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Application of Mixed-Stock Analysis for Yukon River Fall Chum Salmon, 2007

Annual Report for Study 06-205

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Table of Contents

List of Tables

List of Figures

Abstract

Here we report interim results for genetic mixed-stock analysis (MSA) of Yukon River chum salmon harvested from the Pilot Station sonar and Mountain Village test fisheries in 2007; this is a continuation of previous work by Flannery et al. (2007). Fall chum salmon did not outnumber summer chum salmon until the first week of August, two to three weeks after the start of the fall management season. Overall, the largest contribution to the 2007 fall chum salmon return came from the U.S. border region (33.0%). Contributions of fall chum salmon from other regions were: Tanana 28.3%, Canada mainstem 18.4%, Canada Porcupine 3.0%, White 17.1%, and Teslin 0.2%. As in previous years, the abundance estimates derived from combining the results from genetic and sonar estimates continued to be less than those from the escapement and harvest estimates. This disparity increased in 2007 (and 2006) when compared to the results from 2004 and 2005. Some discrepancy between the methods is expected due to the effects of experimental error associated with escapement projects and the fact that on average at least 5% of the fall chum salmon run likely passes Pilot Station after the sonar stops operating for the season at the end of August. Moreover, the level of agreement between the methods appears to be related to the run timing in a given year. There is better agreement between the methods when the timing of the fall run is normal (as in 2004 and 2005). When the fall run is late (as in 2006 and 2007) the genetic/sonar estimates are expected to be lower, relative to the escapement/harvest estimates, because fish returning after operations cease are obviously not counted by the sonar. Furthermore, it is likely that when the fall run is late, some escapement projects are counting summer chum salmon as fall chum salmon because of geographic and temporal overlap between the seasonal races, especially in the Tanana River.

Key Words: chum salmon, Yukon River, mixed-stock analysis, microsatellites.

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Introduction

Determining stock structure and the relative contribution of stocks to harvests are essential for effective management (Larkin 1981). This is a difficult task, greatly simplified through the use of genetic mixed-stock analysis (MSA; Cadrin et al. 2005). Here we provide an interim report documenting the 2007 results of an ongoing MSA study of Yukon River chum salmon harvested from the Pilot Station sonar and Mountain Village test fisheries where regional stock composition estimates are distributed in-season to assist in management decisions. This work represents a continuation of a study initiated in 2004 under the U.S. Fish and Wildlife Service, Office of Subsistence Management, Fisheries Resource Monitoring Program, project 04-228. The final report for that study (Flannery et al. 2007) should be referenced for additional details.

The Yukon River flows 3,200 km through Alaska and Canada, and chum salmon are an important resource for subsistence users in both countries. Two seasonal races of chum salmon, termed "summer" and "fall", return to spawn in the Yukon River. Summer chum salmon spawn only in the Alaska portion of the Yukon River, whereas fall chum salmon spawn in both Alaska and Canada. Both runs are managed to meet escapement goals and provide maximum harvest opportunities. Furthermore, fishery managers have additional obligations to conserve and equitably share fall chum salmon with Canada, per the Yukon River Salmon Agreement, an annex of the 1985 U.S./Canada Pacific Salmon Treaty (PST).

Methods

Sample collection and laboratory analysis—Tissue samples (axillary process) were collected from July 1, 2007 to August 31, 2007 from each chum salmon caught in the Pilot Station sonar test fishery located 197 km upriver of the Yukon River mouth. Samples were also collected from August 31, 2007 to September 10, 2007 from each chum salmon caught in the Mountain Village test fishery located 140 km upriver of the Yukon River mouth. Fall chum salmon typically begin entering the Yukon River mouth sometime in early July, but the fall management season does not officially begin until July 19 at Pilot Station. Sampling began prior to the start of the fall management date in order to accurately reflect the overall seasonal passage of fall chum salmon. Fall chum salmon enter the river in pulses, or surges of fish, that are associated with offshore wind events, high tides, or both. Samples were stratified by pulse of fish or time period, and 210 samples were selected for each stratum, with the daily sample size proportional to the daily sonar passage estimate. Samples were genotyped as in Flannery et al. (2007) for the following loci: *Oki1, Oki2* (Smith et al. 1998); *Oki100* (Miller unpublished); *Omy1011* (Spies et al. 2005); *One102, One103, One104, One114* (Olsen et al. 2000); *Ots103* (Beacham et al. 1998); *OtsG68* (Williamson et al. 2002); and *Ssa419* (Cairney et al. 2000).

Data analysis—The stock compositions of the mixtures were estimated using Bayesian mixture modeling (Pella and Masuda 2001) with the baseline data (Figure 1) described in Flannery et al. (2007). The estimates were summed by seasonal race, region, and country (Figure 1) and then distributed to fishery managers less than three days after the samples were received in the lab. The stock composition for the entire Pilot Station sampling period was calculated by taking a weighted average of each stratum's estimate of stock composition based on the stratum's relative abundance for the entire period as determined from Pilot Station sonar passage estimates (Seeb et al. 1997). Stock specific abundance estimates were derived by combining the Pilot Station sonar passage estimates with the Pilot Station genetic stock composition estimates.

