MEMORANDUM

TO: Tim Copeland

FROM: Jerry McCann

DATE: March 13, 2018

RE: Power Analysis for 2019 Sockeye release groups

Based on your request we developed a sample size analysis required to achieve adequate power to compare release groups of PIT-tagged hatchery sockeye in 2019. As presented to the CSS, IDGF would like to use PIT-tag survival comparisons (release to LGR dam) to evaluate four different hatchery rearing/release strategies for sockeye. The power analyses we conducted accounted for multiple comparisons (3) between treatments and a reference group. We assumed that for juvenile survival a difference of 0.1 (absolute) would be evaluated, while for adults we assumed SARs of 0.5% or less. Our findings are summarized below. Further details can be found in the write-up.

- Approximately 550 PIT-tags per release group would be necessary to effectively measure a reduction in survival of 0.30 compared to a reference of 0.40. This release group number would provide a power of 0.912.
- To compare adult returns to Bonneville Dam, from Lower Granite Dam, approximately 35,000 tags per release group would be required, for a total of 140,000 for four groups. This release group number, would be adequate to measure a difference between an expected SAR of 0.5% versus a lower SAR of 0.25%.
Sample Size Calculations for survival form release to GRA

In order to estimate sample sizes necessary to carry-out this power analysis we needed IDFG to determine the estimated survivals from release to Lower Granite Dam and the desired difference in survival to be able to detect that would be considered biologically meaningful. Based on information provided, the expected reference survival of 0.4 was expected, with a difference of 0.1 the effect needed to be evaluated (i.e. 0.4 versus 0.3). Based on Cohen 1998 we used the difference between the arcsine transformed proportions to determine the index of effect size to be evaluated. We used to R package ‘pwr’ available at https://github.com/heliosdrm/pwr to calculate power. We also used a Bonferroni adjustment α/K (where K is the number of comparisons; in this case we used 3) to account for the anticipated multiple group comparisons.

The results of our analysis was that for comparisons of juvenile survival for the four groups, from release to Lower Granite Dam, 550 PIT-tags per group would be needed to detect the 0.1 difference in survival (i.e. 0.4 versus 0.3). This relatively low sample size reflects the relatively large difference in survival anticipated between the treatments.

Sample Size Calculations for SARs LGR to BOA

In order to detect differences in SAR, a much larger sample size would be required per group. Sockeye SARs have been very low in recent years. The geometric mean SARs from LGR to BOA, for sockeye released from Sawtooth hatchery from 2009 to 2015 was 0.61%. Based on this we used a SAR comparison of 0.5% versus 0.25% for the power analysis. We used similar methods as described above for juvenile survival power analysis. The results of the power analysis was that 14,000 fish per PIT-tag release group would be necessary to detect at difference between these groups. This sample size would represent the juvenile population at Lower Granite Dam. Multiplied by survival rate from release, the sample sizes required would increase, assuming survival of 0.4 to 35,000 PIT-tags per release group. Figure 1 shows the required release numbers for SARs varying between 0.003 and 0.01.

If SARs to LGR were required, release groups would have to be increased to about 35,000 PIT-tags, based on the very low estimates of SARs to LGR in recent years. Again, these would be estimates for juvenile populations at Lower Granite Dam. Based on survival of 0.4, a comparison of overall SARs to LGR would require 87,500 tags per release.
Figure 1. Range of SARs (LGR to BON) for hatchery sockeye and the release group Size needed for a power of 0.9 to differentiate the SAR from a group with a SAR half as large.