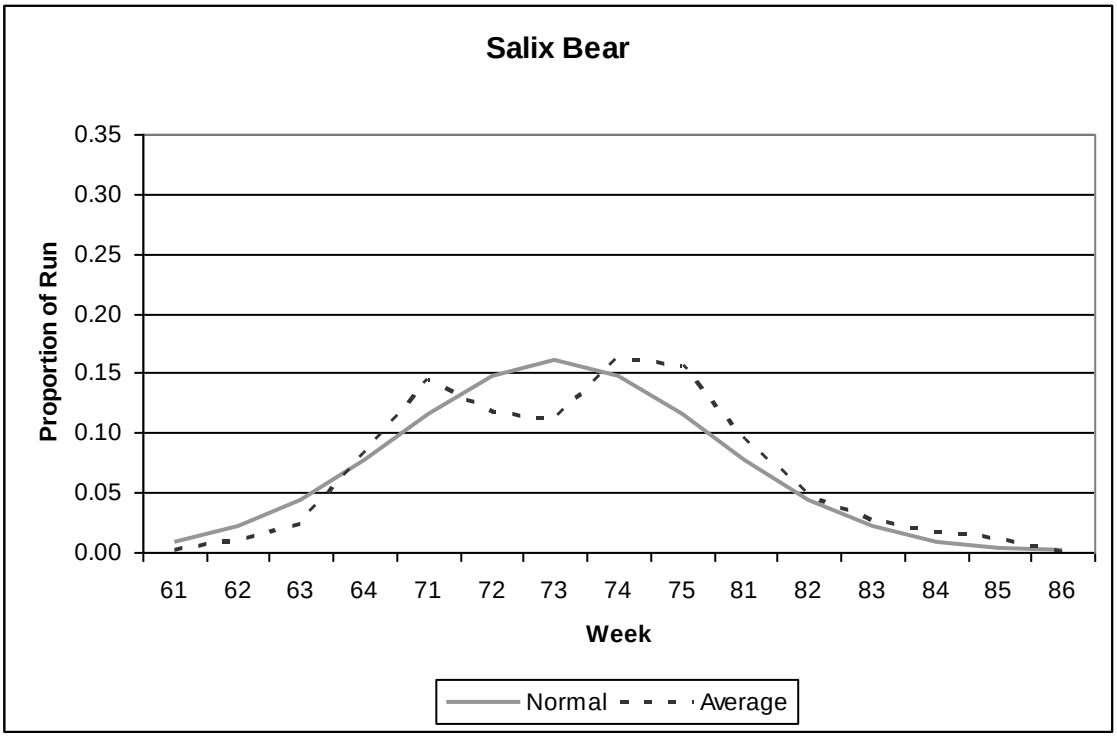
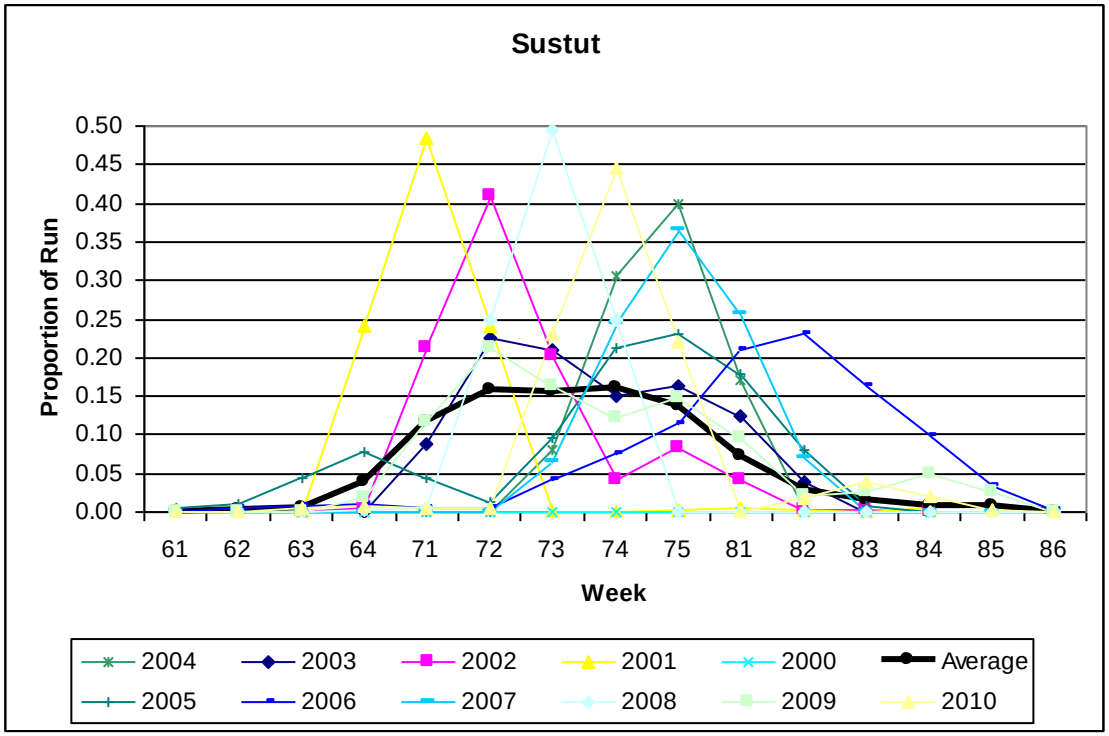


Figure 6. Estimated weekly timing proportions for **Salix/Bear Lake** sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 73 (third week July, bottom graph).



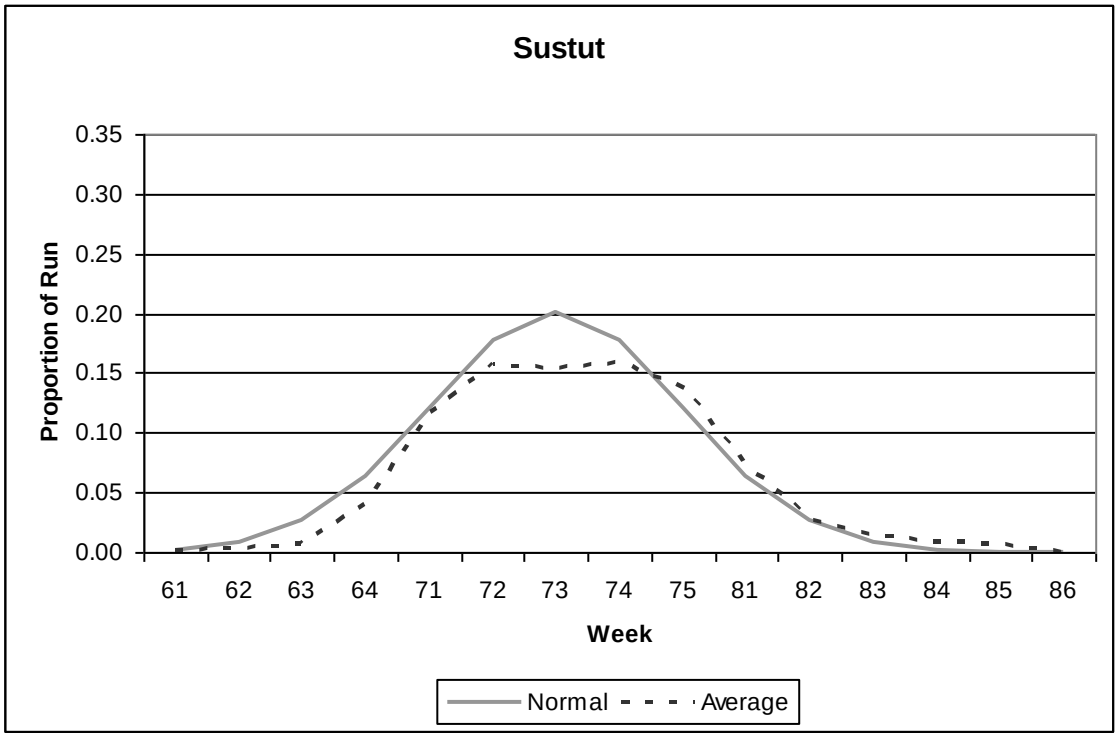
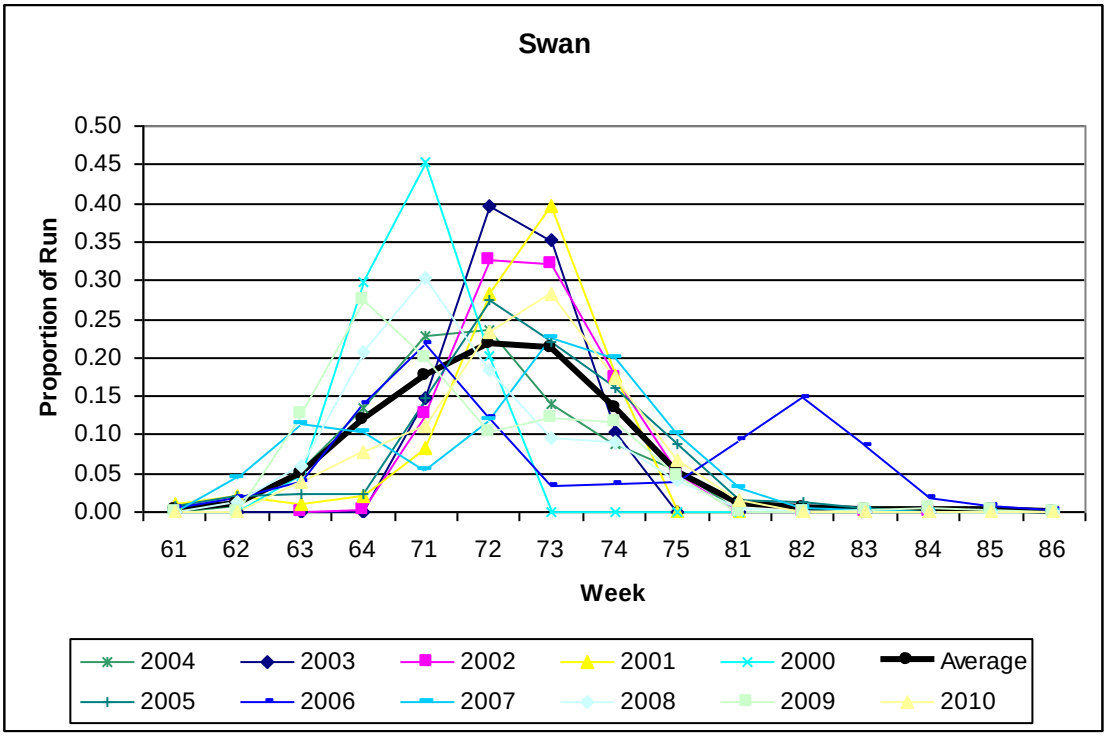


Figure 7. Estimated weekly timing proportions for **Sustut Lake** sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 73 (third week July, bottom graph).



