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Behavioral Interactions among Hatchery-Reared Steelhead Smoltsand Wild *Oncorhynchus mykiss* in Natural Streams

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Abstract.—The potential for hatchery fish to negatively impact wild fish has been identified as a concern for dwindling stocks of naturally produced anadromous salmonids in the Pacific Northwest. Using a control–treatment approach, we performed a multiscale examination of potential behavioral impacts of releases of hatchery-produced steelhead *Oncorhynchus mykiss* (anadromous rainbow trout) on preexisting wild populations of *O. mykiss* (anadromous and potamodromous) over a 4-year period. We released approximately 33,000 conventionally reared hatchery steelhead smolts (treatment) into an upper Yakima River tributary in 1991, 1992, 1993, and 1994 and investigated behavioral interactions and small-scale displacement (0.2–5.0 m). Snorkelers conducted behavioral observations and observed small-scale displacements in treatment and control streams for approximately 1 month following releases. Hatchery steelhead were generally larger than wild *O. mykiss* and dominated most (68%) contests. The types of behavioral interactions observed differed between control and treatment streams ($P < 0.01$). Behavioral interactions involving physical contact (e.g., nips) were observed more frequently in treatment streams than in control streams, whereas those involving nonphysical contact displays (e.g., threats and chases) were more frequent in control streams. Contrary to our expectations, total behavioral interaction rates were generally higher in control streams than in treatment streams, though the difference was not statistically significant ($P = 0.07$). Hatchery steelhead displaced wild *O. mykiss* in 79% of the contests observed between these groups. Our results indicate that the behavior of hatchery steelhead can pose risks to preexisting wild *O. mykiss* where the two interact. Strategies to minimize undesirable risks associated with behavior of released hatchery steelhead should be addressed if protection and restoration of wild *O. mykiss* stocks is the management goal.

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resources and aquatic ecosystems by advancing fisheries and aquatic science and promoting the development of fisheries professionals.