"Process, proxy, or possible? habitat modeling to inform population dynamics models".

Summary:
Ecological modeling is fraught with input variable trade-offs. After accepting and appreciating the fact that the goal is not perfect system replication, other factors can drive the suite of appropriate and available input variables. Input variable availability can be further compromised by applications that require future predictions over spatial scales that differ than those used to calibrate the model, which is common for model applications aimed to inform resource management decisions. In this talk I will explore these issues, and their successful resolutions, using several recent habitat modeling examples. Further, I'll show how statistical techniques and proxy variables can help capture variation necessary to provide process inference that would otherwise not be possible. In the first example, we'll look at modeling the complex process of spawning site selection for Chinook Salmon in the Trinity River, CA. Site selection is hypothesized to vary according to physical, hydraulic, and even social attributes, is known to be impacted by a dam, and predictions of spawning habitat quality are required to implement a population dynamics model over a 40-mile stretch of the river. In this case we take advantage of proxy variables and statistical structural components that address trade-offs: some of which account for process and some simply help to replicate observed data. In another example, we explore a habitat quality model for juvenile Chinook Salmon, also in the Trinity River, CA. Here, we develop a statistical model that includes physical variables and random effects components that capture local habitat quality, as well as how habitat use varies across space and time. We then parlay this information to directly estimate a habitat unit's holding capacity to drive Beverton-Holt density dynamics in a population dynamics model. I'll close with some discussion on how these issues relate the practical relevance and applications of models like these.