Use of Genetic Swamping for Fisheries Management

At its May 18 Work Session, the commission had questions regarding the use of genetic swamping as a management tool in place of fish removal. This document provides additional information regarding application of genetic swamping, examples where it has or has not worked and applicability to some projects now presented to the commission.

As a fisheries management tool, the term swamping refers to the replacement of one population or species with another through repeated stocking of a waterbody. The success of swamping as a tool to replace undesirable fish populations/species with desirable ones depends entirely on the stocked fish having a high degree of physical interaction (including reproductive) with the existing population. The proportional makeup of the stocked species to the overall population of fish in the waterbody then increases through time due to: 1) competition/predation, and 2) hybridization. Consequently, swamping is a generational process that takes several years, sometimes decades, to play out.

Swamping can only effectively replace a population if the stocked fish comprise a high proportion of the overall number of individuals in multiple age classes. Therefore, successful swamping efforts are typically most effective in environments with restricted amounts of spawning and rearing habitats. Without high levels of reproduction between stocked fish and the existing population, the genes of the stocked fish will not “swamp” out the genes from the existing population.

Successful swamping case studies in the South Fork Flathead drainage were initiated more than 30 years ago by stocking high densities (300 fry/lake surface acre vs. the typical 100 fry/surface acre stocking rate) of genetically pure westslope cutthroat trout roughly every 1-4 years in alpine lakes. When FWP made the decision to resume swamping as an alternative to piscicide in certain South Fork Flathead lakes, it did so based on evaluation of a 20+ year genetic data set.

In 2009, swamping was resumed in 6 South Fork Flathead lakes as an alternative to piscicide treatment; currently all 6 lakes are meeting objectives with by harboring westslope cutthroat trout populations with only small amounts of nonnative genetic ancestry. Another 15 lakes in the South Fork were treated with piscicides after the previous attempts at swamping were not effective at restoring pure or mostly pure westslope cutthroat.

Outside of lake settings, swamping is sometimes used in streams above barriers or where populations are slightly hybridized with nonnative fish. For example, stocking via eggs, fry, or hatchery reared fish above a barrier can occasionally reduce nonnative hybridization. It is also effective in streams where nonnative fish very recently established in a stream. As with other swamping applications, several years of stocking is necessary to be effective.

Swamping can also have unintended consequences, especially due to high density situations necessary for effective swamping. High stocking density generally inhibits fish growth and population productivity. Furthermore, there are situations where swamping inadvertently dilutes the native gene pool, and

therefore local adaptation, of the focal native species, thereby leading to the loss of the very genetic background that is intended to be conserved.

Swamping is often closely deliberated when the department is considering a removal project. For example, in the EA for the proposed North Fork Blackfoot project, swamping was considered but not chosen as a viable alternative. The number of fish needed to swamp the existing population was prohibitive, both from the standpoint of rearing enough fish in the FWP hatchery system and delivery of fish in the Wilderness. Additionally, high habitat complexity throughout the drainage reduced the probability of successful swamping. Genetic swamping on such a large spatial scale would be considered experimental, labor intensive, expensive, and take several years to see results. Ultimately, use of piscicides was determined to be more efficient and cost-effective.

Similar considerations were made for Buffalo Creek, but not thoroughly evaluated in the draft EA because project objectives differed from the North Fork Blackfoot project. Since Buffalo Creek is a source of rainbow trout genes in the Lamar River basin the primary objective of the project is to remove rainbow trout genes completely from the drainage. Swamping would take several years of high-density fish stocking in the Wilderness, with a high risk of failure due to the size of the drainage and habitat complexity. Additionally, swamping alone will not meet the desired objective of achieving pure Yellowstone cutthroat trout in the drainage. Indeed, a major limitation of swamping is that it is purely a dilution treatment especially in the context of hybridization; it is not possible to completely eliminate nonnative genes in target populations with this management action alone. Rainbow Lakes, in the nearby Boulder River drainage, has been swamped for several years but has been ineffective at reducing hybridization between rainbow trout and Yellowstone cutthroat trout.