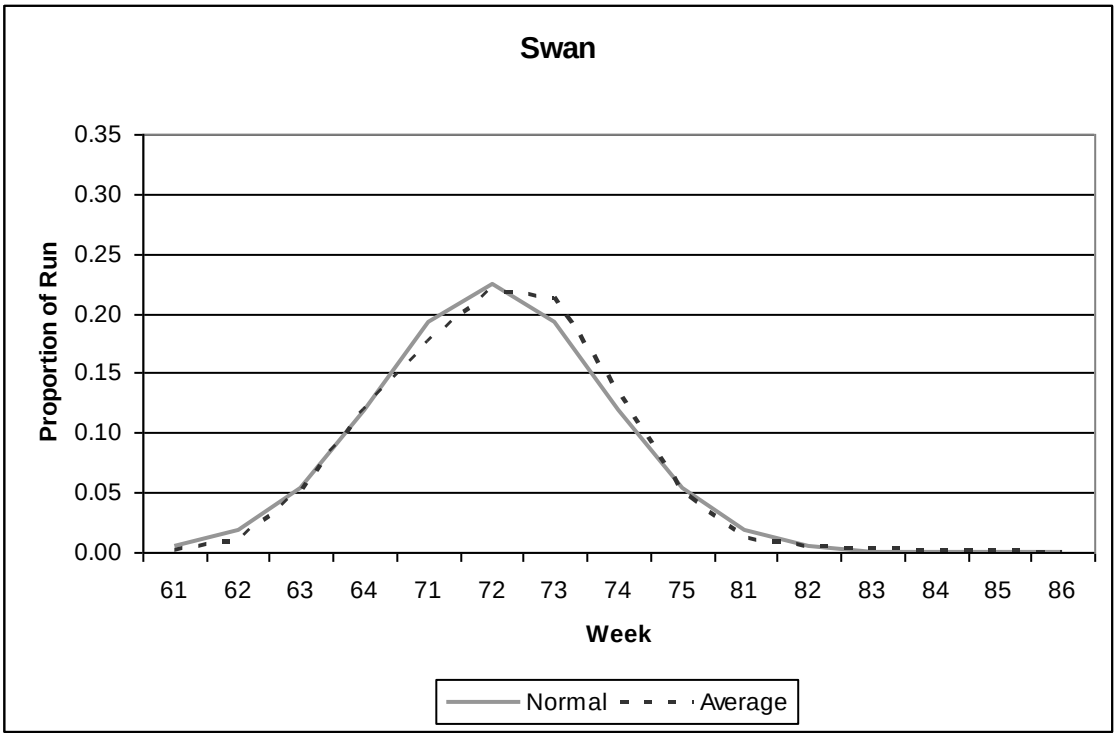
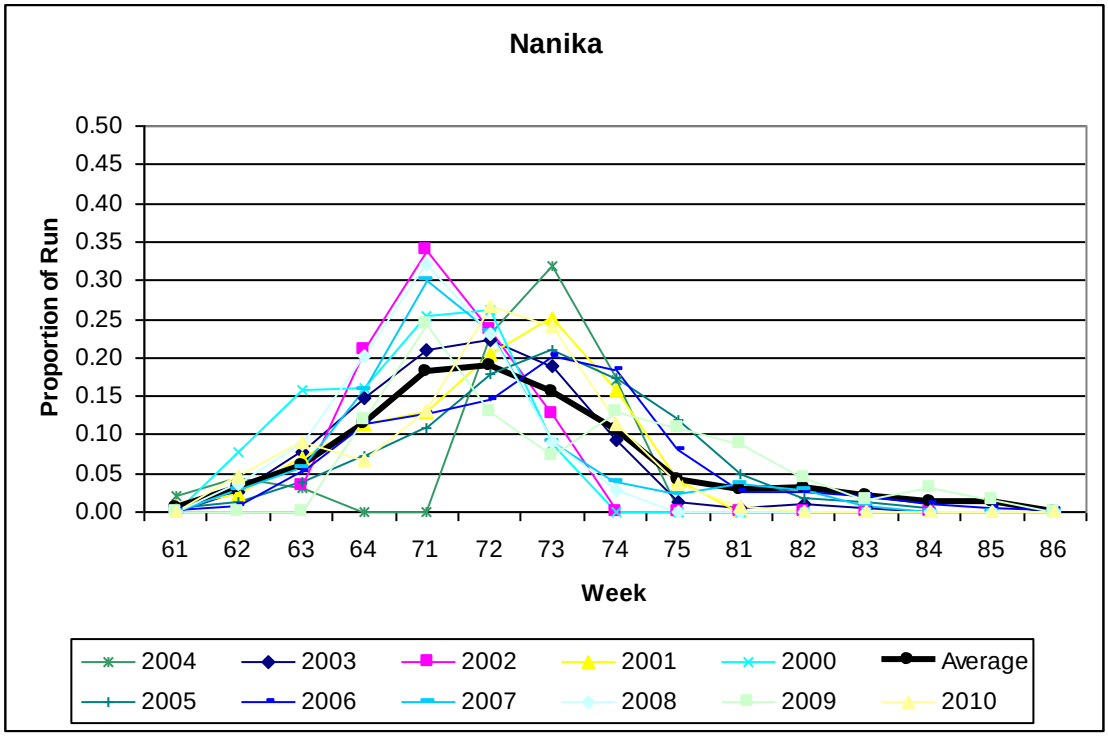


Figure 8. Estimated weekly timing proportions for **Swan Lake** (Kispiox) sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 72 (second week July, bottom graph).



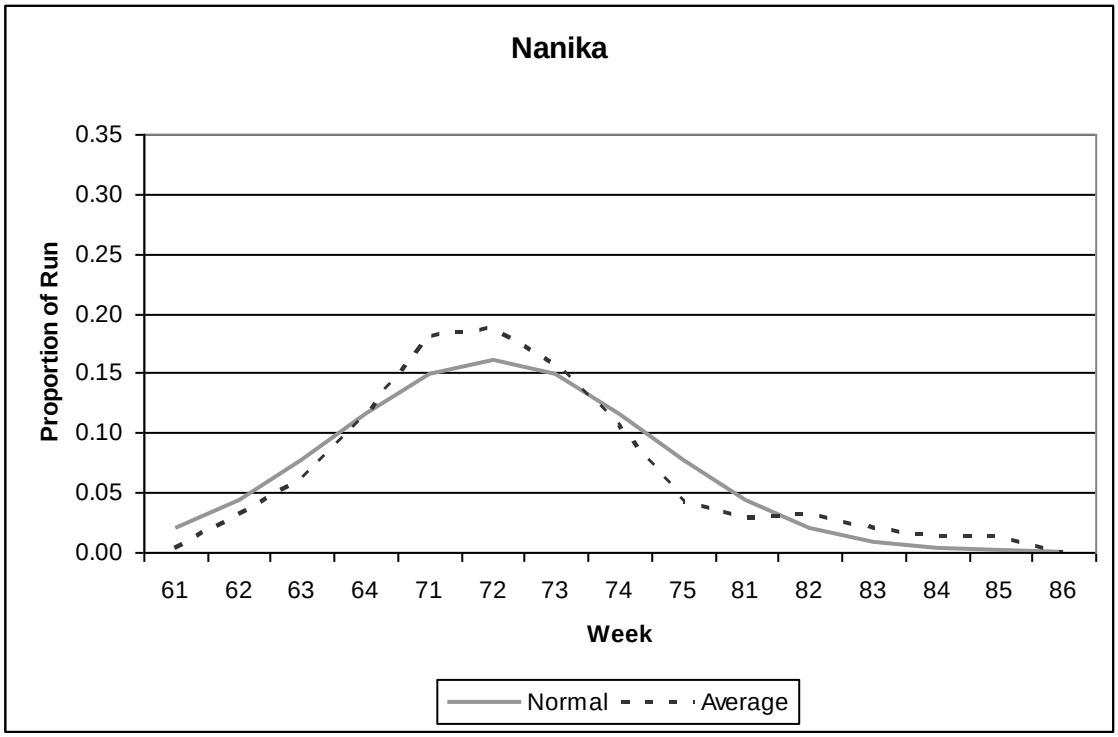


Figure 9. Estimated weekly timing proportions for **Morice Lake** (Nanika) sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 72 (second week July, bottom graph).