A post season analysis was conducted to compare the fall stock specific abundance estimates from the genetic/sonar method against the escapement/harvest method estimates. Escapements from the following projects were compiled: upper Tanana River mark and recapture (JTC 2009), Kantishna River mark and recapture (JTC 2009), Chandalar River sonar (JTC 2009), Sheenjek River sonar (JTC 2009), Canada border sonar (JTC 2009), and Fishing Branch weir (JTC 2009). Harvest estimates (upriver of Pilot Station) by river location were obtained from a post season survey of subsistence fishers conducted by the Alaska Department of Fish and Game (ADFG; Bill Busher, ADFG, pers. comm.). It was assumed that fishers were unlikely to report a summer chum salmon as a fall chum salmon. This assumption contains potential bias because the seasonal races overlap in run timing and because it is difficult to phenotypically distinguish the seasonal race of chum salmon. However, there is little fishing effort during the overlap (Busher et al. 2008), which reduces bias. Moreover, the number of chum salmon harvested is small compared to total escapement, so this bias is negligible. Harvest was apportioned to the U.S. and Canada fall stocks in a stepwise downstream fashion by using the escapements to estimate the relative proportions of these stocks available at various locations and multiplying these proportions by the harvest at each location. These stock specific harvest estimates were then added to the appropriate escapements in order to allow a direct comparison between data sources.

Results and Discussion

In 2007, eight strata of chum salmon were analyzed from the Pilot Station sonar test fishery. All strata were analyzed with a sample size of 210, except stratum four, where 186 samples were analyzed. Summer chum salmon comprised the majority of the harvest during the first three strata (Table 1, Figure 2). Fall chum salmon were first detected in stratum two, the week prior to the fall management season. However, the transition in run majority from summer to fall chum salmon was delayed until the first week in August (stratum four, Figure 3). Summer chum salmon continued to comprise >5% of the harvest through stratum 7, which ended on August 24 (Table 1, Figure 2). The presence of both summer and fall chum salmon before and after the switch in management seasons is consistent with data from previous studies (Wilmot et al. 1992; ADFG 2003; Flannery et al. 2007, 2008). A total 79 samples were collected and analyzed from the Mountain Village test fishery. Tanana fall chum salmon were the largest contributor (72%) to this mixture (Table 2, Figure 2).

Stock compositions vary significantly from year to year. Nevertheless, there are some apparent consistencies. Fall chum salmon from the U.S. border region continued to have the earliest run timing, followed by fall chum salmon from the mainstem and White regions (Figure 2). Teslin fall chum salmon were not appreciable contributors, and Tanana fall chum salmon continued to run last, slowly building until they comprised the majority of the final strata (Figure 2). Porcupine fish were late in 2007 when compared to previous years (Figure 2; Flannery et al. 2007, 2008), though this may be a sampling artifact considering their relatively low numbers. Fall chum from the U.S. border region were again sustained throughout the run, with contributions ranging from 7 – 42% for strata 3 – 8 (Table 1), accounting for 33% of the total fall run, similar to 2004 results, but well below estimates for 2005 (49%) and 2006 (44%; Table 3). Contributions from White region increased nearly 5% from 2006, while the contribution from the Porcupine region decreased slightly to 3%. Other regions were within reported ranges (Table 3). The contribution of U.S. chum salmon to the fall run was 61%, the lowest percentage yet (Table 3). Canada border fall fish, which includes the Canada Porcupine and Canada mainstem regions, continued to return in greater numbers than upper Canada fall fish, which includes the White and Teslin regions. The contribution of Canada border fall fish was 1.2 times larger than upper Canada, a slight decrease from previous years (Table 3).

Overall, stock abundance estimates, the products of estimates of Pilot Station genetic stock composition (Table 1) and Pilot Station sonar passage (Table 4), ranged from 1,046 to 1,134,779 fish (Table 5). Escapement totals from the upriver monitoring projects ranged from 47,641 to 402,654 fish (Table 6). Subsistence harvests from the fishing districts, upriver of Pilot Station, were added to the escapement totals (Table 7). The genetic/sonar estimates continued to be less than the escapement/harvest estimates, though the discrepancy increased in 2007, as it did in 2006, when compared to 2004 and 2005 (Figure 4; Flannery et al. 2007, 2008). The Pilot Station sonar abundance estimate during the fall management season, July 19 – August 31, was 684,011 (Table 4, strata 3-8), but the genetic/sonar estimate indicated that only 553,723 were actually fall chum salmon (Table 5).

The level of agreement between the genetic/sonar and escapement/harvest methods appears to be related, in part, to the run timing. There was better agreement in 2004 and 2005 (Flannery et al. 2007). In those years, fall chum salmon comprised the majority of the run after the transition date. Less agreement was found in 2006 (Flannery et al. 2008) and 2007 when the fall run was late. These results are consistent with the hypothesis that a significant number of late returning fish are missed after the sonar shuts down. Furthermore, it is likely that when the fall run is late, some escapement projects are counting summer chum salmon as fall chum salmon because of geographic and temporal overlap between the seasonal races, especially in the Tanana River. Escapement projects may also be missing the late returning fish as they are designed to account for fish that pass Pilot Station by August 31. However, the summer run is of greater magnitude, two to three times larger, than the fall run, so if escapement projects are counting summer chum salmon as fall, then greater discrepancy is expected.

