



## Charles M. Paulsen, M.S., B.A.

### *Environmental Statistician*

Mr. Paulsen is respected modeler in the field of fisheries population modeling and statistical analysis. He has over 30 years' experience in Columbia Basin fisheries modeling, including many contracts performed for the Bonneville Power Administration, USACE Walla Walla District, and the Chelan County Public Utility District. Mr. Paulsen has performed cost-effectiveness modeling of BPA's Fish and Wildlife Program, participated in ESA salmon modeling processes with representatives of the BPA, NOAA Fisheries, USACE, BOR, CRITFC, NPPC, and state and tribal fisheries agencies, and performed many statistical analyses and modeling exercises, including use of the Bayesian Stock Model (BSM), Columbia River System Passage Model (CriSP and COMPASS), Stochastic Life Cycle Model (SLCM), System Planning Model (SPM), and other fisheries life-cycle and passage models and advanced statistical analysis techniques.

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#### **Experience and Expertise**

- ◆ Data/statistical analysis
- ◆ Model development/coding
- ◆ Fish life cycle modeling
- ◆ Tributary habitat response modeling
- ◆ Water temperature and daily flow fluctuation modeling
- ◆ Cost-effectiveness analysis
- ◆ Population Viability Analysis
- ◆ Chinook/steelhead survival analysis
- ◆ Experimental design and statistics

#### **Education**

- ◆ M.S., 1979, Environmental Management, Duke University, Durham, NC
- ◆ B.A., 1974, Political Science, University of Kentucky, Lexington, KY

#### **Professional Affiliations**

- ◆ American Fisheries Society, 1992-present
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## Professional Experience

### **Bonneville Power Administration, 1986-present**

#### *Analytical Support Services*

Paulsen has performed numerous fisheries data analytical tasks for BPA's Fish and Wildlife Division since the mid-1980's. Examples include:

- ◆ Helped develop life cycle models demonstrating the importance of carrying capacity for extinction risk, 2017-2018.
- ◆ Developed models for Chinook and steelhead responses to tributary habitat actions, 2005-present
- ◆ Participated in NOAA Fisheries AMIP life cycle modeling. Contributed several chapters to ISAB-reviewed AMIP reports. 2010 – present.
- ◆ Participated in NOAA Fisheries COMPASS passage modeling development, 2006-2009. Developed code to model water temperature and daily flow fluctuations.
- ◆ Performed salmonid population dynamics critiques and analyses of NMFS 2000 Biological Opinion, 1999-2002. Assisted with the design of research projects to predict and monitor the effects of habitat restoration on juvenile survival rates. Modeled the statistical power of different monitoring plans to detect effects of habitat alteration.
- ◆ Working with Beak Consultants, Paulsen gathered and organized a database of information on over 100 stocks of Chinook salmon in the Pacific Northwest as part of a multi-agency study conducted by the PATH group, 1995-1997. Beak compiled spawning, life history, and catch data on chinook stocks, and ancillary associated data on streamflow, climatology, habitat conditions, land use, water withdrawals, ocean conditions, and other influences on salmon populations. Performed multivariate analysis of the effects of these factors on salmon population trends. Beak developed datasets of chinook Coded Wire Tag and PIT tag returns. Paulsen used these datasets in innovative analyses of ESA-listed salmonid population dynamics.
- ◆ Performed and managed the Above-Bonneville Cost-effectiveness Analysis for Resources for the Future from 1989-1994, and has since performed additional cost-effectiveness optimization model development, testing, and application, PVA analysis for Snake River spring/summer chinook, fall chinook, and steelhead, life-stage survival analyses for parr-smolt survival as function of land use and climate, design of decision analysis tools for ESA recovery planning, review of BIOP's and other planning documents, and assisted in preparation of ROD's.

