The influence of landscape and predator-prey relationships on recruitment and survival of migratory birds in the Central and Mississippi Flyways

Principal Investigator: William R. Clark
David L. Otis
Rolf R. Koford
Student Investigator: Andrew S. Wiewel (M.S.)
Collaborators: Marsha A. Sovada, USGS Northern Prairie Wildlife Research Center

Duration: May 2001 to December 2003
Funding Source(s): USGS Northern Prairie Wildlife Research Center
Iowa Agriculture and Home Economics Experiment Station
Ecology and Evolutionary Biology Graduate Program

Goals and Objectives:

1. Evaluate mark-recapture, removal, and track tube surveys for assessing small mammal abundance and diversity.
2. Develop regression models predicting small mammal abundance and diversity in grasslands as a function of vegetation and soil moisture characteristics.

Progress:

During the summers of 2001 and 2002, small mammal populations were surveyed on Waterfowl Production Areas in Stutsman County, North Dakota, using mark-recapture (live trapping), removal (snap trapping), and track tube survey techniques. Major data analyses were completed in spring 2003 and Wiewel's M.S. thesis, "Assessing small mammal prey abundance and diversity in North Dakota grasslands," was successfully defended during summer 2003. Two manuscripts are currently in preparation for submission to the Journal of Mammalogy.

The first manuscript, "Assessing small mammal abundance using population estimates and track tube indices," evaluates and compares mark-recapture, removal, and track tube surveys and describes regression models developed to predict small mammal abundance from track tube indices. We found that mark-recapture, removal, and track tube surveys produce qualitatively and quantitatively different conclusions about the abundance and diverisity of small mammals in grassland habitats. Removal surveys consistently capture more species, and more individuals of those species, than mark-recapture surveys. Track tube surveys reflect a skewed small mammal community composition, with thirteen-lined ground squirrels and Franklin's ground squirrels overrepresented, when compared to mark-recapture and removal surveys. Track tube indices, although generally correlated with mark-recapture and removal survey population estimates, were not precise predictors of small mammal abundance estimates derived from mark-recapture surveys.

The second manuscript, "Predicting small mammal abundance and diversity in North Dakota grasslands," describes regression models developed to predict small mammal abundance and diversity as a function of vegetation and soil moisture characteristics in upland and wet-meadow grassland habitats. We found that meadow voles and meadow jumping mice were more commonly captured in wet-meadow habitats, whereas masked shrews and thirteen-lined ground squirrels were more commonly captured in upland habitats. Predictive models generally explained moderate amounts of the variation in total small mammal abundance (mean $r^2 = 0.5$), species-specific abundance (mean $r^2 = 0.52$), and small mammal diversity (mean $r^2 = 0.54$) in grassland habitats. Important variables entering into multiple predictive models of abundance and diversity included soil moisture, percent forb vegetation, percent litter, and litter depth.

Conclusions and Recommendations:

Based upon Wiewel's M.S. research, we conclude that track tube surveys do not provide precise indices of small mammal abundance estimates, and that traditional mark-recapture and removal survey methods are more suitable for generating unbiased and precise estimates of abundance. Vegetation and soil moisture characteristics were useful for predicting small mammal abundance and diversity, particularly between sites but were not as useful for predicting spatial patterns within sites. We recommend further study of these small mammal-habitat relationships, particularly extension to larger scales using remotely-sensed habitat data.