Salmonid Adult Escapement

Estimates of adult salmonid escapement are crucial to evaluating the status of depleted populations and the success of programs to recover them. Unfortunately, estimates of escapement and uncertainty in those estimates can be difficult and/or expensive to obtain, especially in remote locations. To address this, we have developed a branching patch-occupancy model within a Bayesian framework to estimate adult abundance at multiple spatial scales (e.g., tributary, population).

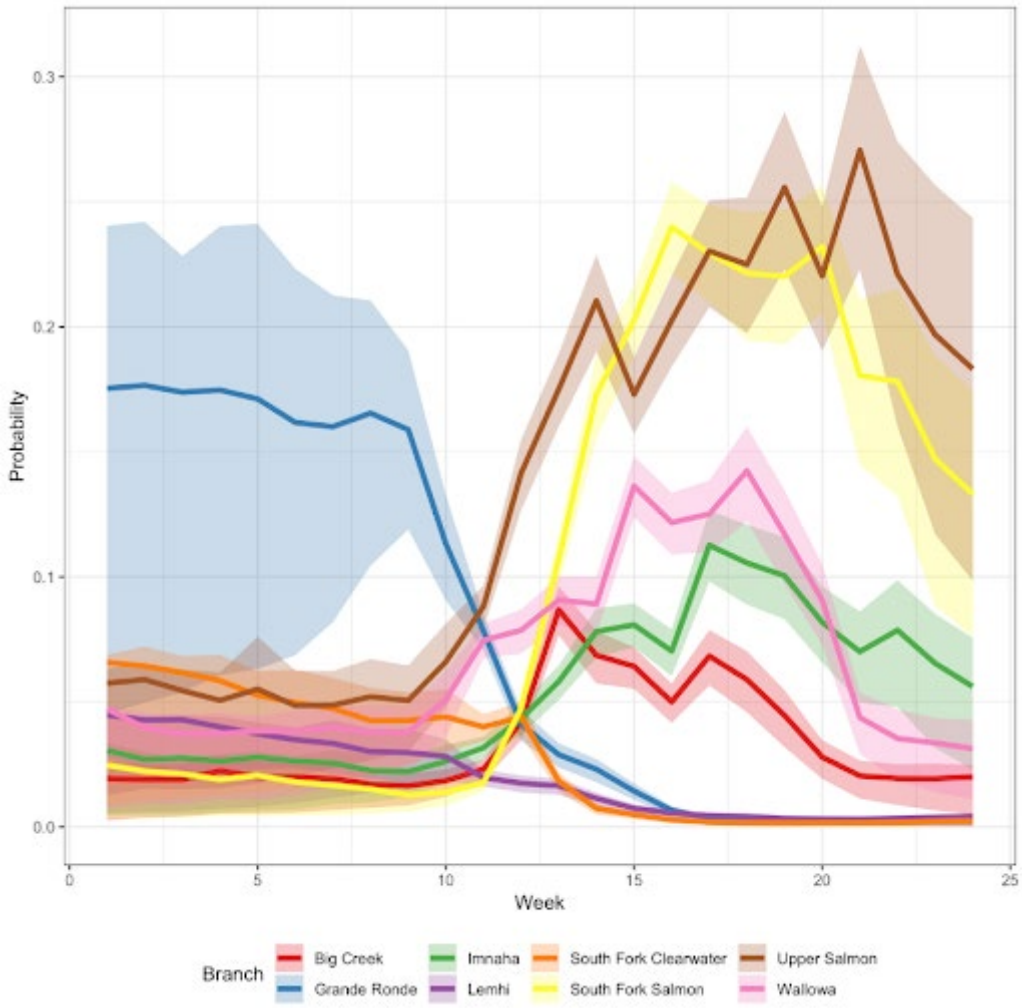
Using PIT Tags to Estimate Escapement

We start by implanting a sample of fish with a Passive Integrated Transponder (PIT) tag at a mainstem dam. Some of those fish are then subsequently re-detected along a network of observation sites during their upstream spawning migration. We use a state-space model to estimate the probability of fish moving past each detection point while accounting for the probability of detection at each site. We can use the movement probabilities, along with an estimate of total fish past the initial marking site, to estimate escapement at a variety of spatial scales across the entire river network.