Several other factors likely contributed to the relatively high discrepancy between the genetic/sonar and escapement/harvest in 2007. First, reverberation bands from large plumes of silt passing the left bank sonar units interfered with the Pilot Station sonar count on August 15 and 16. These plumes occurred when the majority of stratum six was passing the sonar site. The estimates for those two days were partially interpolated based on the August 12 and 13 catch per unit of effort data from the test fishery (JTC 2008). Additionally, poor counting conditions were experienced because of high water and debris during the second half of the season when the abundance of fall chum salmon was highest. Lastly, there was evidence that a pulse of fall chum salmon began passing the sonar on August 31, the last day of operation, so most of this pulse was unaccounted for in the sonar abundance estimates. This was corroborated by individual escapement projects that reported significant passage of fall chum salmon right up to the time the projects were terminated due to the onset of winter.

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Table 1. 2007 Pilot Station test fishery chum salmon stock composition estimates with associated standard deviations and 95% confidence intervals by stratum and management group. A. see Figure 1 for management groups. B. contains allocations to various combinations of management groups; Summer represents allocations to Lower Summer and Tanana Summer; Fall represents allocations to U.S. Border Fall, Porcupine Fall, Mainstem Fall, White Fall, and Teslin Fall; Canada Border represents allocations to Porcupine Fall and Mainstem Fall; Upper Canada represents allocations to White Fall and Teslin Fall; Fall U.S. represents allocations to the Tanana Fall and U.S. Border Fall; U.S. Border + Canada represents allocations to the U.S. Border Fall, Porcupine Fall, Mainstem Fall, White Fall, and Teslin Fall; Mainstem + Upper Canada represents allocations to the Mainstem Fall, White Fall, and Teslin Fall.

Management Group	Stratum 1 7/1 – 7/9 Estimate	SD	95% CI	
A.				
Lower Summer	0.982	0.022	0.921	1.000
Tanana Summer	0.012	0.021	0.000	0.071
Tanana Fall	0.001	0.003	0.000	0.008
U.S. Border Fall	0.002	0.005	0.000	0.015
U.S. total	0.997	0.005	0.982	1.000
Porcupine Fall	0.000	0.001	0.000	0.003
Mainstem Fall	0.002	0.004	0.000	0.016
White Fall	0.001	0.001	0.000	0.004
Teslin Fall	0.000	0.001	0.000	0.003
Canada total	0.003	0.005	0.000	0.018
B.				
Summer	0.995	0.007	0.975	1.000
Fall	0.005	0.007	0.000	0.025
Canada Border	0.002	0.005	0.000	0.017
Upper Canada	0.001	0.002	0.000	0.006
Fall U.S.	0.003	0.005	0.000	0.018
U.S. Border + Canada	0.005	0.007	0.000	0.024
Mainstem + Upper Canada	0.003	0.005	0.000	0.017

Continued

Table 1. Continued.

Management Group	Stratum 2 7/10 – 7/18 Estimate	SD	95% CI	
A.				
Lower Summer	0.909	0.035	0.838	0.978
Tanana Summer	0.050	0.031	0.000	0.118
Tanana Fall	0.003	0.008	0.000	0.027
U.S. Border Fall	0.015	0.020	0.000	0.067
U.S. total	0.977	0.018	0.934	0.999
Porcupine Fall	0.001	0.004	0.000	0.011
Mainstem Fall	0.017	0.018	0.000	0.059
White Fall	0.004	0.006	0.000	0.019
Teslin Fall	0.001	0.003	0.000	0.009
Canada total	0.023	0.018	0.000	0.066
B.				
Summer	0.959	0.022	0.910	0.994
Fall	0.041	0.022	0.006	0.089
Canada Border	0.018	0.018	0.000	0.060
Upper Canada	0.005	0.006	0.000	0.022
Fall U.S.	0.018	0.021	0.000	0.072
U.S. Border + Canada	0.038	0.021	0.005	0.085
Mainstem + Upper Canada	0.022	0.018	0.000	0.065

Continued

Table 1. Continued.

Management Group	Stratum 3 7/19 – 8/2 Estimate	SD	95% CI	
A.				
Lower Summer	0.665	0.059	0.558	0.792
Tanana Summer	0.199	0.057	0.086	0.312
Tanana Fall	0.009	0.017	0.000	0.061
U.S. Border Fall	0.072	0.047	0.000	0.168
U.S. total	0.946	0.036	0.864	0.996
Porcupine Fall	0.002	0.008	0.000	0.027
Mainstem Fall	0.040	0.037	0.000	0.124
White Fall	0.011	0.010	0.000	0.035
Teslin Fall	0.002	0.006	0.000	0.022
Canada total	0.054	0.036	0.004	0.136
B.				
Summer	0.864	0.040	0.780	0.934
Fall	0.136	0.040	0.065	0.220
Canada Border	0.042	0.037	0.000	0.126
Upper Canada	0.013	0.012	0.000	0.041
Fall U.S.	0.081	0.049	0.000	0.182
U.S. Border + Canada	0.126	0.038	0.059	0.209
Mainstem + Upper Canada	0.052	0.036	0.003	0.135

Continued

Table 1. Continued.

