Transactions of the American Fisheries Society 147:1153–1166, 2018

ISSN: 0002-8487 print / 1548-8659 online
DOI: 10.1002/tafs.10112

ARTICLE

Coho Salmon Colonization of Oregon's Upper Willamette River Basin

Matthew L. Keefer,* Timothy J. Blubaugh, Tami S. Clabough, Michael A. Jepson, George P. Naughton, and Christopher C. Caudill

Department of Fish and Wildlife Sciences, College of Natural Resources, University of Idaho, Moscow, Idaho 83844-1136, USA

Abstract

Coho Salmon *Oncorhynchus kisutch* were historically absent from a major Columbia River subbasin, the upper Willamette River (UWR), until a fishway was installed at Willamette Falls and a sustained stocking program was implemented in the 1950s. Despite decades of stocking from three diverse source populations (early run, late run, and coastal Coho Salmon) during the second half of the twentieth century, adult abundance above the falls was less than 1,000 annually during the 1990s. A recent surge (>25,000 adults in 2009) has raised concerns about potential interactions with two native anadromous salmonids listed under the U.S. Endangered Species Act: UWR winter-run steelhead *O. mykiss* and UWR spring-run Chinook Salmon *O. tshawytscha*. We analyzed Coho Salmon stocking records and estimates of abundance from 1954–2017 to summarize population history, demographics, and adult phenology. We also characterized current Coho Salmon distribution using radiotelemetry ($n = 219$ adults in 2014) and evaluated potential mechanisms associated with changes in adult abundance. We identified a shift in adult migration timing over the time series that was consistent with an increase in late-run traits and environmental changes affecting migration cues. The distribution of radio-tagged adults among UWR subbasins was only weakly correlated with past stocking efforts, suggesting that habitat conditions, stocked phenotype, adaptation and range expansion by descendants of the relict stocked populations, or colonization from regional source populations strongly influenced current subpopulation abundance. Annual counts of returning UWR Coho Salmon were positively correlated with counts of Columbia River Coho salmon, suggesting a shared response to freshwater habitat or ocean conditions. Regardless of the underlying mechanisms affecting UWR Coho Salmon distribution and population size, the results illustrate the complex dynamics between changing landscapes and migration corridors, the introduction of nonnative species for harvest management goals, and the potential for nonnative fish to affect the conservation of native populations.

Despite good intentions, the establishment of nonnative salmonids (*Oncorhynchus*, *Salmo*, and *Salvelinus* spp.) typically has had serious consequences for endemic species (Dunham et al. 2002; Crawford and Muir 2008; Arismendi et al. 2014). In the Pacific Northwest of North America, salmonids have been widely stocked or introduced, often in an effort to mitigate for lost natural production associated with overharvest, dams, and habitat degradation (Nickelson et al. 1986; Waples 1991; Brannon et al. 2004) but also to increase commercial harvest and recreational angling opportunity (Levin et al. 2001; Naish et al. 2008). Historically, many hatchery programs used broodstock from non-local populations, with well-documented adverse effects on native fishes, including conspecifics (Myers et al. 2004; Araki et al. 2008; Kostow 2009). Widespread releases of hatchery fish into previously unoccupied habitat have been common, either because access to the species' historic habitat was blocked or to take advantage of what was considered unexploited production opportunity (Naish et al. 2008; Galbreath et al. 2014).

The likelihood that introduced populations become self-sustaining depends on the match between species' traits and their new environment as well as "propagule

*Corresponding author: mkeefer@uidaho.edu
Received May 4, 2018; accepted August 3, 2018