

Annual Report

Period Covered by the Report: May 2000 – April 2002

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Title: The paradox of the Delta: Protecting the biodiversity we do not yet understand

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Research Category: SGER

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Objective(s) of the Research Project

Using funds from ACES, the Total Insect Bioinventory Project (TIBP) of the Mobile/Tensaw Delta (MTD) was established. Initially funding was for a preliminary assessment of the biodiversity of permanent running-water habitats, using aquatic Diptera (two-winged flies) as the study animal. However, with no additional resources, we were able to expand the scope of work to include other aquatic insects. In addition, we were able to undertake preliminary Malaise trap and pitfall collections; these latter data were used to plan our companion study which was also funded by ACES in May of 2001 (A Preliminary survey of the aerial and ground-dwelling insects of the Mobile / Tensaw Delta). Here we report on the current status of the following three sub-projects:

1. A preliminary survey of the aquatic insects of the MTD
2. The spatial-temporal ecology of waterscorpions
3. A preliminary survey of aerial insects of the MTD

Progress Summary/Accomplishments

Preamble:

More than 50,000 insects have been sorted to the level of family. Many of these specimens have been sent to the leading taxonomic specialists. More than 100 species of aquatic insects have been identified to date. About 8% of these species are completely new to science, never before seen. Many additional species are state records for Alabama, and some represent the southernmost distribution records. For example, in the Chironomidae, a group of insects for which distribution records are well known, more than 50% of the species are state records. A list of species identified to date is available upon request.

1. A preliminary survey of the aquatic insects

1.1 Preamble: Permanent flowing water is the most pervasive aquatic habitat in the Delta and, therefore, the main focus of our study. The current status of the aquatic insect bio-inventory is presented in this section of our report.

1.2 Methodology: Given the influence of stream size on insect habitats we stratified on the basis of stream width. Thus, four small (< 10 m), four medium (ca. 20 - 40 m), and four large (> 60 m) streams were sampled monthly (where possible) from June 2000 to May 2001. Streams were intentionally classified into three discrete, easily identified, non-overlapping

sizes to prevent errors in site classification. Streams were sampled by first delineating a length of stream five times the width of the streams, thus insuring each stream was sampled on a proportionally equivalent scale. At each site three sampling stations were randomly selected and sampled using a Ponar grab and a 5-minute D-net sample. For each sampling method the three samples were then pooled. The Ponar grab was used specifically to sample the stream-bed and D-net samples were used to sample the aquatic vegetation. Selection of three sampling stations minimizes bias toward any particular microhabitat. Stream variables measured at the time of each collection included depth, velocity, conductivity, pH, dissolved oxygen, and water temperature. Stream data is available upon request.

1.3 Preliminary Results: A total of 98 pooled (298 unpooled) D-nets samples have been taken. Inclement weather prohibited sampling in November and February. Also, at some sites, vegetation disappeared during January and March, precluding sampling. A list of species identified to date is available upon request. Further sorting, identification and vouchering of specimens is scheduled for June to December, 2002. Other than chironomids (Diptera: Chironomidae) Ponar grabs collected very few other insects, hence, these data are not presented here. A list of species identified to date is available upon request.

2. The spatial-temporal ecology of water scorpions

2.1. Preamble: A fundamental tenet of community ecology is that patterns of species distribution and abundance can provide insight into the mechanisms that structure species assemblages. Therefore, establishing empirical relationships between insects and habitat parameters has occupied a central position in ecology, although many investigations have been limited. Water scorpions (Nepidae: Hemiptera), however, are a taxonomically well known group of North American aquatic insects at the species level. Given their taxonomic status and ubiquitous nature, they are an ideal choice to examine predictability of aquatic species distributions over a spatially heterogeneous landscape.

