



FISH PASSAGE CENTER

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MEMORANDUM

To: Jeff Fryer, CRITFC
Skyeler Folks, ONA

Michele DeHart

From: Michele DeHart

Date: December 18, 2014

Re: Results from 2013 and 2014 pilot studies to explore feasibility of long-term monitoring group for Okanogan River sockeye

In 2013, the CSS Oversight Committee was approached with a request to explore the feasibility of adding a long-term monitoring group for sockeye trapped and released from the Okanogan River. Upon the request from the Okanogan Nation Alliance (ONA) and CRITFC, the CSS Oversight Committee transferred 3,000 PIT tags in 2013 and 2,500 PIT tags in 2014 to the ONA to supplement PIT-tagging efforts at Osoyoos Lake in the spring. Below are preliminary results from these exploratory efforts, followed by more specific details.

- In 2013, a total of 3,543 sockeye juveniles were PIT-tagged and released by ONA into the Okanogan River from two release sites between April 12th and May 7th. The tagging total for 2014 was 5,055, with three different release sites. Tagging in 2014 took place from April 7th through May 5th.
- Survival from release to Rocky Reach Dam was 0.52 in 2013 and 0.57 in 2014.
- Estimates of survival beyond Rocky Reach dam were unreliable in 2013. This was partially due to the low survival from release to Rocky Reach Dam which contributed to a low number of detections of PIT-tagged fish below McNary Dam.
- The larger sample size in 2014 allowed for the estimation of survival from release to McNary Dam, which was 0.39 (95% CI: 0.31–0.47).

- Results from these two years indicate that estimating survival from release to McNary Dam is possible with approximately 5,000 tags.
- At this time, it is too early to tell if estimation of smolt-to-adult ratios is possible from the 2013 tagging efforts.

Methods

Timing and Travel Time

Timing and fish travel times were estimated for 2013 and 2014 out-migrants based on PIT-tag detections at various dams within the Rocky Reach Dam to Bonneville Dam reach. For each year, we estimated cumulative passage timing based on PIT-tag detections at Rocky Reach (RRH), McNary (MCN), John Day (JDA), and Bonneville (BON) dams. Daily PIT-Tag detections at each of these projects were summed and adjusted based on the average proportion of flows that passed through the powerhouse. Minimum, median, and maximum fish travel times were estimated from release to detection at each dam in the reach with detection capabilities.

Survival

For each migration year, we attempted to estimate smolt survival and their associated variance estimates for PIT-tagged juvenile sockeye from their release to BON. PIT-tagged smolts can be detected at RRH, MCN, JDA, and BON dams, as well as downstream of Bonneville Dam using specialized trawl equipment for PIT-tag detection. Using recapture data from fish detected at these sites, single-release mark-recapture survival estimates were generated using the Cormack-Jolly-Seber (CJS) methodology as described by Burnham et al. (1987) with the Mark program (software available free from Colorado State University) (White and Burnham 1999). If possible, survivals from multiple reaches were combined (e.g., Release to MCN combines 2 reaches; Release to RRH and RRH to MCN) and variance estimates for the overall reach (Release to MCN) were generated using the delta method (Burnham et al. 1987).

Results

Travel Time and Timing

Estimates of minimum, median, and maximum travel times from release to RRH, MCN, JDA, and BON dams are provided below (Table 1). Also provided are estimates of the 95% confidence limits around the estimated median travel time.

Table 1. Travel times of juvenile sockeye PIT-tagged and released into the Okanogan River in 2013 and 2014.

