Previous Research Experience

I have been involved with scientific research in a variety of individual and group settings since the second week of my freshman year of college at the University of Vermont. However, my first ecologically relevant research experience did not come until I applied to and was accepted into the NSF funded Research Experience for Undergraduates program at the Cary Institute of Ecosystem Studies in Millbrook NY. At Cary I developed and orally defended a research plan analyzing long-term temperature trends in the Hudson River estuary under the guidance of my REU mentor Dr. Michael Pace, an aquatic ecologist. I applied time-series and regression analysis techniques to 100 years of daily, direct water and air temperature measurements. I found that the Hudson River estuary has warmed substantially over the analysis period and that the warming was due to air temperature, not changes in land use or freshwater discharge. The warming is mainly occurring in the summer. This is in contrast to the Chesapeake Bay estuary which is warming in the winter. The Hudson River warming might adversely affect recreational and commercial fisheries as increased temperature in the late spring and summer months will likely affect the development of some fish species and the ecological interactions of populations as they undergo ontogenetic shifts in diet and predator susceptibility. Warming may also suppress filtration by the invasive zebra mussel, releasing the planktonic food-web from grazing pressure. I also developed and delivered a presentation on climate warming for under-privileged inner-city high school students that visited Cary. I presented my work at a research symposium for REU students and wrote a scientific paper as part of the Institute's Undergraduate Ecology Research Reports series. My work was combined with that of a group analyzing warming trends over a broad geographic extent. This collaboration resulted in a peer-reviewed journal article in *Frontiers in Ecology and the Environment* (Kaushal et al. 2010). With Dr. Pace, I co-authored a popular article on Hudson River warming in the newsletter for the Hudson River Environmental Society (Pace and Seekell 2009).

Following the REU program, I prepared a research proposal and received through a competitive application process a Tibor T. Polgar research fellowship from the Hudson River Foundation. Dr. Pace continued to serve as my advisor for this program. My work used long-term time series to assess zebra mussel impacts on the thermal balance of the Hudson River. Higher bivalve filtration rates after the invasion increased water clarity. This should have decreased the water surface albedo which could alter water temperature. I compared observed water temperatures to equilibrium water temperatures calculated assuming pre-invasion levels of albedo. While these changes should have increased water temperature, the net effect was negligible and not greater than the measurement uncertainty. I compiled my results into a formal scientific report for the fellowship program's edited bulletin. While this project did not produce the exciting results that my REU project did, the project did teach me that not everything works out the way you hope and that disappointing developments need to be accepted as part of the scientific process. Further, the project led me to consider the idea that instead of the zebra mussels changing the river as I had originally proposed the warming river might be changing the zebra mussels. Since then, I have found strong theoretical, simulation, and empirical evidence in the literature to support the hypothesis that warming water temperature reduces zebra mussel grazing pressure on plankton. No study has demonstrated this possibility with data from specific ecosystems (i.e. current work is mainly experimental and inferential) We are currently examining interactions of climate warming and the invasive zebra mussel using the unique long-term time series from the Hudson River (Strayer et al. 2008 *Ecology*, doi:10.1890/07-0979.1).

In 2008 Dr. Pace moved to the University of Virginia. I followed him there upon completion of my undergraduate degree in 2009 to pursue a PhD in ecology. In my first year I completed a project examining the global size-distribution of lakes. An accurate understanding of the size-distribution of lakes is critical for up-scaling estimates of the role of lakes in biogeochemical cycles at regional and global scales. Previous studies had developed statistical models of lake size distributions based on a Pareto distribution. However, there is tremendous uncertainty in lake abundance estimates due to sampling that was not previously been taken into account and I conducted simulations and empirical analyses that demonstrate lake-size distributions are consistent with alternative models. A paper from this work is now in press at *Limnology & Oceanography* (Seekell and Pace in press). The uncertainty in the alternative statistical models results in orders of magnitude differences in estimates of the number of lakes in the world, their total surface area, and their role in the global carbon cycle. I will present this work at the 2011 American Society of Limnology and Oceanography Aquatic Sciences Meeting in San Juan Puerto Rico as well as a special workshop on boreal aquatic biogeochemistry hosted by the American Society of Limnology and Oceanography and the International Federation of Aquatic Boreal Research. This work will lead to more accurate estimates of the role of lakes in the global system. The accuracy of these estimates is important in order for limnologists to frame the field of limnology in the context of global issues and for evaluating lakes and streams as hotspots for biogeochemical processing and storage.

In additional to my proposed work to improve leading indicators of catastrophic regime shifts, which will be the focus of my dissertation, I am also currently involved in a variety of mainly collaborative research projects on topics including fish and fisheries, predation risk allocation, and inequality in global water resource use. One product of this work is an individual effort on the probability of angler catch success. I conceptualized, gathered data, analyzed and wrote a paper from this project. In this study I test and support the likely unpopular idea that fishing success is mainly the result of luck not skill. The paper is currently in review at the *North American Journal of Fisheries Management*.

I believe that these experiences represent a tangible record of success in all aspects of research, from project conception and obtaining competitive funding through dissemination of the final results to the scientific community and the public. Most importantly, these experiences and the encouragement of my advisor and colleagues have given me the sense of excitement to continue my work in ecology with a future research focus on leading indicators of regime shifts in ecological systems.

Presentations:

-**Seekell DA** (2007) Analysis of a warming trend in the Hudson River estuary. Undergraduate Research Symposium, Cary Institute of Ecosystem Studies. Millbrook, New York

-**Seekell DA** (2008) Did the zebra mussel (*Dreissena polymorpha*) alter the thermal balance of the Hudson River? Tibor T. Polgar Fellowship Research Symposium Norrie Point Environmental Center. Staatsburgh, New York.

Publications:

-Pace ML, **Seekell DA** (2009) The Hudson River is warming. Currents: Newsletter of the Hudson River Environmental Society 38:1-3. (popular article, not peer-reviewed)

-Kaushal SS, Likens GE, Jaworski NA, Pace ML, Sides AM, **Seekell D**, Belt KT, Secor DH, Wingate RL (2010) Rising stream and river temperatures in the United States. Frontiers in Ecology and the Environment 8:461-466, doi: 10.1890/090037

-**Seekell DA**, Pace ML (in press) Does the Pareto distribution adequately describe the size-distribution of lakes? Limnology & Oceanography