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# **Presentation Title: Factors Limiting Growth of Juvenile Anadromous and Resident *Oncorhynchus mykiss* in the Duckabush and Hamma Hamma Rivers, Washington**

## Abstract for the 2018 Pacific Coast Steelhead Management Meeting

Growth is a significant factor regulating the survival and life history expression of salmonids, and as such is an important conservation consideration for species like *Oncorhynchus mykiss*. This study evaluated the annual and summer growth potential of *O. mykiss* at various life stages (age 1-2, age 2-3 and age 3-4) above and below anadromous barriers in the Duckabush River and Hamma Hamma River, Washington. The objectives of the study were to determine whether growth was limited by environmental conditions within the watersheds, and if so, whether the greatest influence over growth was the availability of food or the thermal regime. Bioenergetic modeling was used with empirical data on growth, diet, and thermal experience to estimate the feeding rate, growth trajectory and the amount of food required to attain the growth observed between life stages in the, middle and lower reaches below the barrier and the upper reach above the barrier on the barrier Duckabush River and below the barrier and above the barrier on the Hamma Hamma River. Model outputs indicated that *O. mykiss* fed at 25% (age-2) to 32% (age-4) of their maximum consumption rate (%Cmax) annually in the middle reach and above the barriers in the Duckabush and Hamma Hamma Rivers and between 20% (age-2) and 26% (age-4) of Cmax in the lower reaches of the Duckabush and Hamma Hamma Rivers. Summer (June-September 15) was the primary growing season and accounted for 67% to 85% of the annual growth in the middle and above-barrier reaches. However, food was insufficient to support adequate growth for age-2 and older *O. mykiss* in these reaches on both rivers. There was little scope for growth beyond age-2 in the middle reach and above the barriers, and prey quality and consumption rates exerted the strongest influence over growth rates. Feeding rates were also relatively low in the lower reaches of both rivers at 20% (age 2 and 3) to 25% (age-4) of Cmax where salmon-derived resources accounted for the majority of the annual growth. Overall, food availability and quality appeared to limit growth of juvenile *O. mykiss* in the middle reach and above the barriers in the Duckabush and Hamma Hamma Rivers, making these populations vulnerable to density-dependent effects on growth and production. Prey supply and quality were less limiting in the lower reaches below the barriers, largely due to marine subsidies from spawning salmon; however, other factors might limit the populations in these reaches. With steelhead facing declines across their range, this study highlights the importance of identifying factors limiting growth during critical life stages in freshwater.

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