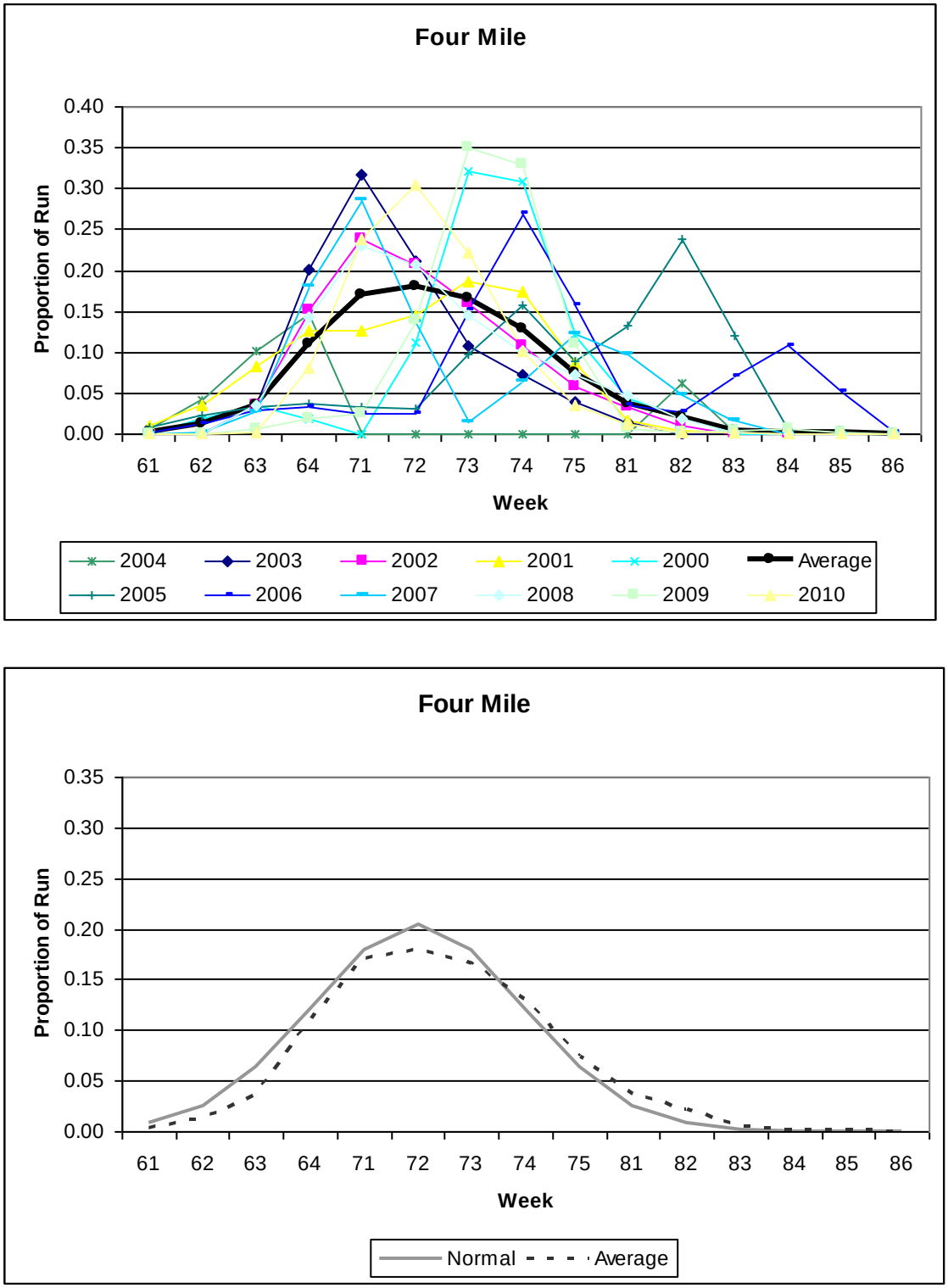


Figure 10. Estimated weekly timing proportions for **early Babine Lake** (Four Mile) sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 72 (second week July, bottom graph).

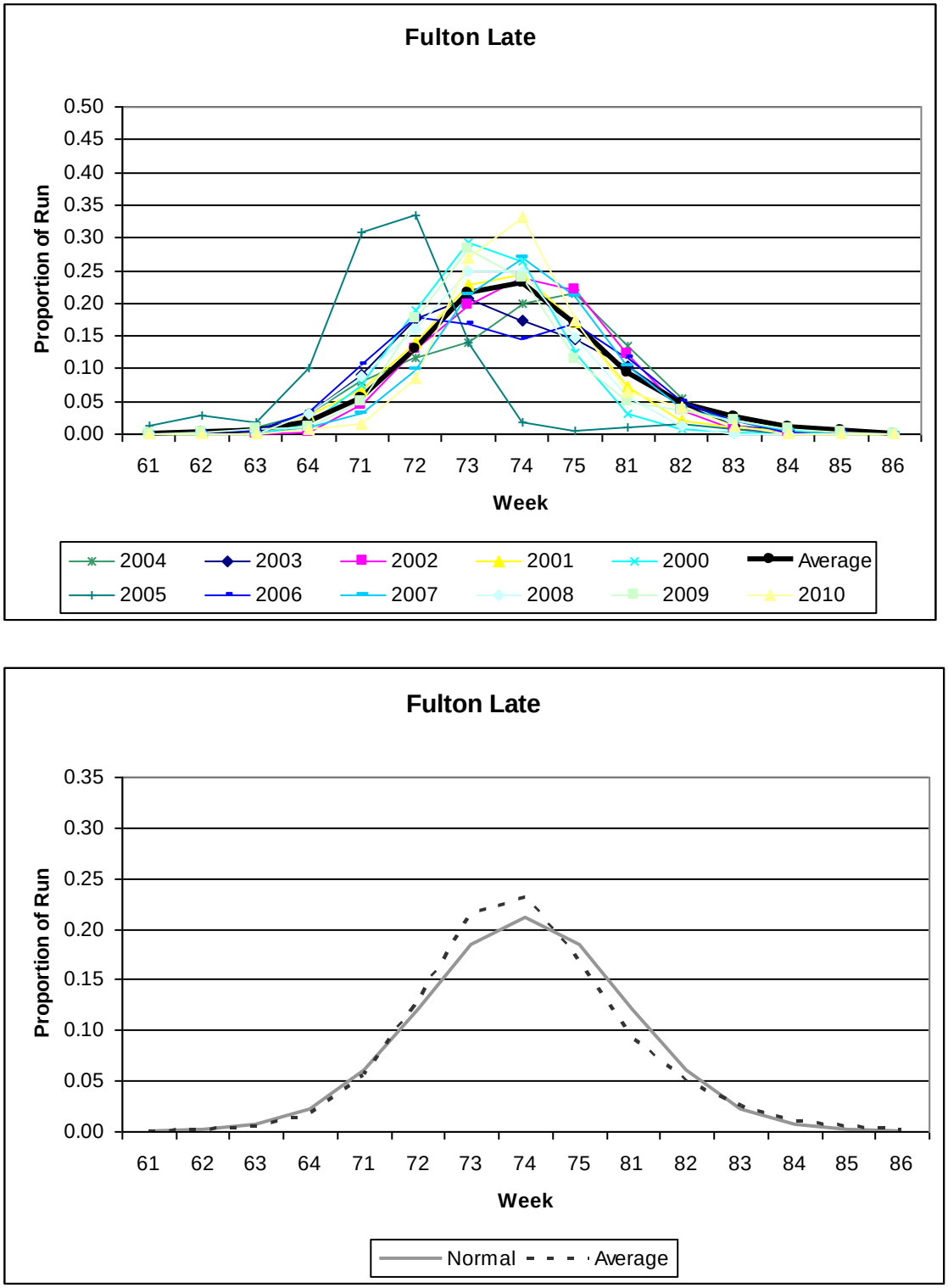
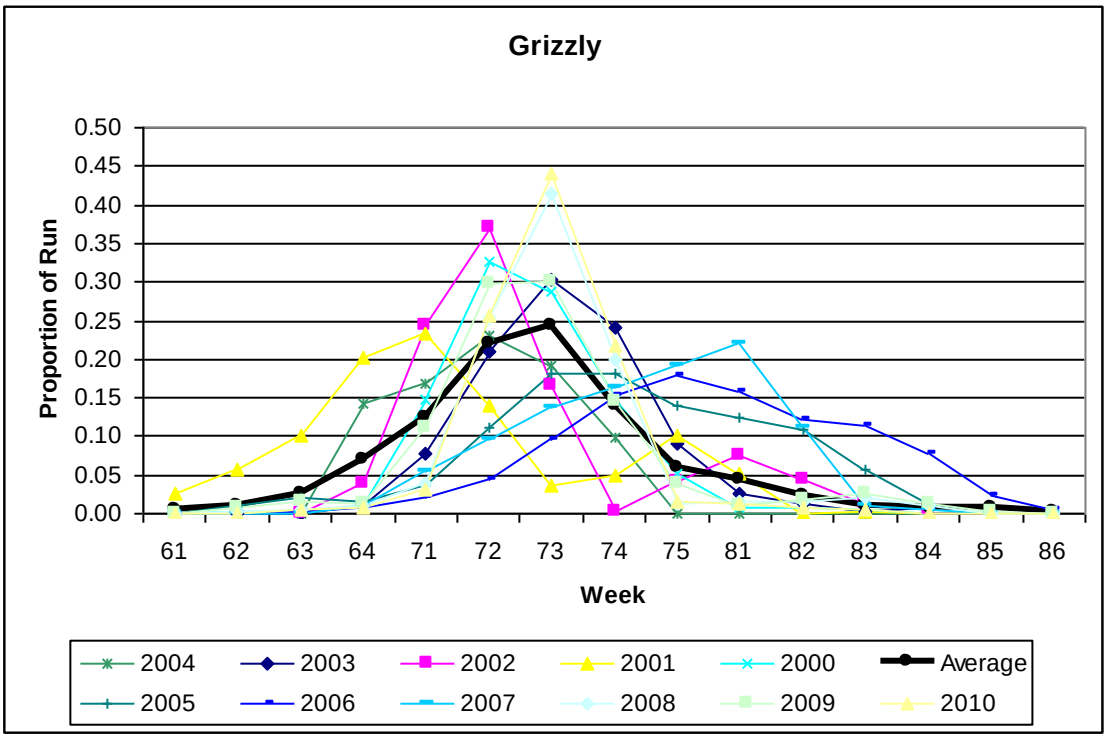


Figure 11. Estimated weekly timing proportions for **late Babine Lake** (Fulton) sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 74 (fourth week July, bottom graph).



