Coastal Cutthroat Trout Ecohydrology and Habitat Use in Irely Creek, Washington

Robert L. Vadas[1], Jr., Hal A. Beecher, and Steve N. Boessow
Washington Department of Fish and Wildlife, Habitat Program, 600 Capitol Way North, Olympia, Washington, 98501-1091, USA

Kathleen A. Enseñat[2]
Washington Department of Ecology, Water Resources Program, P.O. Box 47600, Olympia, WA, 98504-7600.

Extended abstract.—Coastal cutthroat trout *Oncorhynchus clarkii clarkii* are native (adfluvial) in the Irely Creek watershed of the upper Quinault River drainage, which is protected as Olympic National Park. The coastal cutthroat trout coexist with anadromous coho salmon (*O. kisutch*, the dominant fish), two resident fishes, and several amphibian species. During 2001-2002, cutthroat redds and fry were abundant in the main stem (Figure 1), such that we had adequate data (including also 2003 substratum results) to formulate microhabitat suitability curves for spawners and assess the incubation period before fry emergence (roughly two months).

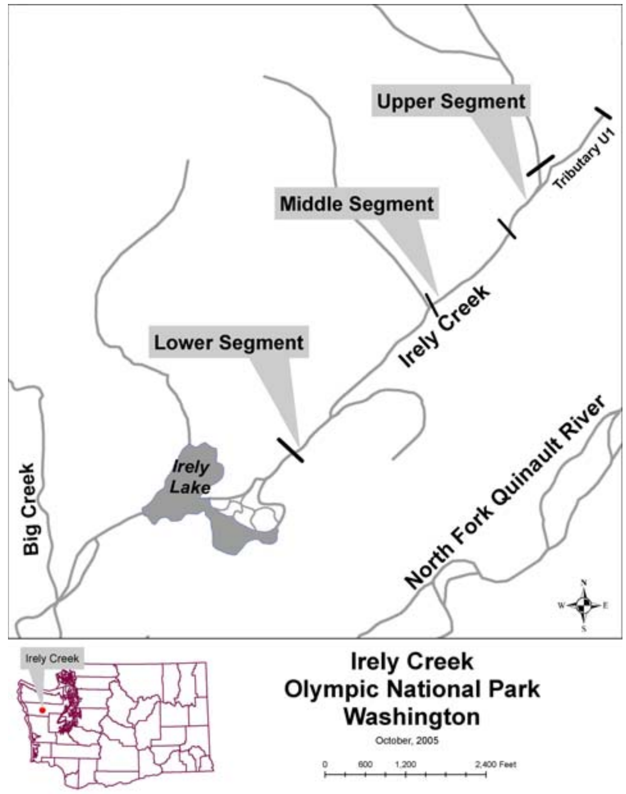

FIGURE 1.—Map of the Irely Creek study area, upstream from Irely Lake. Note that Big Creek (shown) is a tributary of the main stem Quinault River well below where the North and East forks come together. There were three study segments in the main stem, as well as one upper tributary (U1) where cutthroat spawning occurred, the surveyed area being delineated by wider lines and segment boundaries by thinner lines. The lower main stem limit of sampling was above the backwater zone caused by beaver dam and lake inundation effects. The upper main stem and U1 limits of sampling were bounded at points where significant hydraulic drops occurred.

The results for spawning depth preference (optimum = 0.6-0.89 ft [0.18-0.27 m], good = 0.2-0.59 ft [0.06-0.18 m]) and velocity preferences (optimum = 0.8-1.09 fps [0.24-0.33 mps], good = 0.5-1.59 fps [0.15-0.48 mps]) were similar to spawning resident trout species. Those results suggest that cutthroat trout require lower stream flows than salmon or steelhead (*O. mykiss*) for reproduction, supported by 1) our observations that cutthroat spawned at lower flows than coho salmon and 2) predictions based on PHABSIM studies elsewhere in western Washington (Caldwell et al. 2004; Beecher et al. 2006).

In contrast, cutthroat trout substratum preferences for spawning were more similar to those of anadromous than resident Pacific-salmonid spawners. Cutthroat found large gravel to small cobble optimal, small gravel good, and muddy and boulder/bedrock particles completely unsuitable for spawning. Because we employed dominant/subdominant substratum coding to handle sand-caused bimodality, we found weighted geometric, rather than arithmetic, means to be more realistic for estimating habitat suitability (by using geometric means, we avoided predicting nonzero suitability over beds with high amounts of extreme particles—fine and/or large rock—that weren't spawned over). Nevertheless, given our observed use of some fine-bedded habitat for spawning in other glacial-fed rivers of Washington state, the average value of the weighted geometric and arithmetic means may best predict salmonid redd locations. This implies that cutthroat and other salmonid spawners select dominant or subdominant substratum types with some interdependence, but without complete compensation if one particle size is unsuitable. Our observations demonstrate that large (sandy) fines are less harmful than small (muddy) fines for salmonid spawning and incubation. Thus, a fines criteria to assess human impacts should be standardized to these two particle-size ranges.

Our hydraulic and substratum preference data are being used to assess in stream flow needs in smaller western

[1] Corresponding author: vadasrlv@dfw.wa.gov
[2] Present address: South Puget Sound Community College, Division of Natural and Applied Sciences, 2011 Mottman Road Southwest, Olympia, WA 98512, USA

Washington streams having varying levels of riparian disturbance.

In contrast to 2001-2002, cutthroat trout redds were an order of magnitude rarer during 2003-2006, except for a partial resurgence during 2005. This observation corresponds with the summer droughts of 2002-2003, when Irely Lake dried out completely, and 2005, when the lake was nearly dry (potentially causing water-quality and/or predation problems), as contrasted with the non-drought ("normal") year of 2004 that nevertheless showed severe main stem flood scour during winter. In 2006 a summer drought again fully dried out Irely Lake, and further depletion of the cutthroat trout population is expected. But extirpation has not occurred to date, given the consistent presence of cutthroat fry in a headwater tributary, as well as the regular presence of juveniles in the main stem. Despite possible competition with coho salmon, Irely Creek cutthroat often schooled with coho as fry and likely benefited from coho carcass-derived nutrients.

Despite their higher spawning flow needs, coho salmon were less vulnerable to pond dry out than cutthroat trout because the former rear in the perennially flowing creek and because spawners can access the creek during winter when flows are relatively high. Supporting this theory, the winter drought of 2005 corresponded with the lowest level of coho carcass/adult counts (taken at the end of spawning season) between 2002 and 2007. Additionally, sparse spawning may have occurred during the winter drought 2001, based on early-March carcass observations.

Coho salmon persist in Irely Creek because the salmon's in- and out-migration timing corresponds to the colder, high-flow season for which downstream water (Irely Lake, the lake outlet, and the middle Big Creek main stem) is present. During periods of drought, cutthroat trout have lost their primary adult-rearing habitat in Irely Lake, which formerly provided good cutthroat catches for gillnet sampling (J. Meyer, Olympic National Park, unpublished data) and catch-and-release fishing by ourselves and others (Shorett 1996; Wood 2000). Hence, drought timing will impact run timing (if not abundance) of coho differently than it will impact cutthroat escapement. Thus, climatic and flow variability are likely affecting both species in Irely Creek despite its pristine nature.

Finally, we found noticeably later spawn timing (mid-late March to mid-early May, with a peak in early April and sub-peak in late April) than previously reported for migratory cutthroat trout in the Raft/Quinault River area (i.e., January through March) (Blakley et al. 2000). This difference in timing highlights the need for site-specific biophysical data, given thermal differences between streams, even adjacent ones (Vadas 2006).

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