

## **ASSESSING THE VULNERABILITY OF FRESHWATER ECOSYSTEMS TO THE ECOLOGICAL IMPACTS OF INVASIVE RUSTY CRAYFISH (*ORCONECTES RUSTICUS*)**

Julian D. Olden, School of Aquatic and Fishery Sciences, University of Washington, Seattle, WA 98195 USA; [olden@uw.edu](mailto:olden@uw.edu)

M. Jake Vander Zanden, Center for Limnology, 680 N. Park Street, University of Wisconsin – Madison, Madison, WI 53706 USA

Pieter T. J. Johnson, Ecology and Evolutionary Biology, Ramaley N122, University of Colorado, Boulder, CO 80309 USA

Unpublished manuscript

### **Summary**

We used a multi-response artificial neural network (MANN) to model present-day (1985-2006) presence/absence of *Orconectes rusticus* as a function of environmental and human-related factors describing the likelihood of introduction and establishment. Our lake model included 9 variables describing human visitation, lake morphology and water chemistry, and our stream model included 11 variables describing channel characteristics, low flow regime, land use, superficial geology, and regional climate. We developed separate feed-forward MANNs trained by the backpropagation algorithm to model 292 lakes and 546 stream sites. Using the MANNs, we predicted the probability of occurrence for *O. rusticus* for 4,200 lakes and 35,855 stream segments (representing 90,360 river kms) across the entire state of Wisconsin. *O. rusticus* occurrence was highly predictable according to the MANN. The cross-validated neural network correctly predicted *O. rusticus* in 93.2 % of the lakes and 94.3 % of the stream sites (cross-validated estimates), in addition to exhibiting both high sensitivity and specificity. Model performance was significantly greater than random based on Cohen's Kappa for both habitat types.