Long-term population response of Coastal Cutthroat Trout to environmental fluctuations in a temperate-rainforest stream: hydrology, temperature, and invasive weeds and other biotic factors

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In well-forested Irely Creek within ONP, we counted coastal cutthroat trout redds in mainstem and tributary habitats during 2001-2012 and 2015-2023. The adfluvial (landlocked) trout population has fluctuated greatly (over an order of magnitude) since the initially high run sizes of 2001-2002, reflecting low rainfall that caused partial to full dry-outs of adult-rearing habitat in Irely Lake (a large but shallow pond) during summer/fall prior to spring spawning. Because consecutive (2-year) dry-outs have regularly occurred since then, the trout run has shown an overall decline with some smaller-scale increases after wet summers. More-recent upsurges in (a) lake levels (wetter conditions) and (b) the coho run (marine-derived nutrients [MDNs]) were associated with partial trout-run recovery during 2011-2012, the first population increase for two consecutive years. Statistical analyses for this 'natural experiment' showed that cross-year (cumulative) conditions for lake level better predicted trout-run size than single-year hydrologic indices. Other mechanistically valuable variables for our best multiple-regression models included (a) cross-year conditions for peak-spawning temperatures (reflecting the trout's coldwater preferences) and (b) last-year cutthroat escapement and late-winter coho-carcass counts (COHO). Hence, both physical and biotic (stock/trophic) factors appeared important for cutthroat productivity, in negative ways except for COHO. So our best regression models can realistically predict future trout escapements, to assess whether recent (since 2018) lake/stream removals of exotic reed canarygrass is benefiting lake hydrology and/or water quality. Although further evidence of trout recovery was seen in 2015, that year's drought contributed to a general population decline during 2016-2018, followed by recovery during 2019-2020. Since 2021, the trout run has steadily declined in association with summer "heat-dome" events in the Pacific Northwest, and the notable lack of COHO during water-year 2024 (i.e., October 2023-February 2024) – a result of limited downstream (middle Big Creek) connectivity – suggests a "double-whammy" effect of both Irely Lake dry-outs and reduced food levels (MDNs) on the trout run's long-term decline and potential extirpation. Indeed, the best pair of multiple-regresson models predicted loss of the trout population by 2024, such that spring escapement is expected to be zero again (like 2018).