

Supplement B

Fish Direction

We inferred direction of movement at ALP based on the detection patterns. For juvenile outmigrants, 96% of those detected at ALP were detected only once, indicating that most juveniles did not return upstream from the reservoir that spring-summer. Thus, we inferred that the first detection instance for every juvenile outmigrant detected was a movement into the reservoir.

Spawner directions were slightly more complicated because we expected spawners to move upstream over ALP, then pass downstream over ALP on their kelt outmigration. Identifying the first detection at ALP for each spawner was important because it allowed us to calculate the transit time from the release site to ALP, and the spawning time. Imperfect detection probabilities and antenna reader malfunctions on April 16-April 19, 2019 and April 22-April 23, 2019, meant that we likely missed some spawners moving upstream, so their first detection at ALP would actually be a downstream movement for fish whose upstream movement failed to be detected. To differentiate between upstream spawner and downstream kelt movements at ALP, we sequentially numbered the ALP detections for each individual and examined the distribution of transit times to the first detection at ALP. 82 of 83 tagged spawners were detected at ALP, and the distribution of the transit times to first detection was skewed to the left with clear break between <50 hours and >100 hours (Figure SB1). 61 spawners were first detected at <50 hours, and 21 were first detected at >100 hours.

We hypothesized that individuals with transit times of >100 hours were not detected on their initial upstream movement, and were subsequently detected on a downstream movement. To test this hypothesis, we compared the transit times of individuals first detected at >100 hours with the transit times of individuals detected for a second time (presumably moving downstream) at ALP. The median transit time of fish first detected at >100 hours was not significantly different from the median transit time of fish detected on a second occasion at ALP (Wilcoxon rank-sum test; $W=598$, $p=0.44$), whereas the median transit time was significantly different for fish first detected <50 hours after tagging and their second detection at ALP (Wilcoxon rank-sum test; $W=0$, $p<0.001$; Figure SB2). We concluded that first detections <50 hours after release would be considered the initial upstream movement, and any detections >100 hours after release would be a downstream movement.