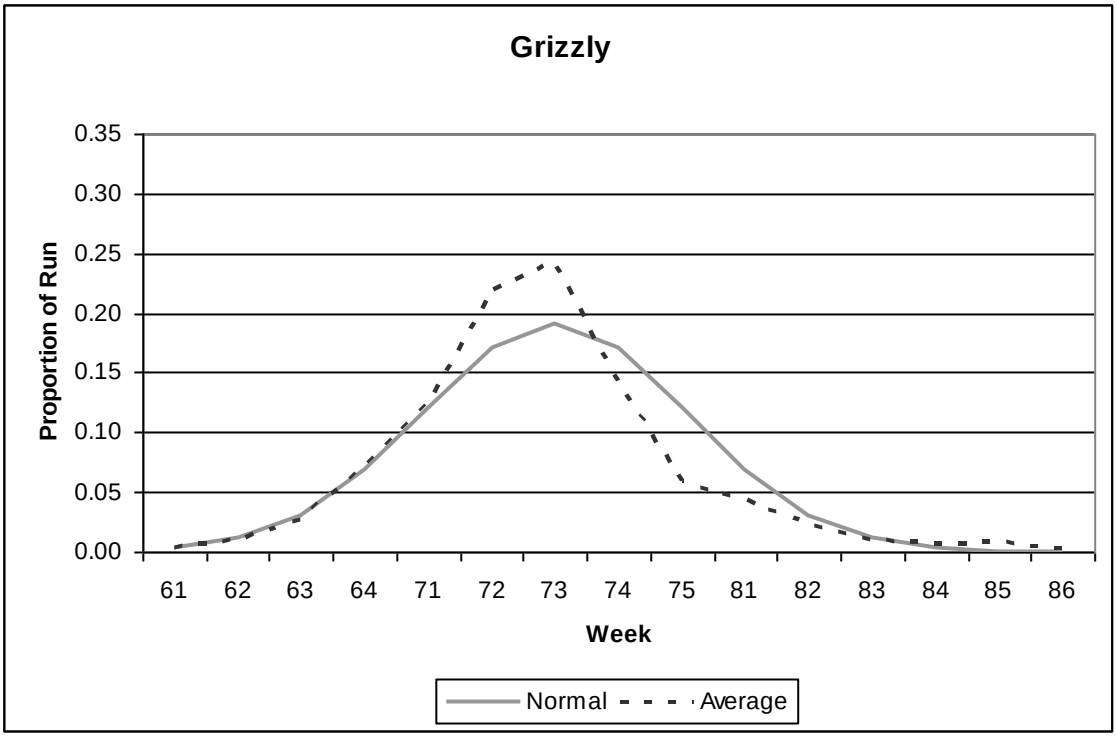
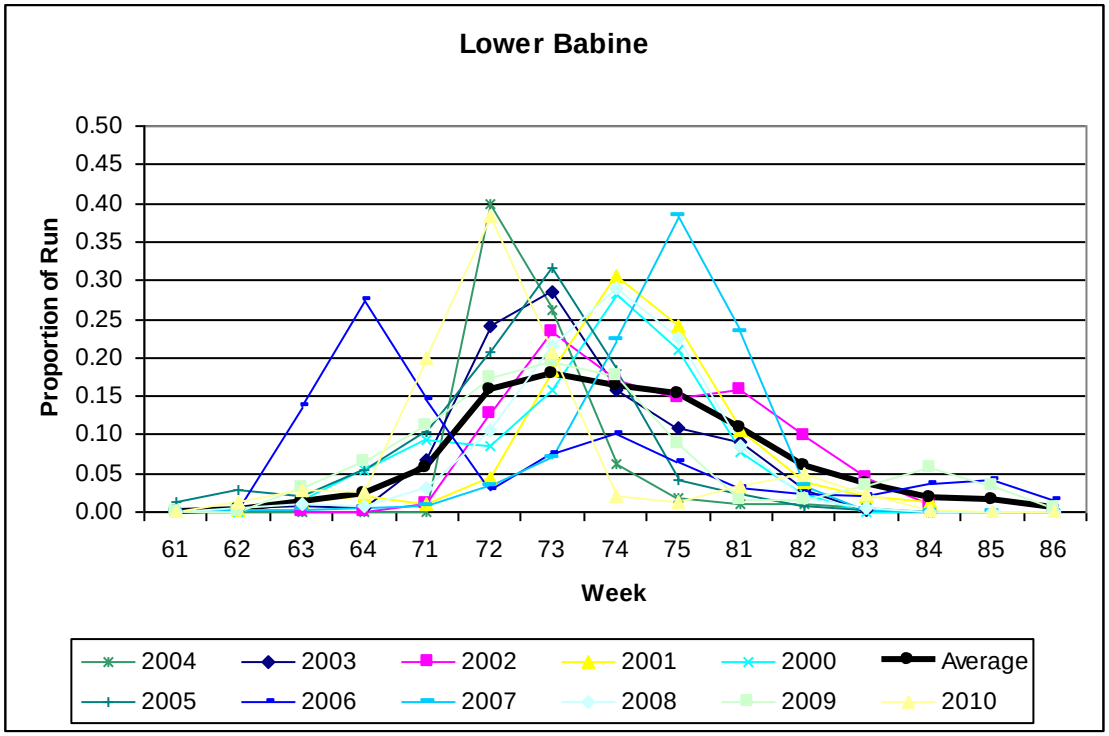


Figure 12. Estimated weekly timing proportions for **mid Babine Lake** (Grizzly) sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 73 (third week July, bottom graph).



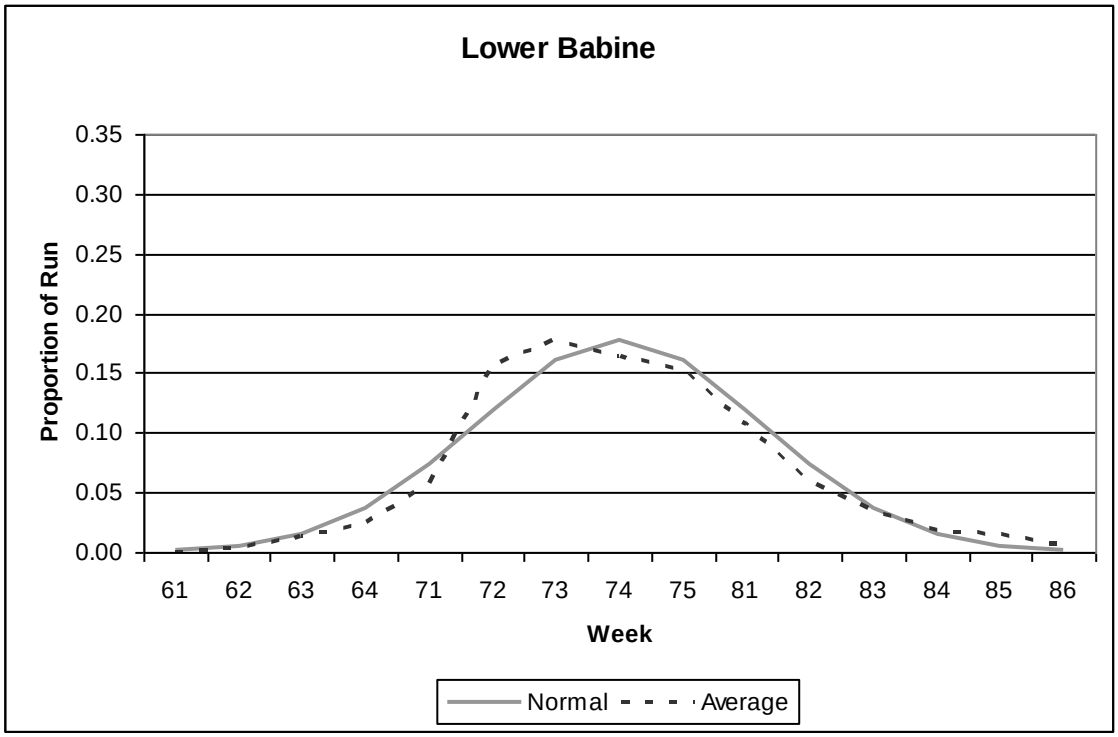
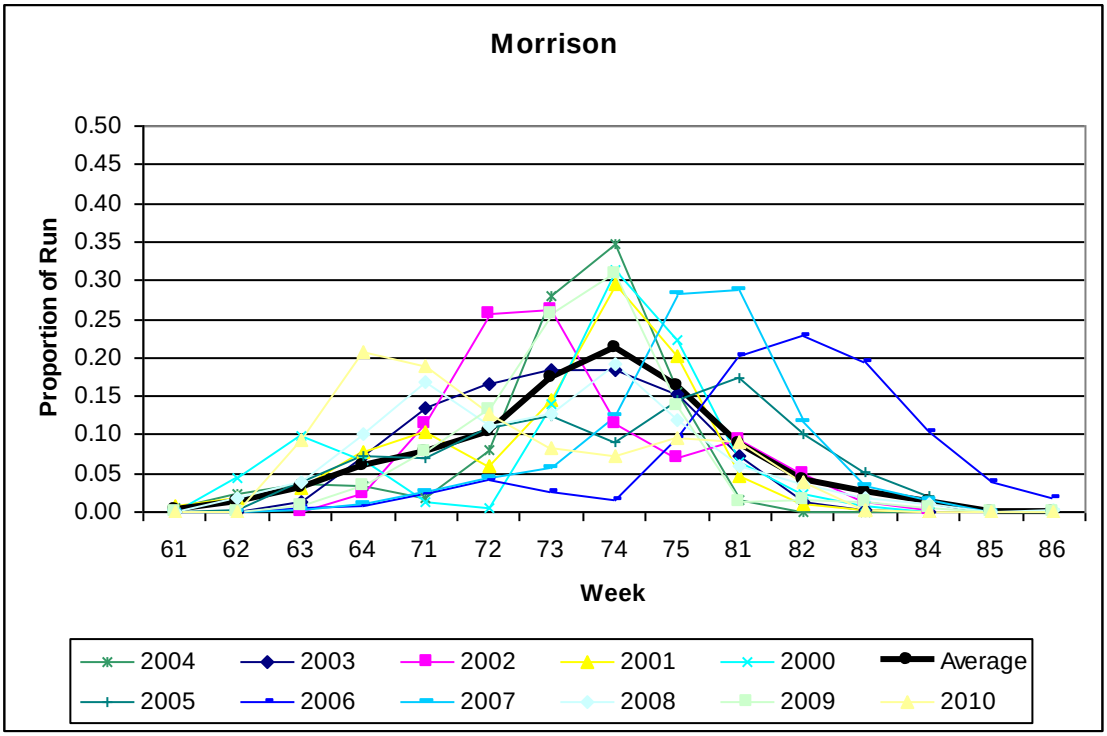


Figure 13. Estimated weekly timing proportions for **late Babine Lake** (lower Babine River) sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 74 (fourth week July, bottom graph).