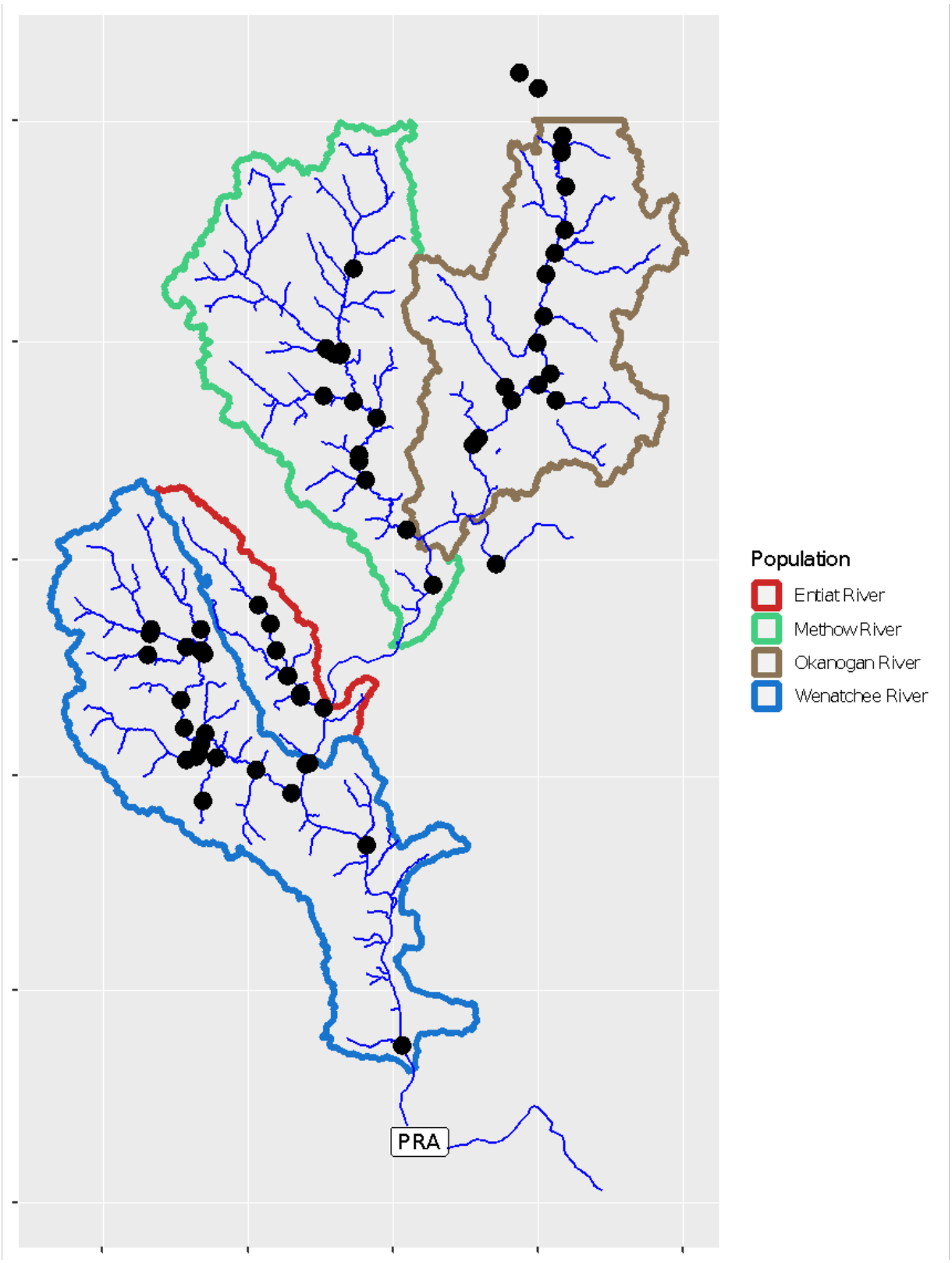
We have applied this model to systems within the Columbia River basin for both Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss*), and have validated it through simulation studies, as well as with comparisons to traditional methods (e.g., redd counts, weirs). These methods provide a reliable estimate of escapement, with uncertainty, at multiple scales, from the population to the tributary.

