

2015 CHaMP Camp Workshop

Fish Habitat Models and Beyond

June 4, 2015

12:30 p.m. – 4:30 p.m.

Trainers: Joe Wheaton, Pete McHugh, and Philip Bailey

Objectives:	Introduce workshop participants to the fish habitat and population modeling tools used by CHaMP to estimate the quality and capacity of survey reaches, as well as to inform high-level population assessments.
Software needs:	None. Pre-installed Habitat Model Software will be used in a demonstration exercise.
Additional Resources:	Habitat Model Software is available for download at http://habitat.northarrowresearch.com

Abstract:

CHaMP, in conjunction with ISEMP (Integrated Status and Effectiveness Monitoring Program), has developed a suite of novel analytical tools to leverage field data and post-processing results (i.e., DEMs, hydraulic model outputs) in order to characterize the quality and capacity of sites, and ultimately inform assessments of population viability and recovery/restoration potential. During this session, the following fish habitat modeling tools will be reviewed: (1) Fish Habitat Model (FHM) Software, including traditional habitat suitability index and fuzzy habitat model components, and (2) the Net Rate of Energy Intake (NREI) model. Presenters will also describe how FHM and NREI outputs are used to compute demographic parameters, such as basin-scale juvenile rearing capacity, and how these values are used to inform ongoing population assessments.

FHM Software: The FHM Software provides a platform to estimate the suitability of CHaMP sites on a cell-by-cell basis as a function of local habitat conditions. Species- and life stage-specific curves relating abiotic conditions (e.g., depth, velocity, substrate size) to habitat suitability are used to compute suitability at X-Y locations throughout CHaMP reaches, given appropriate habitat input layers. Scores are aggregated across inputs into a single index of suitability and then translated into a reach-scale estimate of weighted usable area (WUA). WUA, in conjunction with an estimate of space requirements for species/life-stage combinations, can then be used to estimate reach capacity. FHM Software is a general modeling framework and is pre-loaded with published curves for CHaMP's focal species/stages (i.e., juvenile and adult Chinook salmon and steelhead). However, it is also extremely flexible and accepts a variety of suitability criteria, including user-defined curves and/or curves built on fuzzy logic. Attendees will explore the FHM Software, run a simple exercise using CHaMP data in conjunction with published habitat suitability criteria, and inspect patterns of predicted suitability relative to independent estimates of use.

NREI Model: The NREI Model is a framework for quantifying the energetic quality and rearing capacity of stream reaches. It consists of two sub-models, a foraging model and a bioenergetics model which, given information about ambient food availability (i.e., invertebrate drift), water temperature, hydraulic conditions (depth and velocity, output from 2D flow model), and an average fish size, yield spatially explicit predictions of the energy costs (swimming costs) and benefits (gross energy intake) associated with occupying different locations in survey reaches; a location's NREI value is simply the difference of these quantities (i.e., $NREI = \text{gross energy intake} - \text{swimming costs}$). The resulting high-resolution NREI predictions can then be translated into an estimate of reach-scale fish rearing capacity using fish placement algorithms and a minimum NREI threshold. In this module, we will (1) characterize what's 'under the hood' of NREI, (2) describe recent efforts at calibrating and validating the model, and (3) provide examples of how and where NREI predictions of reach-scale capacity are being used in broader CHaMP- and ISEMP-related applications.