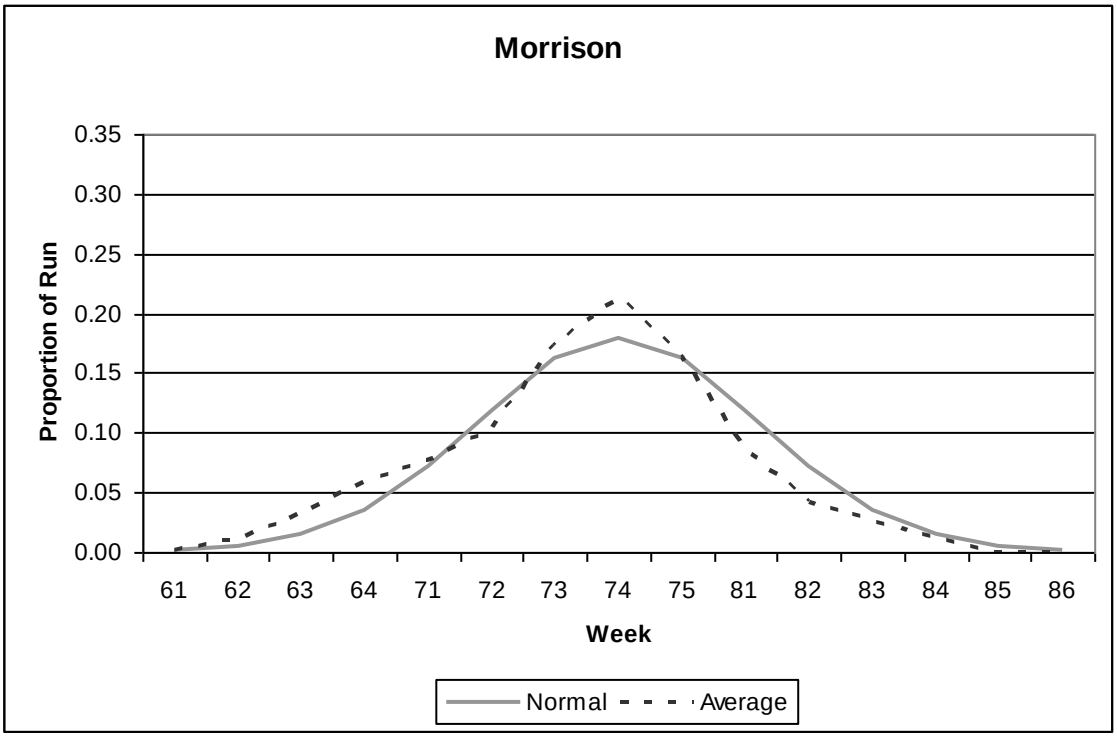
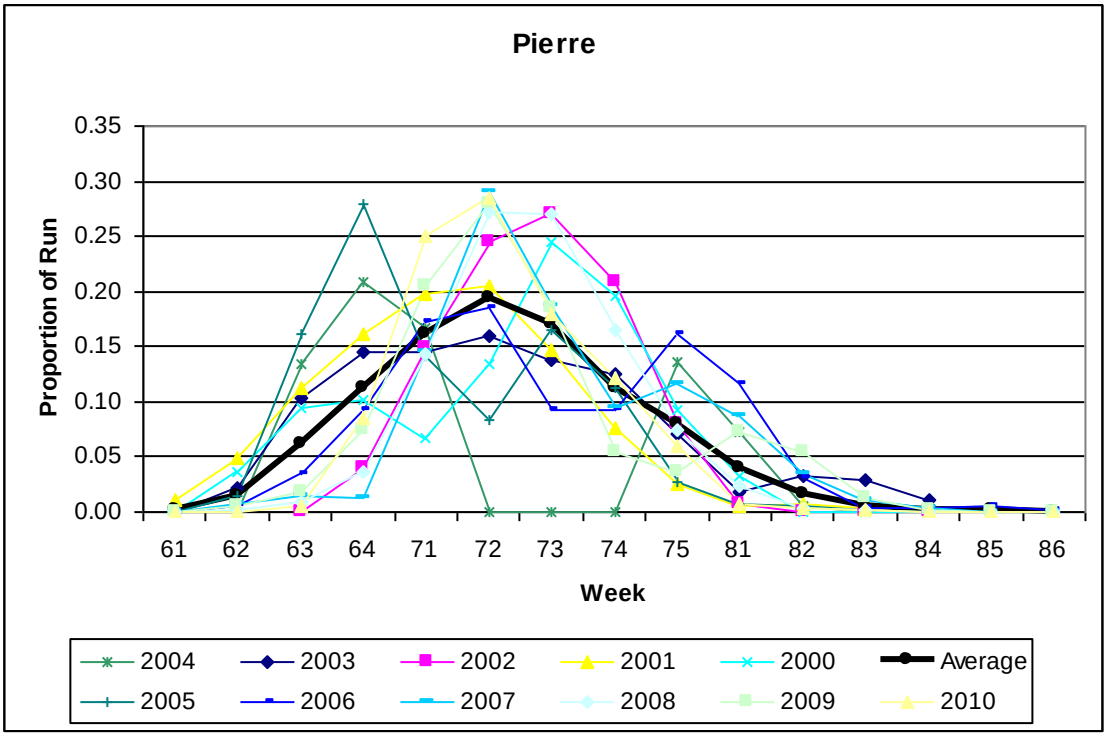


Figure 14. Estimated weekly timing proportions for **mid Babine Lake** (Morrison) sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 74 (fourth week July, bottom graph).



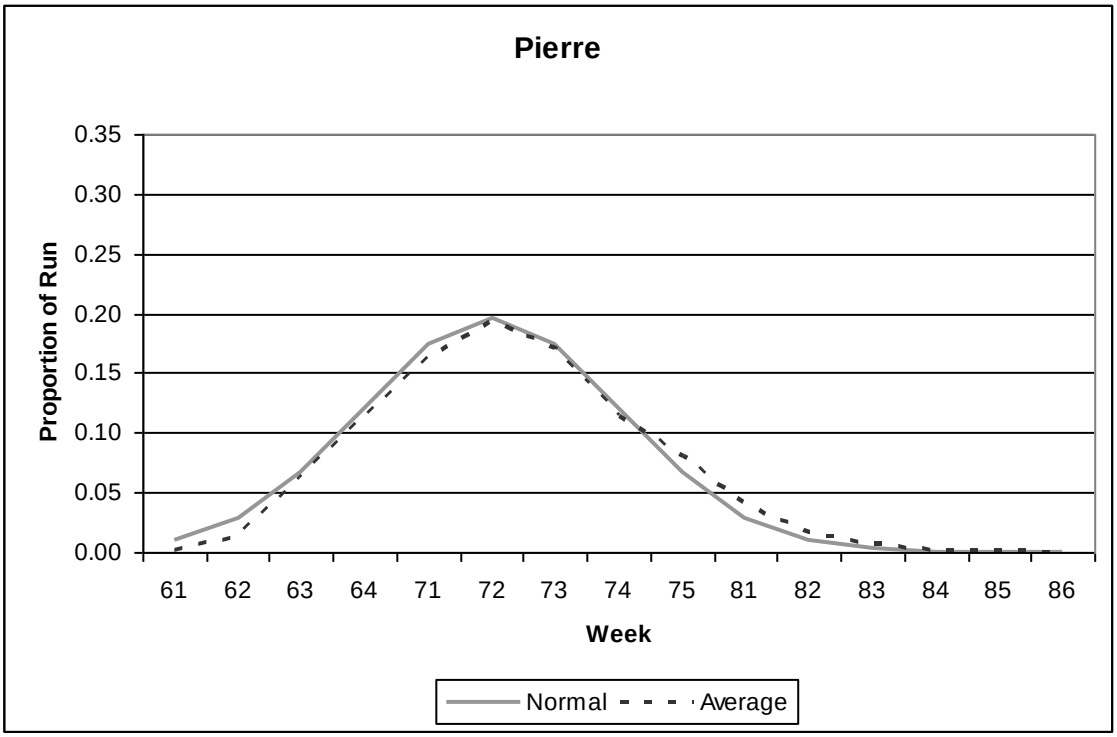
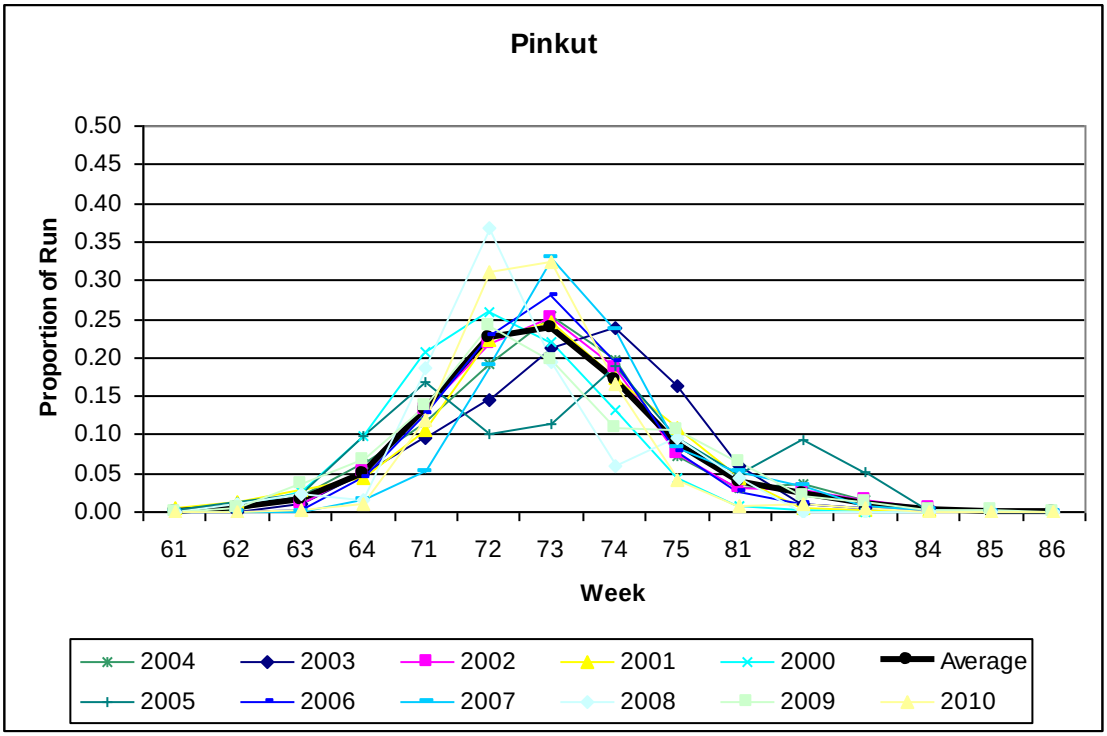


Figure 15. Estimated weekly timing proportions for **early Babine Lake** (Pierre) sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 72 (second week July, bottom graph).



