

taller, conifers are often found further from the primary channel, thereby reducing the shading provided, which is exacerbated during the summer months when the zenith angle of the sun is smaller; (2) on a geomorphic channel scale, steep banks can provide local pockets of shading; and (3) on a regional and watershed scale, the orientation of the ridgelines and canyon walls with respect to the azimuth of the sun will be a main driver of shading. Using GIS and remote sensing software packages in concert with the consideration of various sources of newly-collected satellite imagery (i.e., IKONOS and Quickbird), existing ancillary datasets (i.e., 10 m. DEMs, USFS's Land cover mapping and monitoring program vegetation, USGS's National Hydrography Dataset), and selective ground truthing and equipment specifications (i.e., GPS vegetation, pyranometers), conceptual design and preliminary model investigations suggest the potential for further development of a location-specific metric of seasonal shading potential within a riverine system as a result of watershed features.

Integrated Modeling

Overview of SALMOD, a Fish Production Model, in the Secretarial Decision

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USGS Ft. Collins Science Center scientists have developed a decision support system model (SIAM) for the Klamath River over the past 10–12 years. The model contains 3 major components: a water balance model, a water quality model, and a fish production model. All of these components are coupled in a Windows interface that allows resource managers to “game” with the model to determine the effects of differing water temperatures and flow conditions on production of fall Chinook salmon. The model has been used for a variety of resource management issues including the FERC relicensing and Settlement Negotiations processes. The upcoming Secretarial Decision to either remove or retain four hydropower dams along the Klamath River is another opportunity to apply SIAM, specifically the fish production module – SALMOD – to support this process. SALMOD will provide fish production (number of out-migrating fall Chinook salmon) for the mainstem Klamath River from Keno downstream to the Pacific Ocean. SALMOD will be part of several models that will represent the full-life cycle; i.e., both fresh and salt water phases of this anadromous species. The effort is an intense collaboration among Department of Interior agencies, the National Oceanic and Atmospheric Administration, the Tribes, State agencies, universities, and consultants to provide the best available science for the Secretarial Decision.

Conceptual Design and Approach for Modeling Fall-run Chinook Production Post Dam Removal

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As part of the Secretarial Determination, a population dynamics model capable of forecasting annual abundances of fall-run Chinook with uncertainty over a 50 year time frame was requested. In addition, the model should be capable of comparing a status-quo scenario and dams out scenario. The first step in this process was to construct a conceptual model. The conceptual model should have several

qualities to be useful: (1) capture the biological processes of interest; (2) capture existing hypotheses about environmental or anthropogenic factors thought to affect the population dynamics; (3) identify sources of data for those factors; (4) identify the pathways for management actions; and (5) if using statistical methods, identify sources of data that can be used as indices of abundance. The conceptual model was presented to stakeholders and has resulted in a conceptual model composed of several components including: an adult migration model, an upper basin production model, an outmigrant mortality model (SALMOD), a retrospective ocean survival model, and a harvest model. Using the conceptual model as a blueprint, a life-stage model (e.g., Leslie-matrix type model) with transition among stages described by stage-specific Beverton-Holt functions is being constructed. The Beverton-Holt function is parameterized with two coefficients, the carrying capacity and the productivity. Each of these two coefficients can be further modeled as a function of environmental driver variables. For example, productivity in the rearing stage may be a function of instream temperature. The conceptual models and progress on translating the conceptual models into a quantitative model capable of meeting the objective of forecasting fall run abundances with uncertainty will be presented.

Evaluating Economic Effects on Fisheries Associated with Klamath Dam Removal

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According to the Klamath Hydroelectric Settlement Agreement, the Secretary of the Interior will determine whether removal of four dams on the Klamath River "(1) will advance restoration of the salmonid fisheries of the Klamath Basin, and (2) is in the public interest, which includes but is not limited to consideration of potential impacts on affected local communities and Tribes." Among the myriad analyses being prepared to inform the Secretarial Determination are a number of economic studies that focus on the range of human uses and values potentially affected by dam removal. This presentation focuses specifically on the economic analysis as it relates to fishery effects. Topics to be discussed include data requirements, modeling issues and the need for interdisciplinary collaboration.

Effects of Flow Augmentation and Meteorological Conditions on Coho Salmon Production in the Klamath River Basin

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It has been hypothesized that water project operations in the Klamath River basin are a major driver of anadromous fish production. Moreover, fisheries interests have been strong advocates for mainstem flow augmentation to increase abundance of threatened coho salmon. For this reason there was a sincere desire to understand effects of flow and temperature conditions on coho salmon production. Due to the paucity of data in the Basin, a simulation approach was required. We sought to quantify the effects of flow alterations at Iron Gate Dam on coho production in the Lower Klamath River through population life-cycle modeling. For comparison, we also quantified water year-type (wet, moderate, and dry) effects on coho. The functional relationships between environmental conditions and coho survival were incorporated into a detailed population model, which was used in conjunction with a hydrodynamic model and water operations model to predict freshwater production of juvenile coho outmigrants. Results suggest that changes in IGD discharge have a limited effect on coho salmon production relative to effects of meteorological conditions. The influence of IGD discharge on mainstem

Proceedings of the Klamath Basin Science Conference, Medford, Oregon, February 1–5, 2010

Edited by Lyman Thorsteinson, Scott VanderKooi, and Walter Duffy

Open-File Report 2011–1196

U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
KEN SALAZAR, Secretary

U.S. Geological Survey
Marcia K. McNutt, Director

U.S. Geological Survey, Reston, Virginia: 2011

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Suggested citation:

Thorsteinson, Lyman, VanderKooi, Scott, and Duffy, Walter, eds., 2011, Proceedings of the Klamath Basin Science Conference, Medford, Oregon, February 1–5, 2010: U.S. Geological Survey Open-File Report 2011-1196, 312 p.

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