Management Group	Stratum 4 8/3 – 8/8 Estimate	SD	95% CI	
A.				
Lower Summer	0.377	0.092	0.183	0.546
Tanana Summer	0.045	0.055	0.000	0.180
Tanana Fall	0.042	0.038	0.000	0.128
U.S. Border Fall	0.197	0.081	0.052	0.372
U.S. total	0.661	0.063	0.534	0.779
Porcupine Fall	0.005	0.016	0.000	0.060
Mainstem Fall	0.202	0.060	0.091	0.323
White Fall	0.131	0.027	0.083	0.188
Teslin Fall	0.000	0.002	0.000	0.004
Canada total	0.339	0.063	0.220	0.466
B.				
Summer	0.422	0.081	0.256	0.575
Fall	0.578	0.081	0.426	0.743
Canada Border	0.208	0.061	0.095	0.331
Upper Canada	0.131	0.027	0.083	0.189
Fall U.S.	0.239	0.091	0.076	0.430
U.S. Border + Canada	0.536	0.072	0.402	0.685
Mainstem + Upper Canada	0.334	0.062	0.215	0.457

Continued

Table 1. Continued.

Management Group	Stratum 5 8/9 – 8/13 Estimate	SD	95% CI	
A.				
Lower Summer	0.095	0.039	0.040	0.197
Tanana Summer	0.002	0.005	0.000	0.018
Tanana Fall	0.148	0.043	0.072	0.237
U.S. Border Fall	0.415	0.079	0.263	0.572
U.S. total	0.659	0.072	0.512	0.799
Porcupine Fall	0.001	0.003	0.000	0.005
Mainstem Fall	0.191	0.070	0.060	0.334
White Fall	0.148	0.028	0.095	0.205
Teslin Fall	0.001	0.004	0.000	0.015
Canada total	0.341	0.072	0.201	0.488
B.				
Summer	0.096	0.039	0.042	0.197
Fall	0.904	0.039	0.803	0.958
Canada Border	0.192	0.070	0.060	0.335
Upper Canada	0.149	0.028	0.096	0.207
Fall U.S.	0.563	0.079	0.400	0.711
U.S. Border + Canada	0.756	0.051	0.646	0.846
Mainstem + Upper Canada	0.340	0.072	0.200	0.488

Continued

Table 1. Continued.

Management Group	Stratum 6 8/14 – 8/18 Estimate	SD	95% CI	
A.				
Lower Summer	0.050	0.027	0.015	0.119
Tanana Summer	0.003	0.009	0.000	0.031
Tanana Fall	0.368	0.052	0.269	0.472
U.S. Border Fall	0.216	0.076	0.075	0.365
U.S. total	0.638	0.071	0.497	0.769
Porcupine Fall	0.039	0.047	0.000	0.151
Mainstem Fall	0.146	0.072	0.001	0.297
White Fall	0.176	0.030	0.122	0.240
Teslin Fall	0.001	0.002	0.000	0.006
Canada total	0.362	0.071	0.231	0.503
B.				
Summer	0.053	0.028	0.016	0.124
Fall	0.947	0.028	0.875	0.984
Canada Border	0.186	0.070	0.062	0.325
Upper Canada	0.177	0.030	0.122	0.240
Fall U.S.	0.584	0.074	0.438	0.724
U.S. Border + Canada	0.578	0.054	0.469	0.682
Mainstem + Upper Canada	0.323	0.073	0.178	0.472

Continued

Table 1. Continued.

Management Group	Stratum 7 8/19 – 8/24 Estimate	SD	95% CI	
A.				
Lower Summer	0.115	0.050	0.039	0.234
Tanana Summer	0.005	0.015	0.000	0.052
Tanana Fall	0.335	0.091	0.165	0.520
U.S. Border Fall	0.345	0.113	0.114	0.565
U.S. total	0.800	0.098	0.562	0.938
Porcupine Fall	0.005	0.020	0.000	0.070
Mainstem Fall	0.065	0.089	0.000	0.306
White Fall	0.130	0.051	0.048	0.243
Teslin Fall	0.001	0.005	0.000	0.011
Canada total	0.200	0.098	0.061	0.438
B.				
Summer	0.120	0.052	0.041	0.241
Fall	0.880	0.052	0.759	0.958
Canada Border	0.070	0.089	0.000	0.307
Upper Canada	0.131	0.052	0.049	0.244
Fall U.S.	0.680	0.107	0.437	0.851
U.S. Border + Canada	0.545	0.092	0.362	0.726
Mainstem + Upper Canada	0.195	0.098	0.059	0.435

Continued

Table 1. Continued.

Management Group	Stratum 8 8/25 – 8/31 Estimate	SD	95% CI	
A.				
Lower Summer	0.021	0.014	0.003	0.054
Tanana Summer	0.001	0.003	0.000	0.007
Tanana Fall	0.522	0.049	0.424	0.617
U.S. Border Fall	0.111	0.064	0.000	0.251
U.S. total	0.654	0.064	0.532	0.785
Porcupine Fall	0.103	0.062	0.000	0.223
Mainstem Fall	0.074	0.052	0.000	0.187
White Fall	0.169	0.029	0.115	0.229
Teslin Fall	0.000	0.002	0.000	0.004
Canada total	0.346	0.064	0.215	0.468
B.				
Summer	0.022	0.014	0.003	0.055
Fall	0.978	0.014	0.945	0.997
Canada Border	0.177	0.061	0.054	0.296
Upper Canada	0.169	0.029	0.115	0.230
Fall U.S.	0.632	0.065	0.507	0.763
U.S. Border + Canada	0.457	0.049	0.361	0.554
Mainstem + Upper Canada	0.243	0.059	0.139	0.363

Continued

Table 1. Continued.

