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Field Validation of Habitat Modeling of Chinook Spawning and Fry Life Stages in the Lower Klamath River

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Habitat modeling for chinook spawning and fry were undertaken at several study sites in the Lower Klamath River for the purpose of developing relationships between discharge and available habitat. The modeling employed detailed three-dimensional characterization of the channel topography at each study site using a combination of low elevation high-resolution aerial photogrametry and bottom profiling based on hydro-acoustics. Substrate and vegetation mapping was conducted at each site using polygon mapping and combined with the underlying channel topographies. Hydrodynamic modeling at each study site was conducted using a two-dimensional hydraulic model that incorporated both the substrate and vegetation mapping results to spatially distribute the hydraulic roughness within the channel. Fish observations for chinook spawning and fry life stages were surveyed and used to overlay these locations on the hydraulic model computational mesh. Habitat Suitability Criteria (HSC) were developed from fish observations collected within the Klamath River. Behavioral responses to predator avoidance by chinook fry were incorporated into the habitat modeling using a distance to escape cover and a depth threshold for escape cover based on empirical observations collected within the Klamath River. Escape cover quality was defined based on substrate and/or vegetation type. Habitat modeling results based on depth, velocity, substrate/cover for spawning and inclusion of escape cover for fry were compared to known habitat use of these life stages within the study sites at different flow rates. The modeling results for spawning and fry life stages showed excellent agreement between observed fish distributions over multiple flow ranges with predicted location of high quality habitat. Study results indicate that the conceptual habitat models for these life stages of chinook were validated based on empirical fish observations.