### **USACE Walla Walla District, 1999-2001**

#### *Analytical Support Services*

Performed multiple tasks for the District, including:

- ◆ Statistical analysis of outmigration and overwintering survival of PIT tagged chinook smolts, authored publications in refereed fisheries journals, presented results at symposia.
- ◆ Researched the validity of using CWT catch data to estimate differential life cycle survival among stocks of chinook and steelhead.
- ◆ Analyzed habitat survey data in Snake River basin chinook producing streams.
- ◆ Performed statistical analysis of redd count and parr density data in relation to overwintering survival of Chinook parr.

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**Chelan County PUD, 1994-1996***Assistance with Population Viability Analysis (PVA)*

Mr. Paulsen performed PVA's for mid-Columbia chinook and steelhead, reviewed run reconstruction data and analysis methods, reviewed passage modeling data and analysis methods, and prepared reports for the client.

**Select Publications and Reports**

- Paulsen, C. M., R. Hinrichsen, and T. R. Fisher, 2007. "Measure twice, estimate once: Pacific salmon PVA for highly variable populations," *Transactions of the American Fisheries Society* 136:346–364.
- Paulsen, C.M. and Fisher, T.R. 2005. Do actions affect juvenile survival? An information-theoretic approach applied to endangered Snake River Chinook salmon (*Oncorhynchus tshawytscha*). *Transactions of the American Fisheries Society* 134:68-85
- Paulsen, C.M. and Fisher, T.R. 2003. Detecting juvenile survival effects of habitat actions: power analysis applied to endangered Snake River spring/summer chinook (*Oncorhynchus tshawytscha*). *Can. J. Fish. Aquat. Sci.* 60: 1122-1132
- Paulsen, C. M. and R. A. Hinrichsen, 2002. Experimental management for Snake River spring/summer chinook (*Oncorhynchus tshawytscha*): trade-offs between conservation and learning for a threatened species. *Can. J. Fish. Aquat. Sci.* 59: 717-725
- Paulsen, C. M. and T. Fisher, 2001. "Statistical Testing and Validation of the Relationship Between Snake River Spring/Summer Chinook Salmon Parr-to-smolt Survival and Indices of Rearing Habitat Quality" *Transactions of the American Fisheries Society*. 130: 347-358.
- Botsford, L. and C. Paulsen, 2000. "Covariability in Abundance among Index Stocks of Columbia River Spring/Summer Chinook Salmon," *Canadian Journal for Fisheries and Aquatic Sciences*, v. 57 616-627
- Paulsen, C. and K. Wernstedt, 1995. "Cost-Effectiveness Analysis for Complex Natural Systems: An Application to the Columbia River Basin," *Journal of Economics and Environmental Management* , Vol. 28 No. 3, May, 1995
- Wernstedt, K. and C. Paulsen, 1995. "Economic and Biological Analysis to Aid System Planning for Salmon Recovery in the Columbia River Basin," *Journal of Environmental Management* , Vol. 43 No. 4, June, 1995
- Wernstedt, K., J. Hyman, and C. Paulsen, 1993. "Dollars and Sense Under the Endangered Species Act: Incorporating Diverse Viewpoints in Recovery Planning for Pacific Northwest Salmon," RFF Discussion Paper QE93-11.
- Paulsen, C., K. Wernstedt, and J. Hyman, 1992. "Evaluating Alternatives for Increasing Fish Stocks in the Columbia Basin," *Resources*, Fall 1992.

Lee, D. and Paulsen, C. 1990. "Improving System Planning in the Columbia River Basin: Scope, Information Needs, and Methods of Analysis" RFF Discussion Paper QE91- 07, December, 1990.

Kneese, A., D. Lee, W. Spofford, and Paulsen, C. 1988. "Design of Studies for Development of BPA Fish and Wildlife Mitigation Accounting Policy," (with Allen V. Kneese, Danny C. Lee, and Walter Spofford, Jr.), Bonneville Power Administration, August, 1988.

*Freshwater Recreational Fishing*, (with William J. Vaughan, Clifford S. Russell, and Richard Carson), 1982, Johns Hopkins Press, Baltimore, MD.

## **Professional references:**

### **BPA**

Jeff Stier  
Christine Petersen  
Katie McDonald

### **NOAA**

Rich Zabel, NOAA Fisheries, Montlake