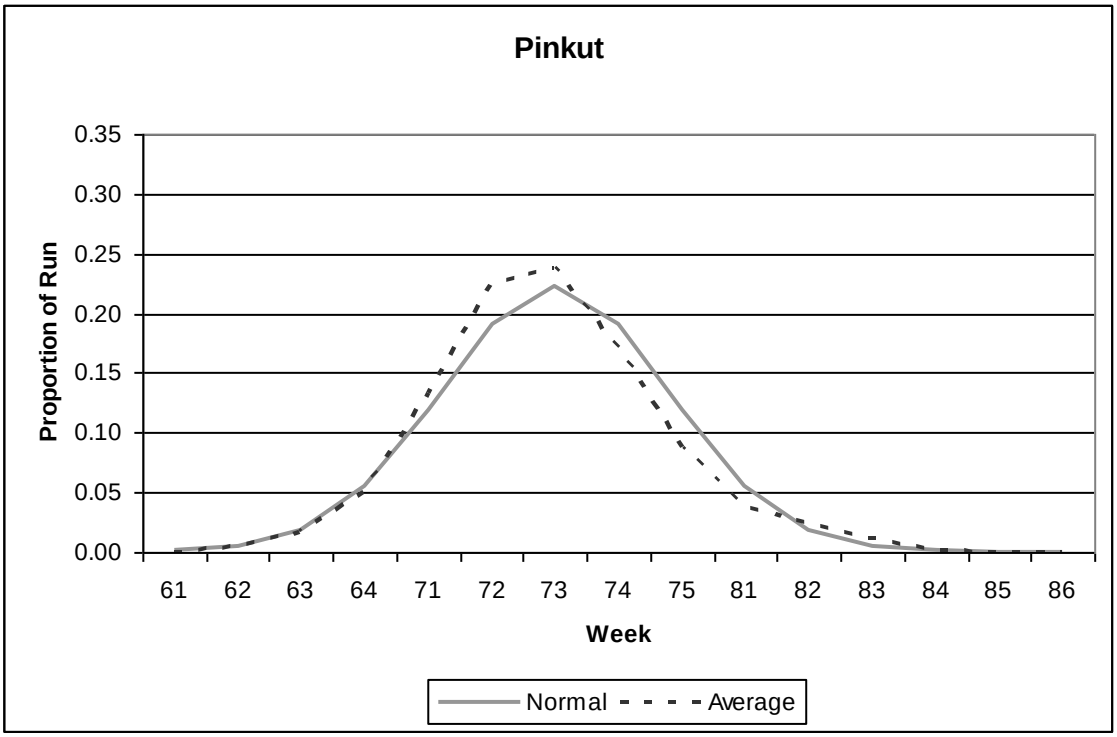
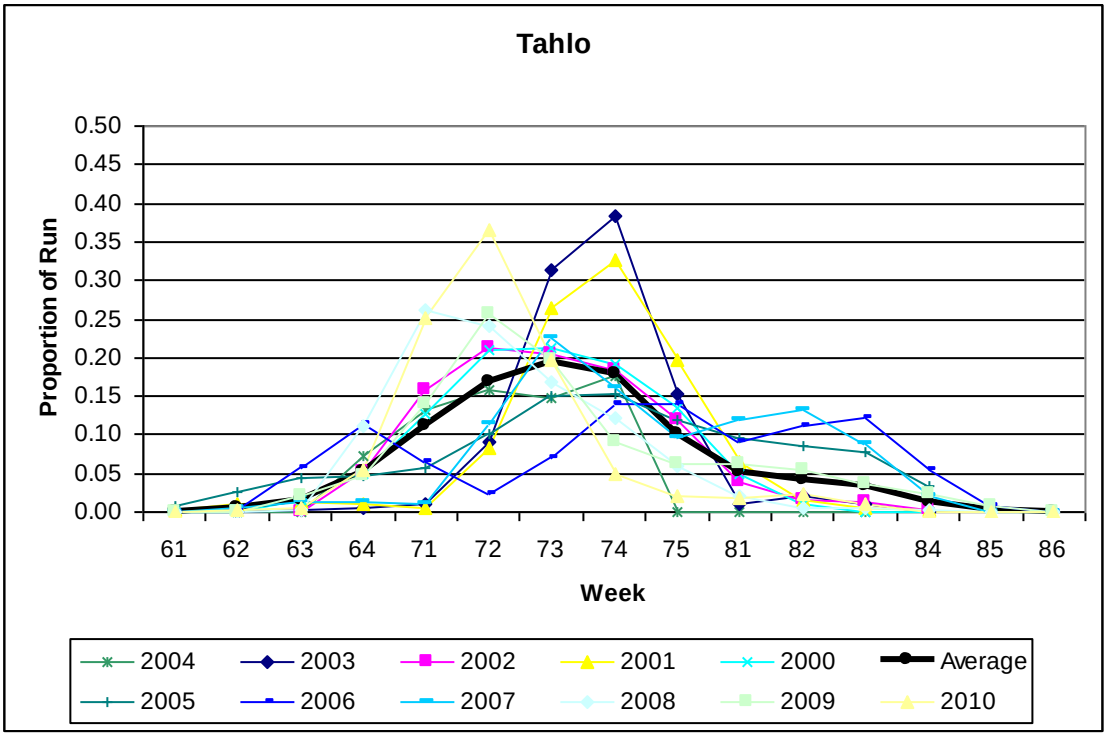


Figure 16. Estimated weekly timing proportions for **mid Babine Lake** (Pinkut) sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 73 (third week July, bottom graph).



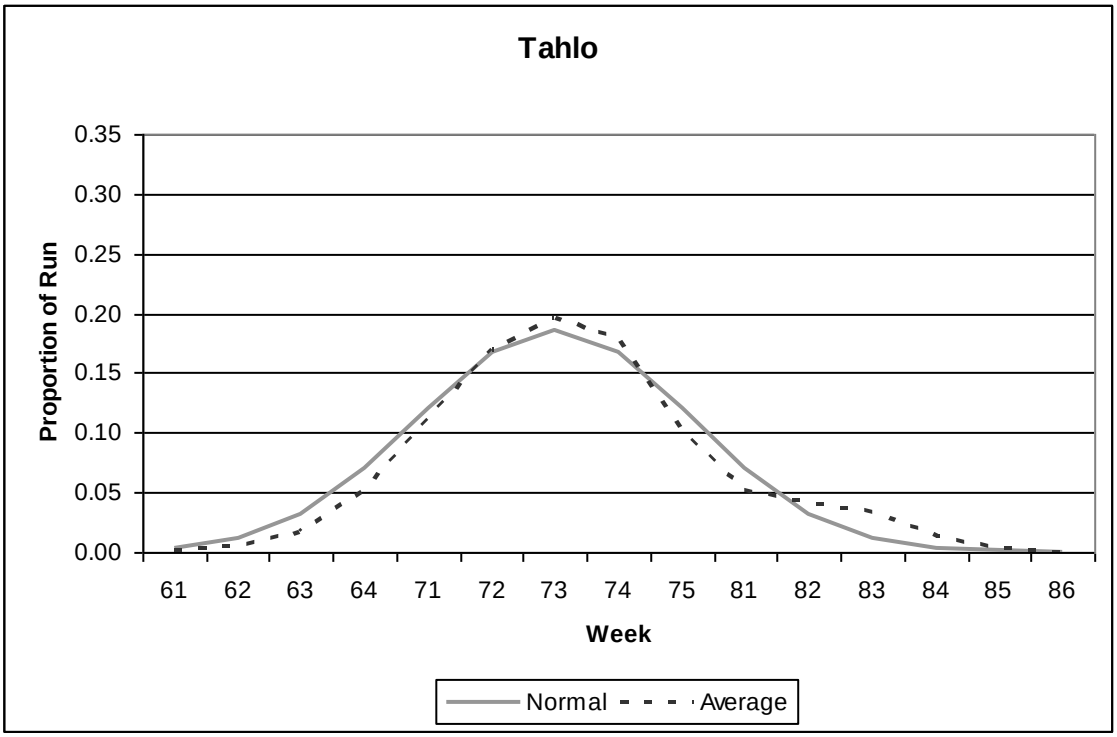
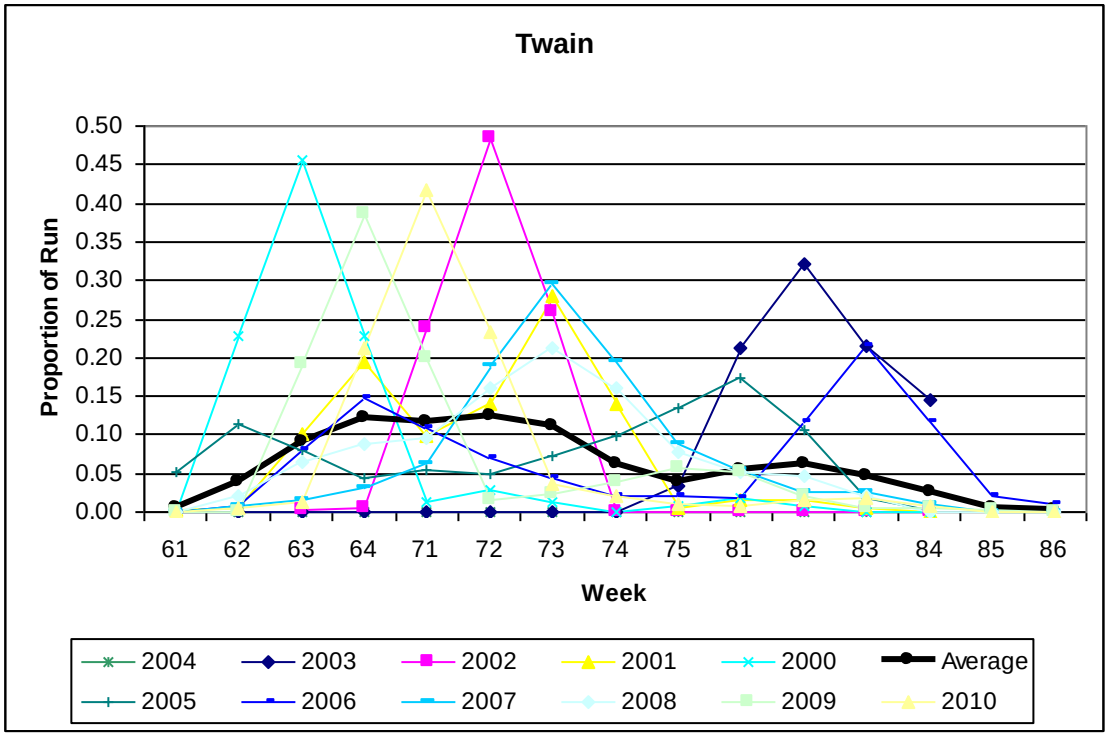


Figure 17. Estimated weekly timing proportions for **mid Babine Lake** (Tahlo) sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 73 (third week July, bottom graph).