Management Group	Total 7/1 – 8/31 Estimate	SD	95% CI	
A.				
Lower Summer	0.560	0.014	0.534	0.587
Tanana Summer	0.029	0.010	0.010	0.048
Tanana Fall	0.116	0.011	0.094	0.139
U.S. Border Fall	0.136	0.020	0.097	0.174
U.S. total	0.841	0.018	0.806	0.877
Porcupine Fall	0.012	0.007	0.000	0.027
Mainstem Fall	0.076	0.018	0.041	0.110
White Fall	0.070	0.007	0.056	0.084
Teslin Fall	0.001	0.001	0.000	0.003
Canada total	0.159	0.018	0.123	0.194
B.				
Summer	0.589	0.010	0.569	0.610
Fall	0.411	0.010	0.390	0.431
Canada Border	0.088	0.018	0.053	0.122
Upper Canada	0.071	0.007	0.057	0.085
Fall U.S.	0.252	0.020	0.213	0.290
U.S. Border + Canada	0.294	0.014	0.267	0.321
Mainstem + Upper Canada	0.147	0.018	0.111	0.182

Table 2. 2007 Mountain Village test fishery chum salmon stock composition estimates with associated standard deviations and 95% confidence intervals by stratum and management group. A. see Figure 1 for management groups. B. contains allocations to various combinations of management groups; Summer represents allocations to Lower Summer and Tanana Summer; Fall represents allocations to U.S. Border Fall, Porcupine Fall, Mainstem Fall, White Fall, and Teslin Fall; Canada Border represents allocations to Porcupine Fall and Mainstem Fall; Upper Canada represents allocations to White Fall and Teslin Fall; Fall U.S. represents allocations to the Tanana Fall and U.S. Border Fall; U.S. Border + Canada represents allocations to the U.S. Border Fall, Porcupine Fall, Mainstem Fall, White Fall, and Teslin Fall; Mainstem + Upper Canada represents allocations to the Mainstem Fall, White Fall, and Teslin Fall.

Management Group	Mountain Village 8/31 – 9/10			
	Estimate	SD	95% CI	
A.				
Lower Summer	0.008	0.012	0.000	0.042
Tanana Summer	0.002	0.006	0.000	0.019
Tanana Fall	0.720	0.065	0.590	0.842
U.S. Border Fall	0.037	0.056	0.000	0.193
U.S. total	0.767	0.070	0.634	0.899
Porcupine Fall	0.005	0.017	0.000	0.059
Mainstem Fall	0.088	0.063	0.000	0.216
White Fall	0.138	0.042	0.066	0.230
Teslin Fall	0.001	0.004	0.000	0.013
Canada total	0.233	0.070	0.101	0.367
B.				
Summer	0.010	0.014	0.000	0.049
Fall	0.990	0.014	0.950	1.000
Canada Border	0.094	0.062	0.000	0.220
Upper Canada	0.139	0.042	0.066	0.231
Fall U.S.	0.758	0.072	0.619	0.893
U.S. Border + Canada	0.270	0.065	0.151	0.398
Mainstem + Upper Canada	0.227	0.072	0.096	0.364

Table 3. Overall estimates of fall chum salmon stock proportions.

Year	Tanana	U.S. Border	Mainstem	Porcupine	White	Teslin
2004	0.370	0.312	0.116	0.079	0.118	0.004
2005	0.209	0.494	0.117	0.048	0.108	0.024
2006	0.206	0.438	0.189	0.033	0.127	0.007
2007	0.283	0.330	0.184	0.030	0.171	0.002

Table 4. Pilot Station sonar chum salmon passage estimates for 2007.

Year	Strata	Passage
2007	Stratum 1 (7/1-7/9)	437,298
	Stratum 2 (7/10-7/18)	227,559
	Stratum 3 (7/19-8/2)	95,093
	Stratum 4 (8/3-8/8)	50,050
	Stratum 5 (8/9-8/13)	259,525
	Stratum 6 (8/14-8/18)	182,792
	Stratum 7 (8/19-8/24)	17,665
	Stratum 8 (8/25-8/31)	78,886
	Total (7/1-8/31)	1,348,868

Table 5. Total abundance estimates derived from Pilot Station genetic stock composition and sonar chum salmon passage estimates for 2007. The standard deviations and 95% confidence intervals are based on the variances of the genetic estimates only.

