*Abstract.* – Summer steelhead *Oncorhynchus mykiss* may enter freshwater almost a year before spawning and potentially make long migrations (>1,000 km) to interior headwater habitats. However, in response to sub-optimal freshwater habitat conditions (i.e., warmer water temperatures and lower water velocities) , adult summer steelhead may exhibit complex behaviors during upstream migration in the Columbia River Basin. Steelhead may migrate upstream of their natal tributary, or overshoot, and spend days to several months before subsequently migrating downstream, or fallback, to their natal tributary to spawn. An expansion of an existing Bayesian patch occupancy model, derived from observations of adult steelhead tagged with passive integrated transponder (PIT) tags to estimate population-specific abundance upstream of the tagging location, incorporated downstream detection locations to estimate the abundance of overshoot fallbacks. Overshoot steelhead abundance at the tagging location was estimated based on the relationship between the number of known overshoot fallbacks and their model-estimated abundance. During the study period (2010-2017), the annual mean (SD) proportion of overshoot steelhead that successfully migrated downstream of the tagging location (i.e., Priest Rapids Dam) was 0.59 (0.14). The number of dams overshoot steelhead encountered during their downstream migration was negatively correlated with their downstream migration success probability. Improved downstream passage survival for adult steelhead will increase the abundance of those affected populations, while reducing potential genetic introgression of upstream populations (i.e., strays). This is the first study to estimate the abundance of overshoot and fallback steelhead providing the data necessary for scientists to estimate potential conservation benefits of improved downstream survival. The proportion of overshoot steelhead for those affect populations will likely increase in response to climate change related effects (i.e., increasing water temperatures). Studies have consistently shown that surface flow passage routes (e.g., sluiceways and temporary spillway weirs) are very effective in guiding and passing adult steelhead downstream of Columbia River hydroelectric projects suggesting changes in dam operations must occur throughout the migration period to maximize conservation benefits.