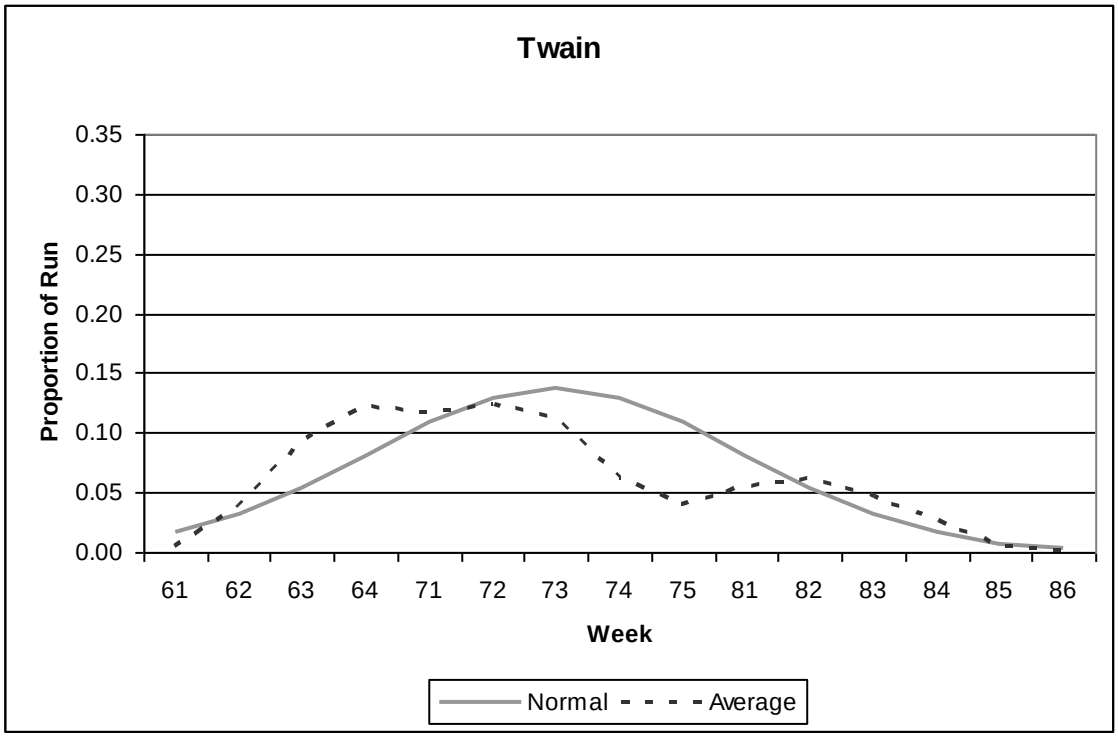


Figure 18. Estimated weekly timing proportions for **early Babine Lake** (Twain) sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 73 (third week July, bottom graph).

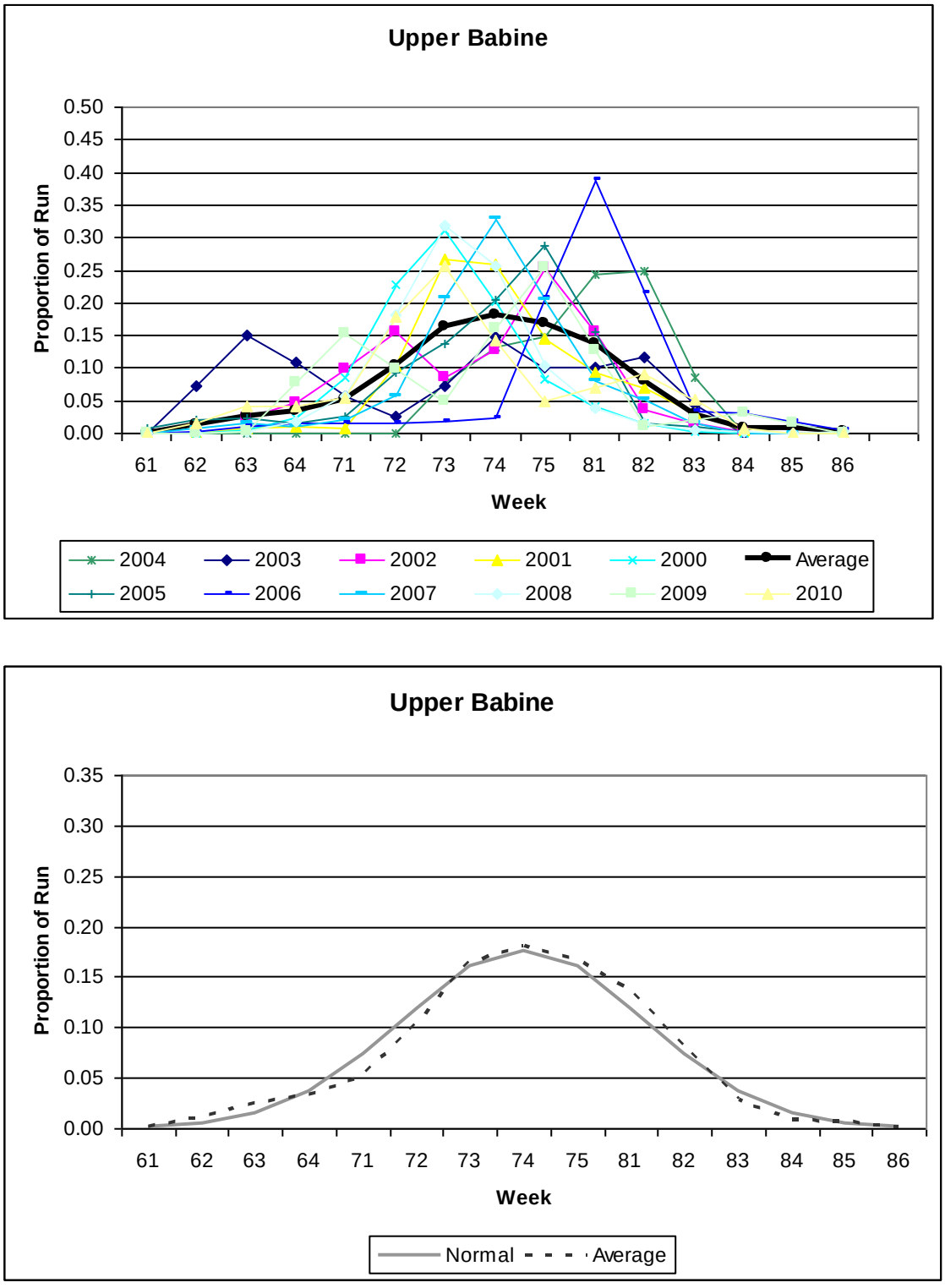


Figure 19. Estimated weekly timing proportions for **late Babine Lake** (Upper Babine River) sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 74 (fourth week July, bottom graph).