Management Group	2007 7/1 - 8/31 Estimate	SD	95% CI	
A.				
Lower Summer	755,545	18,298	719,681	791,410
Tanana Summer	39,274	13,120	13,560	64,989
Tanana Fall	156,834	15,472	126,510	187,159
U.S. Border Fall	182,913	26,416	131,137	234,689
U.S. total	1,134,779	24,330	1,087,093	1,182,466
Porcupine Fall	16,340	10,078	0	36,094
Mainstem Fall	101,999	23,689	55,570	148,429
White Fall	94,920	9,709	75,890	113,950
Teslin Fall	1,046	1,607	0	4,196
Canada total	214,089	24,330	166,401	261,776
B.				
Summer	795,145	13,994	767,718	822,572
Fall	553,723	13,990	526,303	581,143
Canada Border total	118,256	23,640	71,922	164,590
Upper Canada total	95,871	9,825	76,614	115,129
Fall U.S.	339,646	26,504	287,699	391,593
U.S. Border + Canada	396,957	18,664	360,375	433,539
Mainstem + Upper Canada	197,831	24,405	149,997	245,666

Table 6. Preliminary chum salmon escapement project estimates for 2007.

Escapement project	Estimate
Upper Tanana River Mark-Recapture	320,811
Kantishna River Mark-Recapture	81,843
Total Tanana River	402,654
Chandalar Sonar	228,056
Sheenjek Sonar	65,435
Eagle Sonar Border Passage (Mainstem + Upper)	263,979
Fishing Branch Weir	33,750

Table 7. Preliminary chum salmon subsistence harvest estimates for 2007. Bold numbers indicate escapements estimated by the monitoring projects. Harvest was apportioned to the U.S. and Canada fall stocks in a stepwise downstream fashion by using the escapements to estimate the relative proportions of these stocks available at the river locations and multiplying these proportions by the harvest at the river locations.

		Abundance of Contributing Stocks				
Location	Harvest	Canada Mainstem + Upper	Canada Porcupine	Sheenjek	Chandalar	Tanana
Chandalar (w/ Black)	934				**228,056**	
Y6	30,066					**402,654**
Y5D Above Porcupine	19,988	**263,979**				
Ft. Yukon	6,010	283,967	**33,750**	**65,435**		
Y5D Below Chandalar	553	288,421	34,279	66,461	228,990	
Y5C	2,376	288,679	34,310	66,521	229,195	
Y5B	21,596	289,788	34,442	66,776	230,075	
Y5A	0					432,720
Y4	7,358	299,864	35,639	69,098	238,075	432,720
Y3	925	301,916	35,883	69,571	239,704	435,681
Y2 (Marshall only)	789	302,174	35,914	69,630	239,909	436,053
Total	90,595	302,394	35,940	69,681	240,084	436,370

Continued

Table 7. Continued.

Location	Proportion of Contributing Stocks				
	Canada Mainstem + Upper	Canada Porcupine	Sheenjek	Chandalar	Tanana
Chandalar (w/ Black)	0.0000	0.0000	0.0000	1.0000	0.0000
Y6	0.0000	0.0000	0.0000	0.0000	1.0000
Y5D Above Porcupine	1.0000	0.0000	0.0000	0.0000	0.0000
Ft. Yukon	0.7411	0.0881	0.1708	0.0000	0.0000
Y5D Below Chandalar	0.4666	0.0555	0.1075	0.3704	0.0000
Y5C	0.4666	0.0555	0.1075	0.3704	0.0000
Y5B	0.4666	0.0555	0.1075	0.3704	0.0000
Y5A	0.0000	0.0000	0.0000	0.0000	1.0000
Y4	0.2788	0.0331	0.0643	0.2214	0.4024
Y3	0.2788	0.0331	0.0643	0.2214	0.4024
Y2 (Marshall only)	0.2788	0.0331	0.0643	0.2214	0.4024

Location	Harvest Apportionment				
	Canada Mainstem + Upper	Canada Porcupine	Sheenjek	Chandalar	Tanana
Chandalar (w/ Black)	0	0	0	934	0
Y6	0	0	0	0	30,066
Y5D Above Porcupine	19,988	0	0	0	0
Ft. Yukon	4,454	529	1,026	0	0
Y5D Below Chandalar	258	31	59	205	0
Y5C	1,109	132	255	880	0
Y5B	10,076	1,198	2,322	8,000	0
Y5A	0	0	0	0	0
Y4	2,052	244	473	1,629	2,961
Y3	258	31	59	205	372
Y2 (Marshall only)	220	26	51	175	317
Total	38,415	2,190	4,246	12,028	33,716

Figure 1. Baseline sampling locations, 1 = Andreafsky, 2 = Chulinak, 3 = Anvik, 4 = California, 5 = Nulato, 6 = Gisasa, 7 =Henshaw, 8 = Jim, 9 = South Fork Koyukuk Early, 10 = South Fork Koyukuk Late, 11 = Melozitna, 12 = Tozitna, 13 = Chena, 14 = Salcha, 15 = Delta, 16 = Kantishna, 17 = Toklat, 18 = Big Salt, 19 = Chandalar, 20 = Sheenjek, 21 = Black, 22 = Fishing Branch, 23 = Big Creek, 24 = Minto, 25 = Pelly, 26 = Tatchun, 27 = Donjek, 28 = Kluane, and 29 = Teslin. Pilot Station is located on the Yukon River mainstem near sample location 2. Mountain Village is located on the Yukon River mainstem downriver from sample location 1.The grey shaded areas delineate fishery management regions, with summer regions outlined by dashed lines and fall regions by solid lines. The Canada border encompasses the Canada Porcupine and Canada mainstem regions, and upper Canada encompasses the White and Teslin regions.

