EVALUATION OF ENERGY EXPENDITURE IN ADULT SALMON MIGRATING UPSTREAM IN THE COLUMBIA RIVER: UNDERSTANDING THE INFLUENCE OF DELAY, FALLBACK, AND DAM OPERATIONS ON FISH PERFORMANCE

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Although radio telemetry studies of anadromous salmonids have been conducted in the Columbia River Basin for decades, little is known about the energy use of adult salmon as they migrate upstream through the hydroelectric system. To determine the energetic costs of passing a Columbia River dam, 96 adult spring chinook salmon were implanted with electromyogram (EMG) transmitters, calibrated against swim speed, and released downstream of Bonneville Dam in 2001. Using a combination of fixed and mobile tracking, EMG signals were recorded from 87 fish as they passed through the dam tailrace, fishways, and forebay. Active, aerobic metabolism was estimated for each fish using EMG-swim speed calibration data collected just prior to release, and swimming respirometry studies conducted in 2000. Median aerobic energy use was highest while fish were in the tailrace of Bonneville Dam (ca. 116 kcal), intermediate in the fishways (ca. 33 kcal), and lowest in the forebay (ca. 4 kcal). Such energy use is probably conservative because many fish showed burst swimming activity in their EMG history, indicating some degree of anaerobiosis occurs during dam passage. Energy used by individual fish to pass the dam varied greatly due to different migration behavior, passage routes, and the time it takes to pass the

dam (which ranges from few hours to over a week). Our results will be used to identify areas of difficult passage that may be modified to help decrease energy use of upstream migrating fish. Ultimately, we hope to assess the potential for depletion of energy reserves and the consequences of excessive energy use on survival and reproductive performance of adult salmonids.

Acknowledgements

This study was funded by U. S. Army Corps of Engineers, Portland District. We thank personnel at the Columbia River Research Laboratory and the Pacific Northwest National Laboratory for their excellent help in the laboratory and field.