A Model of a Storied, Lacustrine-Adfluvial Cutthroat Trout Population of Yellowstone Lake: Development, Parameter Estimation, and Population Prediction

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A dynamic, age-structured model of the lacustrine-adfluvial Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*) population of Clear Creek, a tributary of Yellowstone Lake in Yellowstone National Park, Wyoming, was developed and its key parameters estimated on the basis of data taken from fish in the spawning run during each of two periods, "pre lake trout" (1977–1993) and "lake trout" (1994–2007). The illegally introduced, reproducing, nonnative lake trout (*Salvelinus namaycush*) were discovered in the lake in 1994. Separate fitting of the model to data from each period allowed assessment of the robustness of the procedures employed and the rigor of conclusions. The model–of the time-variant, nonlinear

linear, Leslie form–explained 72 percent of the variation in observed annual run size during the lake trout period when fitted to data from the pre-lake trout period. Conversely, the model explained 70 percent of the variation in observed annual run size during the pre-lake trout period when fitted to data from the lake trout period. The models each explained 85 percent of variation in observed run size when the two periods were combined. Results strongly suggested that climate (as indexed by total-annual atmospheric degree-days measured on the lake's north shore) had an important effect on recruitment of age-0 Yellowstone cutthroat trout to subsequent spawning runs. Characteristics of climate that individually or collectively affected first-year survival of YCT are unknown. Results also suggested that the effect of lake trout predation on the YCT population was small. Ongoing efforts to control lake trout in Yellowstone Lake may be importantly limiting lake trout predation on YCT.