Researcher profile for the Ocean Acidification Principal Investigators' Meeting. Ocean Carbon and Biogeochemistry Program, Woods Hole, MA. March 22-24, 2011.

Research Interests:
The research I conduct at EPA focuses on application of quantitative ecological methods, especially those of theoretical and experimental population ecology, in risk assessment. Much of our recent effort has focused on marine mysids because of their legacy as a model system in ecotoxicology and their importance in marine food webs. Using this system, we have found that the short-term cohort studies of early life stages that figure so prominently into population research sometimes produce dramatically different descriptions of risk than those produced by studies of fully structured populations. This result is not surprising on theoretical grounds but is problematic because cohort studies have become the basis for published meta-analyses of ocean acidification effects on marine biodiversity. Thus, we are examining solutions to the observational and computational limitations that have impeded observation of intact populations. These solutions include applications of digital imaging technology, inverse demographic modeling, and information-theoretic inference. We use seawater CO_2 manipulations to test the sensitivity of these methods for detecting stressor effects on populations.

Synopsis of current ocean acidification-relevant research or work:
Our current ocean acidification-related work is motivated by the research objectives described above and by EPA's responsibilities under both the Clean Air Act and the Clean Water Act. Our laboratory setup uses a bubbling system with CO_2-enriched air and continuous seawater flow. Manipulated seawater is distributed into replicated mysid population tanks. We recently completed a 4-month experiment (~5 generation lengths) with ambient and elevated CO_2 treatments. Population structure was measured once per week via digital imaging and we are currently analyzing these measurements using inverse demographic analysis to determine which life history traits govern the population response. We used this approach successfully in a prior study of resource limitation effects that is currently in review.

We monitor pH in our experiments using glass electrode measurements at 5-minute intervals and twice-weekly calibrations with standard pH buffers. Twice during the recent 5 month experiment, we also measured dissolved inorganic carbon using a TOC analyzer. Our pH measurements confirm strong absolute differences between treatments, as well as expected daily and seasonal pH signals in the incoming seawater, but these data will be insufficiently accurate for determining actual pH and other carbonate system characteristics. To address this problem in future experiments, we plan to include occasional alkalinity titrations and spectrophotometric pH measurements. Finally, we are examining possibilities for acquisition of pCO_2 monitoring equipment that could be deployed alternately between EPA's survey vessel (O.S.V. Bold) and our seawater laboratory. A major challenge will be to assure quality in this chemistry work while at the same time maintaining rigor and quality in the ecological methods.

Related information:
Grear, J.S., Doranne Borsay Horowitz and R. Gutjahr-Gobell. *Accepted* . Mysid population responses to resource limitation differ from those predicted by cohort studies. Marine Ecology Progress Series.