

Project Spotlight

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What is the topic of your research within the CWC?

I study the effects of the oil spill on Seaside Sparrows and marsh rice rats together with co-PIs Phil Stouffer, Stef Woltmann, Andrea Bonisoli Alquati, Mike Polito and Jill Olin. Collectively, we are looking at reproductive success (sparrows), population size (sparrows, rats), gene expression (sparrows, rats), stress hormones (sparrows), isotopes (sparrows, rats), and DNA diet analyses (sparrows).

What methods are you using to answer your questions?

-To estimate reproductive success, we find and follow nests to determine their fate (successful/unsuccessful), and if the nests were successful, how many eggs were hatched and how many chicks were fledged.

-To estimate population size, we use point counts for birds and capture-mark-recapture for rats (this involves live-trapping with Sherman traps and marking the rats).

-We examine gene expression with the CYP1A gene, which is a gene involved in metabolizing PAHs (polycyclic aromatic hydrocarbons). We collect a small number of samples from livers (the main detoxifying organ of the body where the gene is most active), extract mRNA, convert it to a more stable form (cDNA) and then compare the number of copies in individuals from oiled and unoiled sites. If an organism has been exposed to PAHs, the gene becomes active (DNA makes RNA, which makes proteins), and so we expect to see more mRNA copies on oiled sites.

-We plan to examine the stress hormone corticosterone in bird plasma (from the blood) and feathers. If birds on oiled sites are more stressed, we expect to see higher levels of corticosterone.

-We will examine a variety of isotopes in bird and rat muscle tissue, livers, and feathers. This information will tell us whether the animals are dependent on benthic and/or terrestrial food webs. This analysis also allows us to examine how these species fit into the overall food web.

-We will extract DNA from Seaside Sparrow fecal samples and gut contents to get an accurate idea of what the birds are eating.

What results have you gotten thus far?

-In birds, reproductive success appears to be lower on oiled sites, and although population size was initially lower on oiled sites, Hurricane Isaac had a big impact, knocking back population size on all sites. Since the hurricane, population size has increased on all sites but there are no differences between oiled and unoiled areas.

-CYP1A gene expression was much higher on oiled sites in 2011, but since that year, there are no differences among sites. Hurricane Isaac did appear to have an effect, perhaps by re-suspending buried oil, because birds on all sites had increased levels of CYP1A expression in 2013.

Did any of these results surprise you?

I think its interesting (although perhaps not unexpected) that the oil spill, which was spatially restricted to a narrow band of the marsh, had individual-level effects that do not seem to have translated to the wider population. In contrast, Hurricane Isaac, which only lasted a few days but affected a very large area, did produce population-level effects.

What are the next steps in your research?

There are several things we still need to do: analyze population size and CYP1A expression in rats, analyze sparrow feathers and plasma for corticosterone, and analyze DNA in sparrow fecal and gut contents to determine diet.

What are the "big picture" implications of your study?

The ultimate goal is to examine how two top predators, seaside sparrows and marsh rice rats, respond to natural and anthropogenic disturbances as well as how they fit into the overall food web. The results from a variety of approaches (demographic, genetic, physiological) at two levels of organization (individual and population) will help to reveal key mechanisms.