Applicable Services:

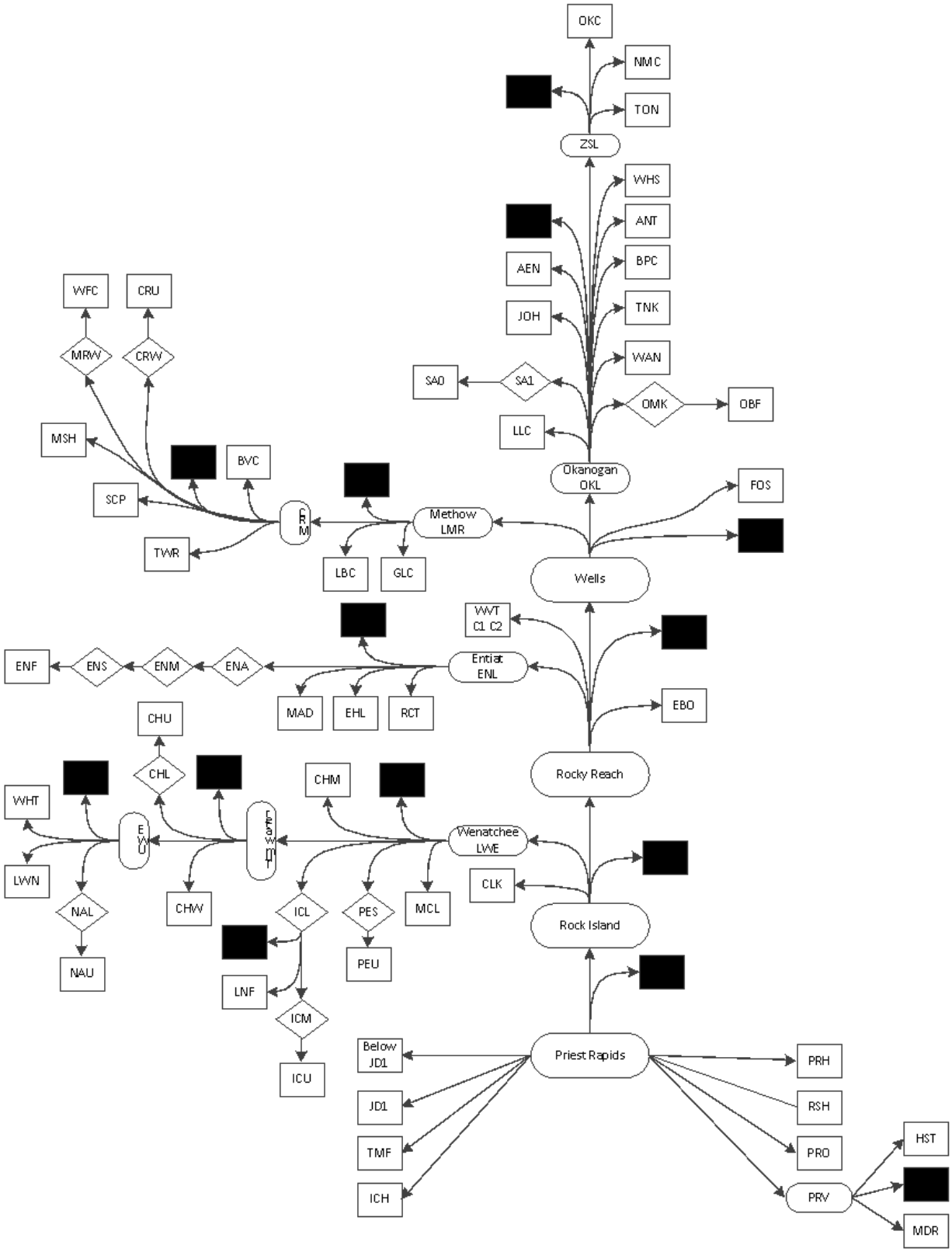
- Estimates of adult escapement past each detection location
- Sex ratios and age compositions, by origin



The probability of a fish heading to particular tributaries changes throughout the season. This plot shows the probability (and uncertainty) of adult Chinook moving to a subset of tributaries above Lower Granite Dam throughout the 25 week season in 2016.



An example of the network of observation sites above Priest Rapids Dam (PRA) in Washington state. Each point represents the location where a PIT tag may be detected.



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The network diagram of detection sites (and codes) for fish tagged at Priest Rapids dam (see Figure 2 for a map of these locations).