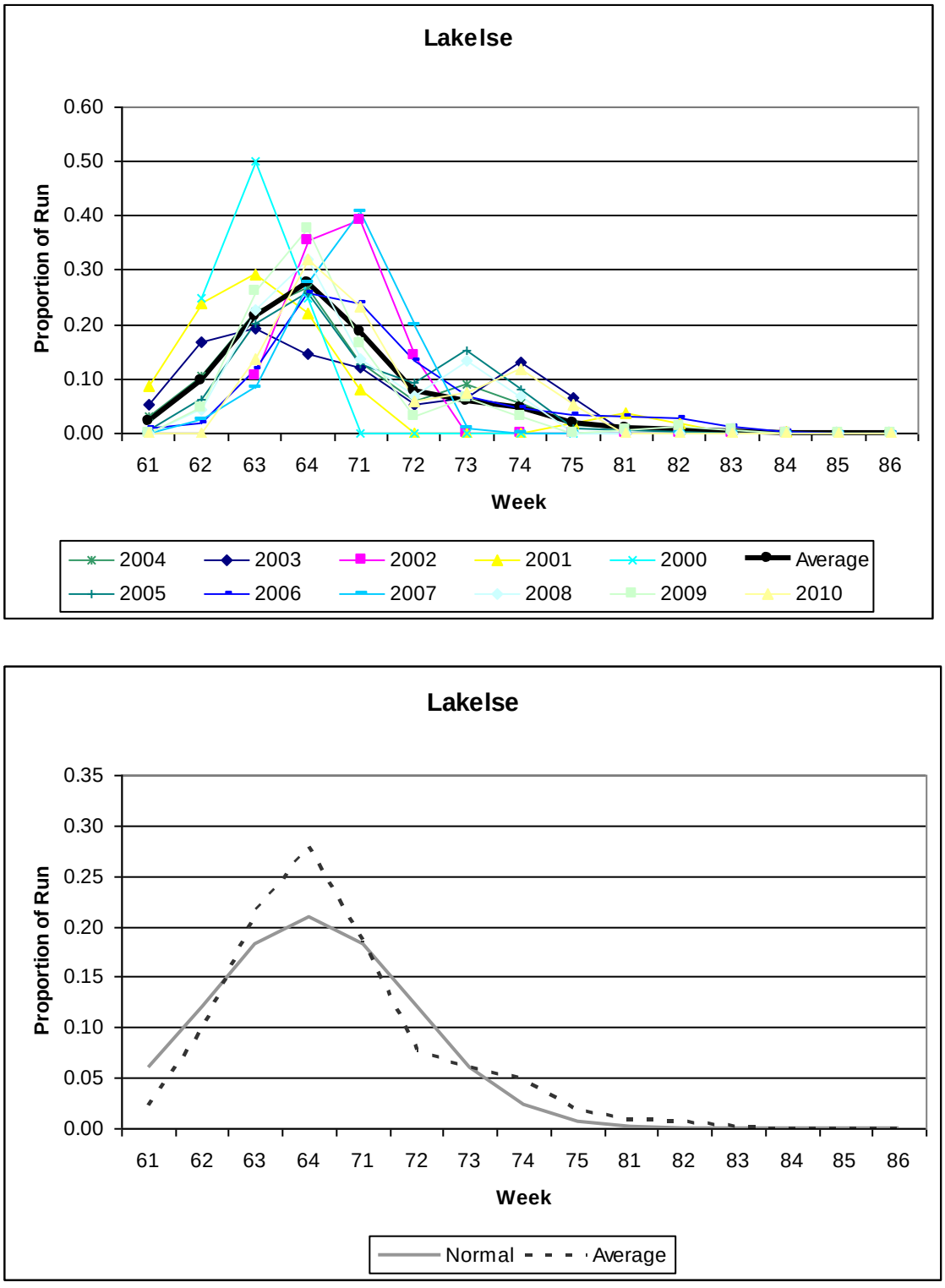


Figure 20. Estimated weekly timing proportions for **Lakelse Lake** sockeye entering outer Area ¾ based on mDNA analysis of Tyee Test Fishery samples collected from 2000-2010 (top graph). The estimated average **peak** week is 64 (last week June, bottom graph).

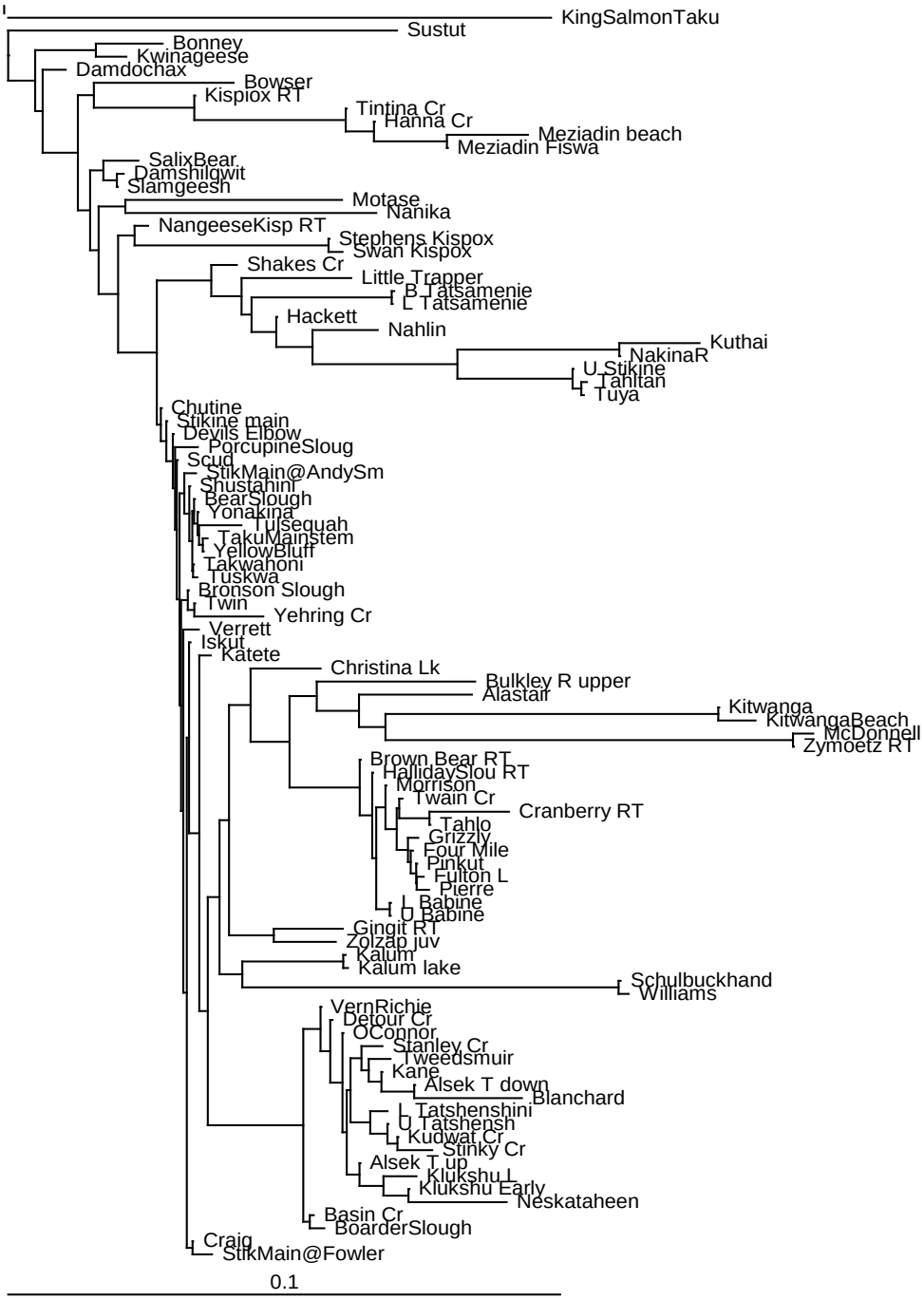


Figure 21. Sockeye dendrogram showing genetic relationships amongst north coast spawning ground baselines.

Lake	Estimated Peak Timing	Peak Week	Management Group	Allowed Range	Standard Deviation	Allowed Range	**2000-2010 DNA Anal.**	**Standard Deviation** (weeks)
Alastair	June 24-30	64	ENB	+/- 1 week	1.5 weeks	+/- 1/2 week	71	2.6
Aldrich	July 8-15	72	MNB	+/- 1 week	1.5 weeks	+/- 1/2 week	71	1.4
Asitka	July 8-15	72	MNB	+/- 1 week	1.5 weeks	+/- 1/2 week		
Atna	July 1-7	71	ENB	+/- 1 week	1.5 weeks	+/- 1/2 week	72	2.5
Azuklotz	July 22-28	74	LNB	+/- 1 week	1.5 weeks	+/- 1/2 week	73	2.5
Babine-Nilkitkwa	July 8-Aug 4	72-75	BAB	+/- 1 week	1.5 weeks	+/- 1/2 week	72-75	1.8-2.9
Bear	July 22-28	74	LNB	+/- 1 week	1.5 weeks	+/- 1/2 week	73	2.5
Bulkley	July 1-7	71	ENB	+/- 1 week	1.5 weeks	+/- 1/2 week	72	2.5
Club	July 8-15	72	MNB	+/- 1 week	1.5 weeks	+/- 1/2 week	72	1.8
Damshilgwit	July 15-22	73	MNB	+/- 1 week	1.5 weeks	+/- 1/2 week		
Dennis	July 8-15	72	MNB	+/- 1 week	1.5 weeks	+/- 1/2 week	71	1.4
Johanson	July 8-15	72	MNB	+/- 1 week	1.5 weeks	+/- 1/2 week	73	2.0
Johnston	June 24-30	64	ENB	+/- 1 week	1.5 weeks	+/- 1/2 week		
Kitsumkalum	July 22-28	74	LNB	+/- 1 week	1.5 weeks	+/- 1/2 week	73	2.5
Kitwanga	July 22-28	74	LNB	+/- 1 week	1.5 weeks	+/- 1/2 week	74	2.8
Kluatantan Lks	July 8-15	72	MNB	+/- 1 week	1.5 weeks	+/- 1/2 week		
Kluayaz	July 8-15	72	MNB	+/- 1 week	1.5 weeks	+/- 1/2 week		
Lakelse	June 24-30	64	ENB	+/- 1 week	1.5 weeks	+/- 1/2 week	64	1.9
Maxan	July 1-7	71	ENB	+/- 1 week	1.5 weeks	+/- 1/2 week	72	2.5
McDonell	July 8-15	72	MNB	+/- 1 week	1.5 weeks	+/- 1/2 week	71	1.4
Morice	July 1-7	71	ENB	+/- 1 week	1.5 weeks	+/- 1/2 week	72	2.5
Morrison	July 15-22	73	BAB	+/- 1 week	1.5 weeks	+/- 1/2 week	74	2.2
Motase	July 15-22	73	MNB	+/- 1 week	1.5 weeks	+/- 1/2 week	74	2.2
Sicintine	July 15-22	73	MNB	+/- 1 week	1.5 weeks	+/- 1/2 week		
Slamgeesh	July 15-22	73	MNB	+/- 1 week	1.5 weeks	+/- 1/2 week		
Spawning	July 8-15	72	MNB	+/- 1 week	1.5 weeks	+/- 1/2 week		
Stephens	July 8-15	72	MNB	+/- 1 week	1.5 weeks	+/- 1/2 week	72	1.8
Sustut	July 8-15	72	MNB	+/- 1 week	1.5 weeks	+/- 1/2 week	73	2.0
Swan	July 8-15	72	MNB	+/- 1 week	1.5 weeks	+/- 1/2 week	72	1.8

(1) Run-timing variability for each stock assumes a triangular distribution for the peak and its s.d.:
e.g. for Alastair, the peak week is set to 64 (June 24-30) with a minimum of week 63 and a maximum of week 71
-the standard deviation about the peak week is set to 1.5 weeks (Cox-Rogers 1994) with a minimum of 1 week and a maximum of 2 weeks.

(2) Management Group	Weeks
BAB = (Babine system)	72-75
ENB = (Early non-Babine)	64-71
MNB = (Mid non-Babine)-	72-73
LNB = (Late non-Babine)	74-81

Table 1. Comparison of estimated Area ¾ entry timing (peak weeks and spreads) for Skeena River sockeye sub-stocks as reported in Table 2 of Cox-Rogers et al (2004) and Cox-Rogers and Spilsted (2010), and as estimated in this analysis (last two columns, data in Appendix 1).