

Using genetic analysis to assess barriers and historical distribution of steelhead in the Eel River, California

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Preservation of phenotypic and life-history complexity is central to the resilience and sustainability of diverse anadromous fish stocks. Steelhead express a diversity of life history strategies, e.g., propensity towards and scope of migrations (anadromy vs. residency) and state of maturity and timing of return to freshwater (run-timing), providing an opportunity to study adaptive complexity in an iconic, culturally, and economically important species. Historically, the Eel River in northwestern California supported upwards of one million salmon and steelhead and was home to one of the largest recreational and commercial fisheries on the west coast, but the past century and a half of management has resulted in dramatic declines of all salmonid species in the Eel. We explored a number of issues related to steelhead conservation in the Eel River: 1) the extent to which upstream passage of anadromous adults is blocked by ostensible physical barriers to dispersal; 2) spawning and rearing distribution of summer and winter-run steelhead; 3) distribution of resident and anadromous genotypes; 4) genetic diversity in a population of resident trout isolated above an impassable dam for nearly a century, and 5) the extent to which genetic variation that is necessary for producing the summer-run variant is maintained in a population where the summer-run phenotype is no longer present. We observed distinct spatial segregation between winter and summer-run steelhead in both the Middle Fork Eel and Van Duzen Rivers. We found evidence that prior to dam construction, summer-run steelhead inhabited the upper mainstem Eel, and that both life-history and overall genetic diversity are currently maintained in the resident trout population. And finally, we found no evidence of the summer-run allele in the South Fork Eel, indicating that we cannot expect the summer-run allele to arise from standing genetic variation.