Migration Year	Project	Release to Project Travel Time (days)			95% Confidence Limits	
		Min	Med	Max	Lower	Upper
2013	RRH	5.6	19.1	56.3	18.4	19.7
	MCN	10.0	23.5	63.7	21.9	24.7
	JDA	12.0	25.4	62.3	23.4	27.9
	BON	16.3	27.8	57.3	26.3	29.0
2014	RRH	4.4	16.7	40.6	16.4	17.4
	MCN	8.1	19.4	54.8	18.8	20.0
	JDA	13.0	23.0	67.5	22.1	24.0
	BON	11.8	22.7	59.0	20.8	24.6

In 2013, a total of 3,543 juvenile sockeye were tagged and released from two release sites (OSOYOL and SKATAL) by the ONA. Sockeye tagging in 2013 began on April 12th and ended on May 7th. Overall, these PIT-tagged sockeye juveniles passed through the Upper and Lower Columbia River from mid-May to early June. In fact, the estimated 90% passage date at BON was June 2nd (Table 2, Figure 1).

In 2014, a total of 5,055 juvenile sockeye were tagged and released from three release sites (OSOYOL, SKA, and SKATAL) by the ONA. Sockeye tagging in 2014 began on April 7th and ended on May 5th. Overall, these PIT-tagged sockeye juveniles passed through the Upper and Lower Columbia River from mid-May to late May (Table 2, Figure 1).

Table 2. Migration timing of PIT-tagged juvenile sockeye from Lake Osoyoos detected at RRH, MCN, JDA, and BON dams in 2013 and 2014.

Migration Year	Project	Estimated Passage Date		
		10%	50%	90%
2013	RRH	9-May	13-May	19-May
	MCN	11-May	17-May	27-May
	JDA	15-May	21-May	27-May
	BON	15-May	24-May	2-Jun
2014	RRH	10-May	14-May	22-May
	MCN	12-May	19-May	24-May
	JDA	15-May	21-May	27-May
	BON	16-May	21-May	27-May

