The population dynamics of the crustacean zooplankton in Carolina Bays of the Savannah River Site

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Background

Carolina Bays are ancient elliptical wetlands found within the Atlantic Coastal Plain from Delaware to Alabama. Most Carolina Bays have been dramatically impacted by agriculture and development, but on the Savannah River Site (Aiken, South Carolina) there exists a fairly large number of relatively intact Carolina Bays. Carolina Bays were anecdotally reported to exhibit extremely high biodiversity of crustacean zooplankton, particularly cladocera, copepods, ostracods, fairy shrimp, and clam shrimp. In January 2009, researchers from the Odum School of Ecology commenced a two year study of the composition and dynamics of crustacean zooplankton in sixteen bays on the Savannah River Site. A summary of this study is provided in Zokan (2015).

These data represent a phenomenal resource for studying population and community ecology. Date are drawn from 1,522 different sampling events and represent 485,047 individual organsims collected and identified. Some preliminary analysis has been reported by Zokan (2015), but the work remains largely unpublished. We will work with these data for the rest of the semester, using them to explore problems in population dynamics, species interactions, and the measurement of biodiversity.

Data

The data are archived in the zip directory `zooplankton.zip`. This directory contains two files, `SRSsurvey.xlsx` and `zooplankton.csv`. The file `SRSsurvey.xlsx` consists of multiple sheets with information collected about different dates of sampling, environmental conditions, and taxonomy of species collected. The file `zooplankton.csv` contains primary data on the abundance of zooplankton of each species obtained at each collection date and time.

Assignment

Working in designated groups, you must conduct a data-driven research project on one of the topics listed below related to the study of population dynamics, using the Savannah River Site zooplankton survey data.

Each group must choose a different topic. Following selection of a topic, your first task will be to pose an *answerable research question*. It is important that this question is indeed *answerable*, so you will want to spend a significant amount of time composing your question and considering the methods you might adopt to answer it. Groups are encouraged to investigate the data while discussing their question and to engage their instructors in this process. **Research questions must be approved by end of class August 30, 2018.**

Once you have identified your research question, work should begin in earnest to answer this question. You are encouraged to consult your readings, outside material, and the instructors as you seek to answer your question. It is anticipated that considerable time outside of class will be required to complete your project. Such outside work may be achieved by meetings of the group, online meetings, or distributing responsibilities among group participants. Six class periods have been designated to work on these projects, primarily to enable you to consult the instructors for assistance with data analysis, programming, or other technical matters.

The required output of this work is a final report. This should be written to be fully reproducible using R Markdown and presented in the format of a scientific paper (*Introduction*, *Methods*, *Results*, *Discussion*, *References*). Both `.pdf` and `.Rmd` versions of the report should be turned in. In many scientific journals, it

has become customary to identify the individual contributions to a collaborative work. See, for example, http://journals.plos.org/plosone/s/authorship#loc-author-contributions. One report will be turned in for the whole group, but the report should contain a statement of each person's individual contributions. Projects will be scored according to their *innovation*, *sophistication*, *comprehensiveness*, and *success in answering the question posed*. **Your final report is due October 2, 2018.**

Topics

- What evidence is there for population cycles and the underlying drivers of the cycles?
- Do zooplankton populations exhibit Allee effects?
- To what extent are population growth rates seasonal?
- What evidence is there for density-dependent population growth in zooplankton?
- Is there evidence of overcompensation?
- Are population growth rates more sensitive to population processes (e.g. density dependence) or environmental processes (e.g. water depth, temperature)?
- What is the strength of competition among selected species?
- How does population variability scale with average population size, body size, or intrinsic rate of increase?
- How does the intrinsic rate of increase vary with body size?

Group assignments

Group assignments are designated below (by student initials).

Group 1: KFC, CAW, ADM, ACR, GNX

Group 2: GTF, AGB, CEM, GGR,

Group 3: ANK, CAC, EBD, AHS,

Group 4: SPL, JAG, AN, FS

References

Zokan, M. 2015. "Zooplankton species diversity in the temporary wetland system of the Savannah River Site, South Carolina, USA." PhD thesis, University of Georgia.