Annual Report

Period Covered by the Report: 01 / 24/ 2006 (date funds received) – 05/15/2007
Date of Report: 05/15/2007
Title: Biodiversity of Diptera and Odonata in Relation to Ecosystem Health of the Mobile/Tensaw Delta.
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Research Category: SGER
Project Period: 11/10/2005 – 10/30/2007

Objective(s) of the Research Project

The Mobile/Tensaw Delta (MTD), the nation's second largest river delta, is thought to harbor a wealth of biological diversity. Traditionally, the MTD has been considered the 60-km long, 15-km wide stretch of wetland from the head of Mobile Bay north to the confluence of the Alabama and Tombigbee Rivers (Zolczynski & Shearer 1997). Much of this 900-km^2 area remains in a natural state (Henwood et al. 1980, Smith 1997), a remarkable fact given that the Southeast has relatively little land under federal or state protection (Loomis & Echohawk 1999). The MTD consists largely of cypress-gum swamps and bottomland hardwood forests, interlaced with streams, canals, bayous and marshes (Henwood et al. 1980). Through the process of flocculation the MTD is a major source of food for the filter-feeding organism that inhabit the estuaries of Mobile Bay. As such, human-induced changes of the waters of the MTD will have a direct impact on the nutrient loads of the surrounding saltwater habitats. Furthermore, because of its extreme size, the MTD watershed acts as a large scale funnel, collecting and directing a variety of insults into Mobile Bay. Clearly, understanding the conditions in the MTD is a prerequisite for assessing how future land and water use in the drainage basin of Mobile Bay will influence water quality and biological productivity in Mobile Bay and surrounding estuaries.

Delineation of the Problem: An essential step in watershed protection and restoration is the ability to detect changes, subtle or gross, in the biological communities inhabiting these waters. Macroinvertebrates are often the center-piece biomonitors in watershed restoration and protection because they play a major role in ecosystem processes and are sensitive monitors of environmental change (Richards et al 1993), i.e., they are the invertebrate 'canary in the coal mine'. However, many management regimes still rely heavily on physical and chemical parameters to assess the health of freshwater basins and estuaries. Reliance on these parameters, without reference to the existing biota, will inevitably produce erroneous conclusions (Paulsen et at 1998). For example, based on chemical and physical parameters, the Delaware Department of Natural Resources concluded that 87% of its streams fully supported aquatic life (DNREC 1994).However, based on a survey of benthic macroinvertebrates, it became clear that only 13% of these streams actually were able to support the aquatic biota (Maxted 1997). Although dramatic, such errors are common when habitat assessment is based solely on physical and chemical criteria (Paulsen et al. 1998).

Because our knowledge of the invertebrate biota is rudimentary, organismal changes in response to either environmental degradation or remediation cannot be detected. Our current ignorance of the invertebrate biota relegates our estimates of the Delta's health and management decisions to little more than educated guesses. Simply stated, determining the factors associated with human-induced changes in MTD, which in turn transports sediments, nutrients and insults into the Mobile Bay estuary system, cannot be assessed with any confidence at this time. Given that biological surveys are the cornerstone on which conservation priorities are established and management practices implemented (e.g.,

Balmford & Gaston 1999, New 1999), a detailed inventory of select groups of invertebrates is mandatory. Our specific objectives are as follows:

1. produce a preliminary though representative list of the Diptera and Odonata in the MTD, including vectors of human disease agents. This is our primary objective as the data collected will help form a benchmark against which all future changes in environmental conditions can be measured.

2. create range maps for each species within the delta.

3. compile biological information for the most common species, such as habitat selection and phenology.

4. organize information gathered into our database so that it is available to other researchers worldwide.

5. determine to what degree the Delta is a refuge for the nation's biodiversity.

6. establish a metric between habitat variation and faunal differences.

7. identify locate 'hot spots' of biodiversity

8. document new species.

9. deposit voucher specimens of in the USSAD for future researchers.

Progress Summary/Accomplishments

Methodology: Dipteran Collection: Four sampling stations were selected, each located in a unique topographical / vegetational area to maximize the number of species collected and to examine the effect of landscape features on dipteran biodiversity and community structure. Each sampling station consisted of a Malaise trap 'array'. Each Malaise trap consists of a system of fine-mesh net baffles that end in a large collecting net. Each trap is approximately 2.5m x 2.0 m x 1.0 m (H x L x W) and is effective at capturing flies (e.g., Darling & Packer 1988, New 1999). The top of the collecting net terminates in a plastic cannister that holds 1 liter of 95% ethanol (fixative). Each trap passively intercepts flying insects as they hit the baffles. Insects then work their way to the collecting cannister where they are fixed in the ethanol. Each of the four trapping 'arrays' consisted of four Malaise traps for a grand total of 16 traps. By placing the traps in groups of four (25 m apart), estimates of relative abundance at each trapping location for each species collected can be calculated. Collecting arrays were operate for 1-week intervals, each season between January 06 to May 07.

Larval Odonate Collections: Streams will be sampled by first delineating a length of stream five times the width of the stream, thus ensuring that each stream is sampled on a proportionally equivalent scale. At each site, five 5-minute bank-side samples will be obtained using a wide-mesh net that is effective at collecting odonate larvae (Needham et al. 2000). Based on our preliminary studies, each site will be sampled once a season for 12 months.

Results: To date the Malaise trap collections have been accomplished. This represents a total of 48 collections and approximately 100,000 specimens. All traps have now been removed from the field and the process of sorting these collections for identification has begun. The larval odonate collections will begin by June of 2007..

Future activities

This will consist of Dipteran identification, odonate collections and identifications and vouchering of specimens. As identifications are completed analyses and publications will follow.

Supplemental Keywords
Malaise, survey, faunistics, insect, wetlands

Acknowledgments and disclaimers
This research has been supported by a grant from the U.S. Environmental Protection Agency's Science to Achieve Results (STAR) program. Although the research described in the article has been funded wholly or in part by the U.S. Environmental Protection Agency's STAR program, it has not been subjected to any EPA review and therefore does not necessarily reflect the views of the Agency, and no official endorsement should be inferred.

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