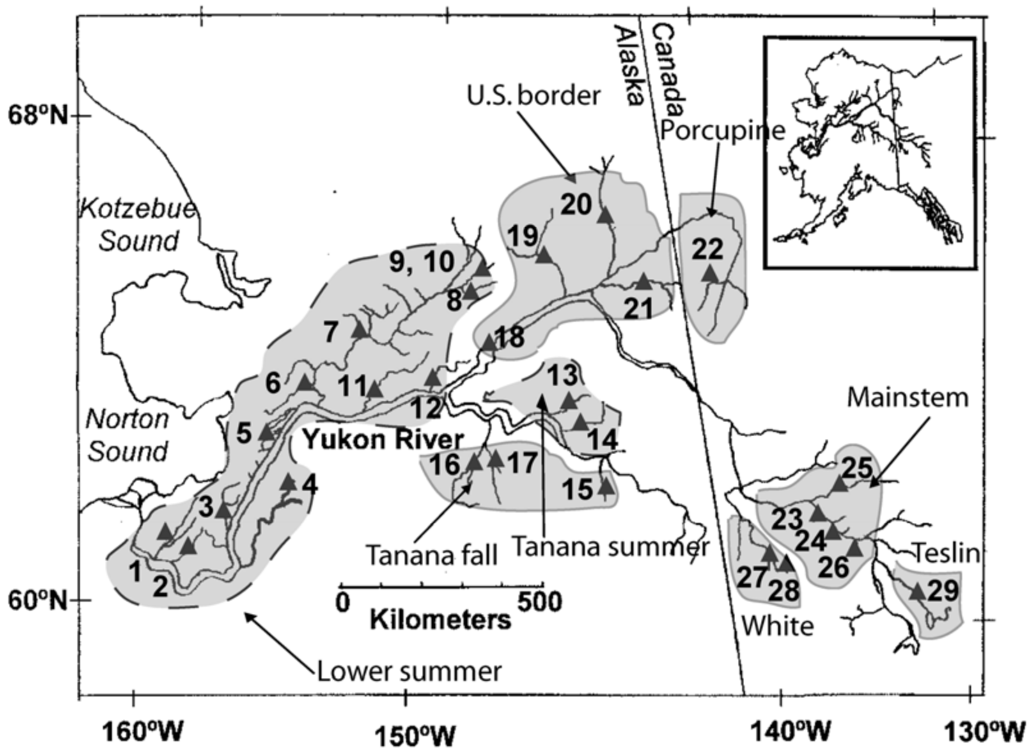


Figure 2. Pilot Station and Mountain Village test fisheries chum salmon stock composition estimates for 2007. Error bars represent one standard error.