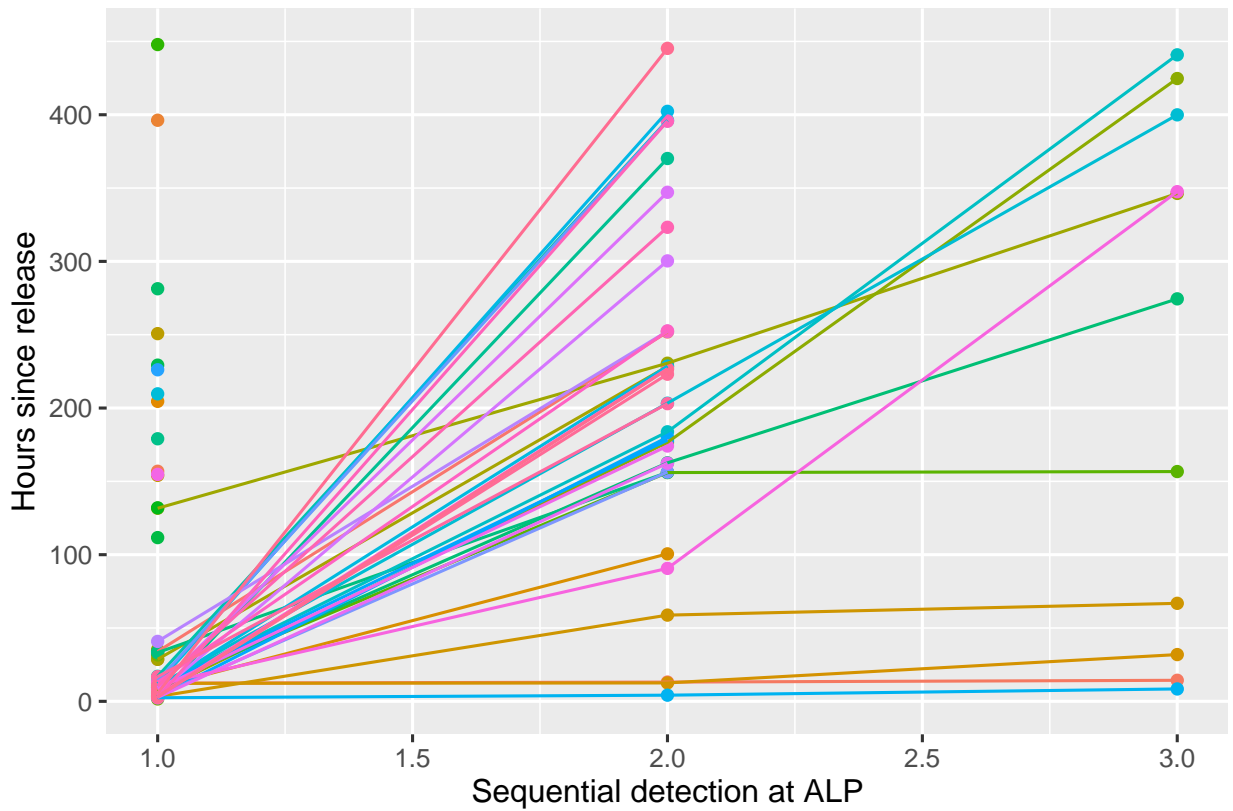


Figure SB1: We calculated the number of hours between when spawners were released into the reservoir and each sequential detection at the above-dam antenna (ALP). Notice that most spawners were first detected within 50 hours of their release (at sequential detection=1), and there was a clear break between those detected at <50 hours after release and those detected >100 hours after release. The spawners first detected >100 hours after release had detection timeframes that were similar to the second detections of fish first detected <50 hours after release.

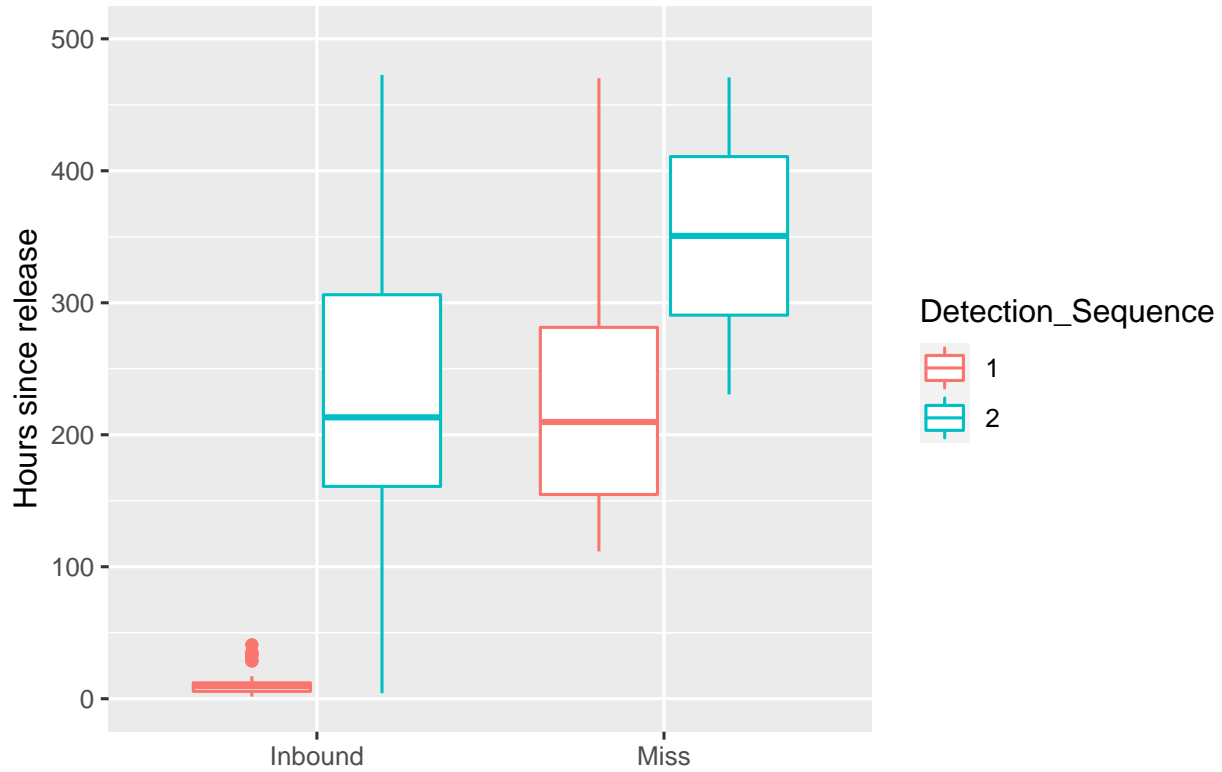


Figure SB2: Based on the distribution of detections in Figure SB1, fish were categorized as ‘inbound’ if their first detection at ALP was <50 hours after tagging or ‘miss’ if their first detection at ALP was >100 hours after tagging. The first and second detections at ALP are plotted for both categories of fish. Notice that the median and variance of the second detection for inbound fish is not different from the median and variance of the first detection for missed fish. Based on that result, we concluded that we did, in fact, miss the first detection for the fish in the miss category, and therefore we excluded those fish from the inbound travel time and spawning time estimates.