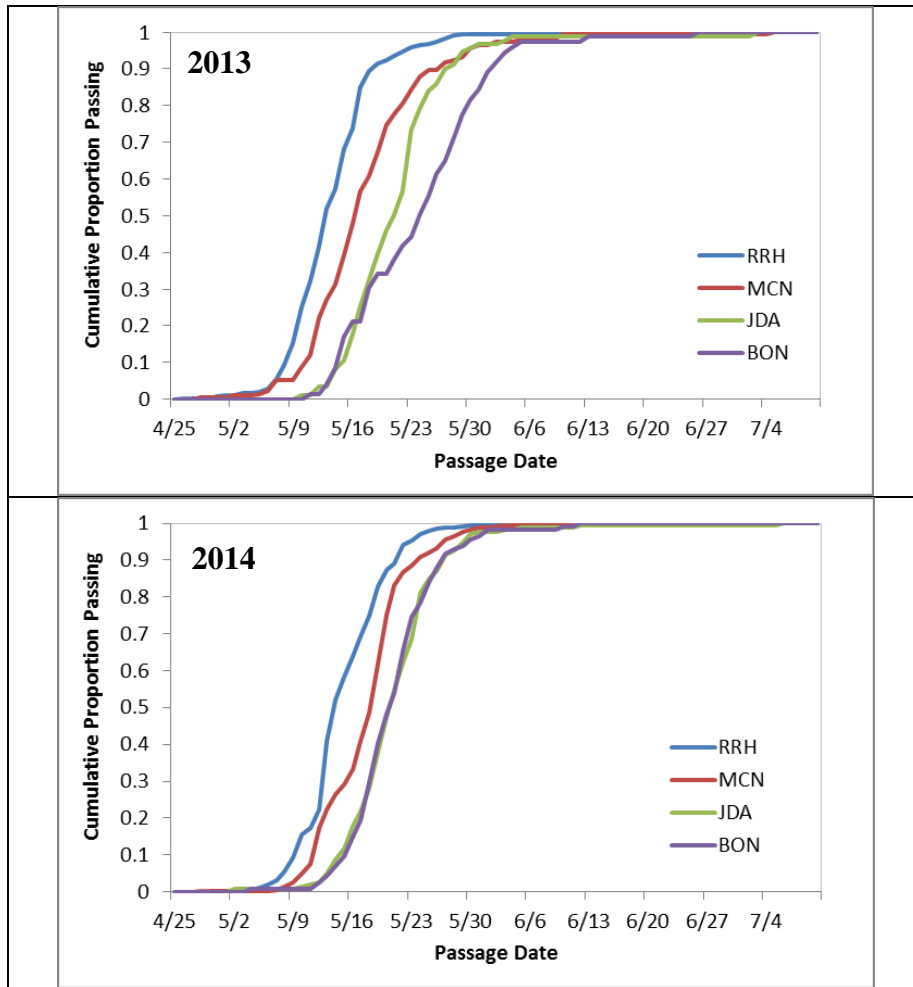


Figure 1. Cumulative passage timing at RRH, MCN, JDA, and BON dams of juvenile sockeye PIT-tagged and released into the Okanogan River by ONA in 2013 and 2014.

Survival

With the 3,543 PIT-tagged sockeye from 2013, we were able to estimate survival from release to RRH, which was 0.52 (Table 3). However, sample sizes were too low to get reliable estimates of survival below RRH. This is largely due to low numbers of subsequent downstream detections. For example, of the 174 PIT-tagged sockeye smolts that were detected at MCN, only 18 were subsequently detected downstream of MCN. This low number of downstream detections led to an unreliable estimate of survival from RRH to MCN of 1.06 (Table 3). Given the unreliable estimate of survival from RRH to MCN, it was not possible to estimate survival from release to MCN for 2013 (Table 3).

The larger sample size in 2014 (5,055 PIT-tagged sockeye) allowed for estimation of juvenile survival from two reaches, release to RRH and RRH to MCN. Survival from release to RRH was 0.57 and survival from RRH to MCN was 0.68 (Table 3). The estimated reach survival from release to MCN was 0.39 (Table 3).

Table 3. Survival of PIT-tagged sockeye juveniles tagged and released into the Okanogan River in 2013 and 2014.

Migration Year	Release-RRH (95% CI)	RRH-MCN (95% CI)	Release-MCN (95% CI)
2013	0.52 (0.45-0.59)	1.06 (0.59-1.53)	N/A
2014	0.57 (0.51-0.64)	0.68 (0.51-0.82)	0.39 (0.31-0.47)

To put into context the out-migration conditions that the PIT-tagged sockeye juveniles may have experienced while migrating through the Upper Columbia, Table 4 provides the average spring flow volume (April 15–June 30) for the Upper Columbia River (as measured at Priest Rapids Dam), along with the average spring spill proportions at each of Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids dams in 2013 and 2014.

Table 4. Average spring (April 15–June 30) flow at Priest Rapids Dam (PRD) and average spill proportion at Wanapum (WAN), Priest Rapids (PRD), Rock Island (RIS), Rocky Reach (RRH), and Wells (WEL) dams in 2013 and 2014.

Migration Year	PRD Flow Volume (Kcfs)	Spill Proportion				
		WAN	PRD	RIS	RRH	WELL
2013	186.6	0.26	0.29	0.15	0.10	0.11
2014	189.4	0.31	0.35	0.21	0.10	0.13

Conclusions

Based on these preliminary analyses, we feel a long-term monitoring group for Okanogan River sockeye trapped and released at Osoyoos Lake (or some other site) would be valuable to the Comparative Survival Study if enough PIT-tagged individuals could be released annually. Results from 2013 and 2014 indicate that approximately 5,000 PIT-tagged individuals may be sufficient to obtain reliable estimates of juvenile survival from release to MCN. Adult sockeye tend to return after 1 to 2 years in the ocean. Given this, it is too early to tell if estimates of smolt-to-adult returns are possible from 2013 tagging, as only 1-salt adults have returned to date.

References

- Burnham, K. P., D. R. Anderson, G. C. White, C. Brownie, and K. H. Pollock. 1987. Design and analysis methods for fish survival experiments based on release-recapture. American Fisheries Society Monograph 5. Bethesda, MD. 437 pp.
- White, G.C. and K. P. Burnham. 1999. Program MARK: Survival estimation from populations of marked animals. Bird Study 46 Supplement, 120–138.