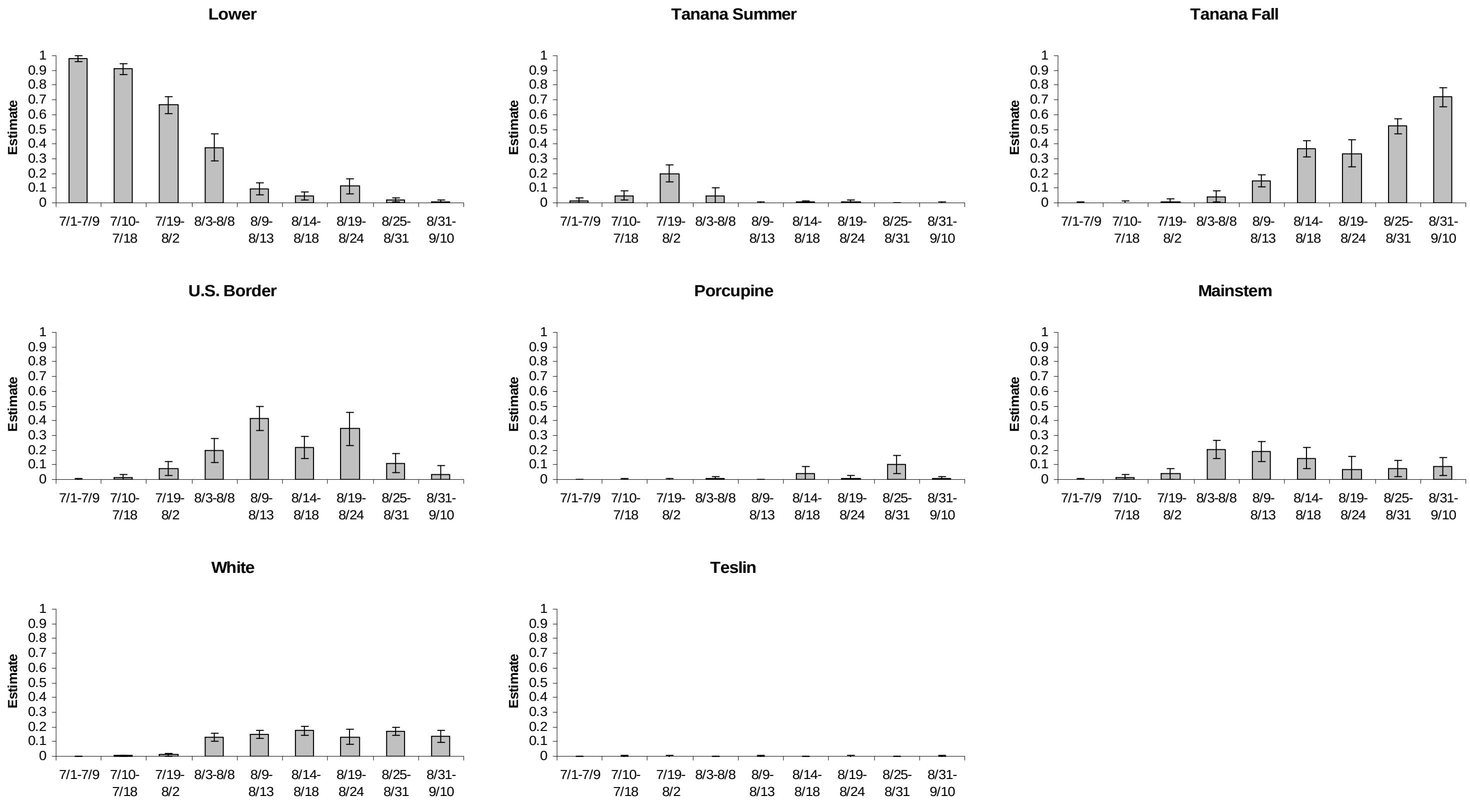


Figure 3. Pilot Station stock composition estimates for Yukon River chum salmon.

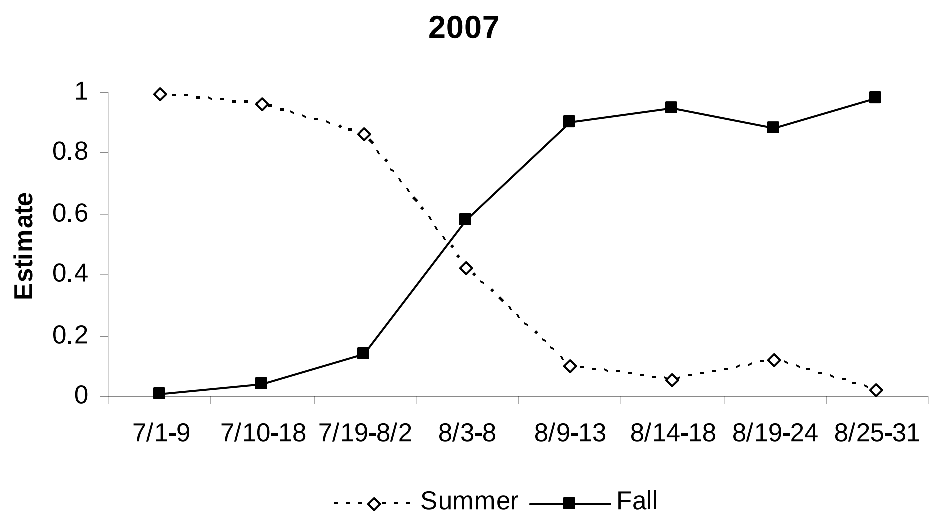
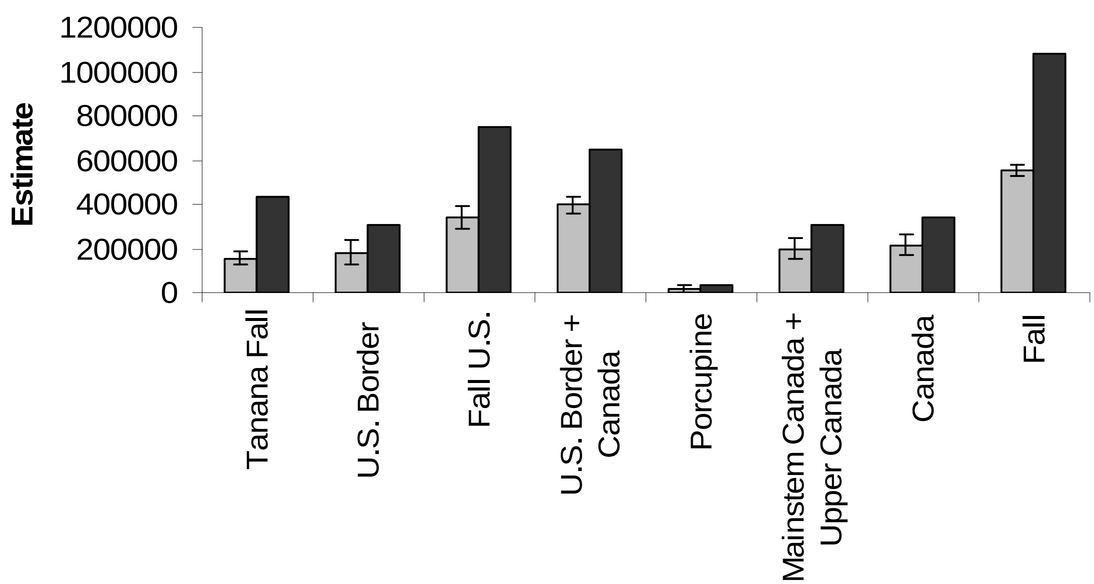


Figure 4. Comparisons of chum salmon stock abundance estimates from genetic/sonar (grey bars) and escapement/harvest (black bars) methods for 2007. The 95% confidence intervals are based on the variances of the genetic estimates only.



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