2.2 Methodology:

Sampling Protocol: The study area includes all of the waters in the lower half of the MTD from 30.45E to 31.15EN and from 87.53E to 88.05EW. Aquatic vegetation at each site was sampled with three 5-minute large dip-nets samples (mesh = 500 Fm mesh; dimension = 46 cm x 30 cm x 27 cm). Three 5-minute D-nets samples were also taken at each site. All nets samples from a site were then subsequently pooled to estimate the relative abundance of water scorpions. Water depth, dissolved oxygen, pH, conductivity, water temperature, and depth were measured at each collection. Stream width was estimated using the Delorme® 3-D topo quad software for the state of Alabama. A Global Positioning System was used to spatially reference each collection. Sites were sampled from October 10 - 16, 2000. By sampling over a short period of time, changes in abundance due to seasonal dynamics can be ignored. Sampling was repeated in again in May, 2001 and results combined.

Data Analysis: Because site variables are potentially inter-correlated, principal component analysis (PCA) was used to collapse these parameters into a smaller number of statistically independent principal components (PCs). PCs with eigenvalues greater than 1, therefore, replace the original stream variables in all further analysis. Stream variables not normally distributed were subjected to appropriate transformations before entering into PCA. Interpretation of each PC was based on rank correlations between the PC and the original

stream variables. Waterscorpion abundance was related to site parameters, now expressed as PCs, using stepwise multiple regression.

2.3 Results:

Fauna: To date four species of waterscorpions have been collected in the MTD including *Ranatra kirkaldyi*, *R. nigra*, *R. australis*, *R. buenoi*. Based on previous collections from southern Alabama, *R. drakei* might also be present in the Delta. Over 90% of specimens collected thus far are *R. nigra*, accordingly, the following statistical analysis pertains only to this species.

Spatial distribution of *Ranatra nigra*: A total of 27 sites were sampled. Site conditions, locations and *R. nigra* abundance for each site are available upon request. Based on our interpretations of the PC's and regression ($F = 13.11$; $p = 0.001$; $R^2 = 31.8\%$), *R. nigra* was most abundant in warm, small, high conductivity streams close to the Bay.

3. Aerial insects from the Mobile / Tensaw Delta

3.1. Methodology: A single Malaise trap was placed at each of the following sites in the MTD — Raft River (30.77E N, 87.95E W), Little Briar Creek (30.84EN, 87.94E W) and Byrnes Lake (30.79E N, 87.91E W). Depending on ambient weather conditions, traps were left unattended from 1 - 3 weeks, from June 2000 - May 2001.

3.2. Results: A list of species identified to date is available upon request..

4. Significance

Given that the Southeast has a much lower percentage of protected land than most other regions of the nation, the need for a complete Delta bioinventory becomes particularly urgent. It is clear that we will only be able to preserve a small fraction of the earth's fauna in parks and reserves. Thus, management decisions in these preserves will be crucial for protecting the world's decreasing biodiversity and as 'seeds' for other areas under restoration. The first and most critical step in proper management is an accurate inventory of the taxa present.

Publications/Presentations:

Ihle, D., and McCreadie, J.W. 2001. Spatial distribution of Waterscorpions (Nepidae: Hemiptera) and parasitic mites (Hyrachnoidea: Hydrachnidae) in lower Mobile / Tensaw Delta. Graduate Student Symposium, 2001. Dauphin Island Sea Lab, AL.

Ihle, D., and McCreadie, J.W. 2001. Spatial distribution of Waterscorpions (Nepidae: Hemiptera) in lower Mobile / Tensaw Delta. Entomology Society of America Annual Meeting, San Diego, CA.

Future Activities:

This will consist of continued sorting and identification of insects collected. Spatial analysis of other taxa will be undertaken as identifications continue. This will most likely included the

dragonflies *Erythemis simplicicollis* and *Pachydiplax longipennis* and the creeping water bug *Pelocoris femoratus*. In addition future analysis will consider the spatial distribution of species richness.

Supplemental Keywords: aquatic, survey, faunistics, insect, lotic

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