Burman River Chinook Escapement Estimation, 2012

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The Burman River Chinook salmon population belongs to the WCVI fall Chinook salmon stock aggregate which is an important production group contributing to catches in AABM and ISBM fisheries. Since 2009 the abundance of $\geq$age-3 Chinook salmon that returned to the Burman River were estimated with a conventional 2-event Petersen mark-recapture experiment. In 2012 Chinook salmon were captured and marked using a beach seine in the lower river staging area and by recovering carcasses. Biological samples were collected while marking, from hatchery brood collections or during carcass recoveries. In 2012 salmon were marked with a dorsally visible uniquely numbered 80 lb. monofilament-cored Floy tag secured with a 'J' size metal sleeve, and a secondary mutilation mark. One hundred and thirteen fish were marked with radio tags. Fish were identified by sex, post-orbital hypural length was measured, and scales were collected for ageing. Otoliths were recovered from carcasses to determine origin.

A total of 1166 adult Chinook salmon (399 females and 767 males) were marked and 94 marked animals (31 females and 63 males) were encountered among 348 carcasses (156 females and 192 males) recovered between Sept 19 and November 7. The preliminary resulting summed pooled Petersen estimates of > age-3 and older Chinook salmon (> 500 mm) was 4,119 fish (SE = 405.9, CV = 9.9%). The CV of the 2012 estimate met the CTC data standard; CVs of estimates from 2009-2012 have averaged 13.4%. The sex stratified pooled Petersen estimates generated by SPAS were 1954 females (SE = 322.7, CV=16.5%) and 2165 males (SE=246.3, CV=11.4%). Complete mixing of females (X2 =3.47 df= 4, and P = 0.50) and males (X2 = 7.69, df-4, P = 0.10) and equal proportions among females (X2 = 2.27, df=3, p = 0.52) and males (X2=1.97, df=2, P = 0.37) suggested the temporally pooled Petersen estimates stratified by sex were appropriate estimators. Sex selectivity was not significant although marked males (0.082) were recovered at a higher rate than marked females (0.078) (X^2= 0.185, *df* = 1, *P* = 0.667). Size bias was not evident as the cumulative percent length-frequency distributions were not different between all fish marked and all fish recovered in the carcass survey (D_1 = 0.0357, *P* = 1.00) and of all marked carcasses (D_1 = 0.000, *P* = 1.000). The hatchery program in 2012 removed 194 adults and nine jacks.

Chinook salmon escapement was estimated using snorkel surveys and area-under-the-curve (AUC) methods. Visual observations of live radio marked and unmarked fish were made to estimate observation efficiency (OE) during 22 snorkel surveys. Survey life (SL) was estimated with radio tags and from with visual tag depletion curves. Individual radio tags were intended to signal when a fish died by emitting an altered code when motion of the fish has ceased for 12 hours. Many of the radio tags did not function as intended or operated in reverse with the inactive code preceding the active code signals. Fixed telemetry receivers sites were established at the lower and upper bounds of the spawning area. One-hundred and seven unique radio tagged fish were detected entering the snorkel survey study area. Two faulty radio tags (9.5%) that did not transmit any signals were recovered among 21 radio tags collected during carcass surveys. Eighty-two radio tags were detected during mobile telemetry surveys intended to identify the number of live radio tagged fish available for observation. Three radio tagged fish ascended above the normal survey area boundary. The stray rate was very low validating the critical closure assumption. After ascending 4 km up the Burman River one radio tagged Chinook (<1%) strayed to the Gold River. The lower receiver was overwhelmed with signals on Sept 22 – Oct 2 due to high density of radio tagged fish present in Section 1. Mobile surveys during this period were used to detect entry of radio tagged fish. Entry time was estimated as the mid-point between mobile surveys if not detected at the lower fixed receiver site; and death times were mid-points between surveys less the 12 hour delay period if the radio tag operated properly. When single detections occurred SL was calculated as the average times between the adjacent surveys times.

Survey life (SL_{fixed}) estimated using lower receiver site and mobile (foot and raft) detections ranged from 0.1 to 15.7 days and averaged 5.1 days (SE = 4.2, n = 107). Observer efficiency (OE) measured with radio tags was variable but averaged 0.58 (SE=0.53). When snorkel observations were adjusted for OE and plotted against time, the resulting preliminary AUC estimate of escapement was 20,660 fish days and the population estimate was 4,051 or 6% less than the closed population mark-recapture estimate. A maximum likelihood AUC estimate of escapement quantifying the associated uncertainty will be included in the project report.

The ratio of males to females was 1.1:1.0 in 2012. Although ageing is not complete, a partial sample of 183 scales available indicate proportions by age of 21.9% (SE = 3.06, *n* = 183) age-2, 7.7% (SE= 1.96) age-3, 44.3% (SE=3.67) age-4, and 26.2% (SE= 3.25%) age-5. Unmarked otoliths comprised 17 or 0.048 (SE=0.011, n = 350) of the origin samples (including three overgrinds). Hatchery origin remained high with 0.951 (SE=0.011, n = 350) of otolith samples bearing thermal marks. Burman River hatchery fish dominated the marked sample (99.1% or 330) that included one RCH and two Conuma late-release hatchery origin fish. Given the escapement estimate the number of naturally produced fish was about 200 animals in 2012. Carcass recovery was enhanced in 2012 due to the prolonged low flows over most of the spawning in period. An open population Jolly-Seber estimate using POPAN in Program MARK will be provided in the final report.