Paul P. Tinerella, PhD
Curator of Entomology, UMSP Insect Collection
Department of Entomology
University of Minnesota
St. Paul, MN 55108 USA
e-mail: ptinerel@umn.edu
Phone: 612-624-1254

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Introduction

This report summarizes results of a biotic survey of aquatic true bugs (Insecta: Hemiptera: Heteroptera) conducted to date throughout Big Thicket National Preserve (BITH) during April 2009 - December 2011. During the survey, a total of four trips was made by the PI (Table 1), sampling a total of 166 localities throughout all units of Big Thicket National Preserve (NPS) and the Roy E. Larsen Sandylands Sanctuary (The Nature Conservancy). Survey throughout Big Thicket National Preserve and adjacent lands included sampling at all BITH units, including recently acquired property in the Beaumont Unit, in 2011, with BITH Preserve biologist Brian Lockwood.

Table 1. WaterBug ATBI Sampling events in Big Thicket National Preserve and R.E. Larsen Sandylands Sanctuary, southeastern Texas, USA.

Sampling Date	No. Sampling Localities
June 16-20, 2009	37
March 28 - April 2, 2010	39
June 6-15, 2010	31
June 1-15, 2011	59
Total Sampling Days: 37	**Total Localities: 166**

Methods

During this water bug ATBI survey, standard entomological techniques were employed, including aquatic dip nets, aerial sweep nets, aspirators, and irregular black light/Hg vapor “light trapping” to collect aquatic true bugs and aquatic beetles. Specimens were collected from the shore of aquatic habitats, as well as by (NPS) boat (Beaumont Unit), and kayak (Menard Creek corridor; Neches River corridor). All specimens collected were preserved in 80% ethanol in the field and brought back to the PI’s laboratory for processing. Specimens were sorted by taxonomic group, pinned, pointed, or permanently preserved in ethanol (vials) utilizing standard entomological curatorial preparation techniques. Geospatial coordinates were obtained at all localities with a hand-held GPS unit and coordinate data were associated with all specimens.

Map datum was WGS84. Specimens were further sorted and identified to the lowest taxonomic level possible, utilizing published and unpublished taxonomic keys. Additional identifications were confirmed by examination of original species descriptions, comparison of museum specimens, and known biotic distributions.

All specimens are databased and have been deposited in the University of Minnesota Insect Collection (UMSP). A synoptic representation will be made available for deposition into the Sam Houston State University Insect Collection (Dr. Jerry Cook) and other appropriate collection repositories. Upon receipt, specimen preparation will be complete with addition of National Park Service tracking labels. All deposited material (UMSP) will be incorporated into the museum's relational database for tracking and data dissemination.

Results and Discussion

During the survey, a total of **1,337** specimens of aquatic true bugs (Heteroptera) was collected from Big Thicket and adjacent areas. To date, **64 species** of aquatic true bugs comprising **13 families** and **29 genera** have been identified from BITH sampling localities (Appendix 1). This checklist consists of **16 new state records**, with most of the species previously unreported for BITH. Additionally, two species of backswimmers, genus *Buenoa* Kirkaldy (see below) are possibly new to science. Further study and comparison of selected groups and survey specimens with museum material is needed to complete species identifications and descriptions.

At present, all groups are positively identified to species (Appendix 1) with the exception of the following, for which species verifications will be obtained by existing museum material to be loaned to the PI and/or collaboration with current specialists in these groups:

1) **Family Notonectidae; genus *Buenoa*.** To date, series of two species are tentatively identified as possibly undescribed (new to science). These two morphospecies will be incorporated into a taxonomic study of the genus. Further collecting in BITH and adjacent areas is needed to obtain more individuals, phenological and life history data, and habitat requirements.
2) **Family Pleidae: genus *Neoplea***. Taxonomic resolution of *Neoplea* in the southern United States and especially throughout eastern Texas is currently unresolved. Further collecting is needed to obtain series of morphospecies for quantification of variability and species boundaries. Likewise, phenological, life history, and habitat data are critically needed to address the taxonomic status and geographic distribution of this genus throughout eastern Texas and the region.
3) **Family Saldidae: Genus *Pentacora* and others**. Taxonomic resolution of Saldidae (shore bugs) in the southern United States is currently unresolved due primarily to: a) lack of sufficient taxonomic keys for identification; and b) adequate representation of individuals and associated habitat/collection data. The saldid fauna of BITH and adjacent areas is undoubtedly highly diverse, but further collecting is needed as well as comparison and study of museum preserved material, for positive identifications.
4) **Family Veliidae: Genus *Microvelia***. *Microvelia* are very small insects (0.9 - 5.0mm) that inhabit the water surface in a variety of aquatic habitats. Species diversity in the southern United States is quite high (see species list and totals for this ATBI water

bug survey, as an example) and the lack of a modern revision and adequate taxonomic keys currently impedes identification of some highly variable species. Special effort was made during this ATBI survey to collect numerous individuals of *Microvelia* from a given habitat, as well as to focus on the abundance and presence of collections in particular microhabitats throughout BITH. Numerous factors currently contribute to confusion in recognition of variability among species of this genus - including high abundance and multi-species assemblages, winged- and non-winged conspecific morphs, seasonal abundance, and life history and voltinism (number of generations/year). Further collections from BITH are needed to supplement those from this survey. In the interim, museum material and ongoing revisionary study material will aid in positive identification of the BITH *Microvelia* fauna.

Conclusion and Future Research

At least one additional trip is planned by the PI to survey and further photo-document all previously visited localities. This trip is planned for Fall 2012 and will include PhD student Gretchen Wilbrandt, and undergraduate NSF-REU (Research Experience for Undergraduates) student Jamee Snyder, from the PI's lab. The students research in water bug systematics, biotic survey, and monitoring will include select water bugs species known to occur in BITH. The trip will also afford the students valuable field experience to supplement their degree programs and training. This additional trip and any subsequent will serve to supplement material for groups listed above in which taxonomic identification is in progress. Moreover, this will allow for collection and study of habitat requirements for the species from this survey that are new to science - the backswimmer genus *Buenoa* and possibly a species of the pygmy backswimmer genus *Neoplea* Esaki and China.

As all identifications and museum study are complete, the results of the water bug ATBI will be assembled as a manuscript for peer review and published as a biotic list for the Preserve. Additionally, species diversity and distributions from this survey will be analyzed with newly assembled broader geographic data sets (water bug distributions throughout the central and southern Plains states) and contribute to efforts in synthesizing historical and modern-day distributions and range changes among aquatic true bugs.

It is hoped that biotic survey results from this ongoing research will serve as a baseline not only documenting the aquatic bug biodiversity in Big Thicket National Preserve, but also to stimulate further research on the incredibly diverse insect fauna and other biota of BITH. Further survey efforts will undoubtedly add water bug species to the checklist, as well as critical information on biology and natural history.

APPENDIX 1. Checklist of aquatic and semiaquatic true bugs (Insecta: Heteroptera) surveyed from Big Thicket National Preserve (NPS) and Roy E. Larsen Sandylands Sanctuary (TNC), 2009-2011. Total specimens (except unidentified immature states) and new Texas state records noted.

Family Belostomatidae: giant water bugs	**Total**	**Texas State Record**
Belostoma lutarium (Stål)	[2]	
Belostoma testaceum (Leidy)	[3]	
Benacus griseus (Say)	[1 nymph]	
Lethocerus uhleri (Montandon)	[1]	
Family Corixidae: water boatmen		
Hesperocorixa brimleyi (Kirkaldy)	[4]	State Record
Hesperocorixa lucida (Abbott)	[1]	
Hesperocorixa nitida (Fieber)	[1]	
Palmacorixa buenoi Abbott	[1]	
Sigara mississippiensis Hungerford	[1]	State Record
Sigara modesta (Abbott)	[23]	
Trichocorixa calva (Say)	[52]	
Trichocorixa kanza Sailer	[32]	
Trichocorixa louisianae Jaczewski	[37]	
Trichocorixa macroceps (Kirkaldy)	[4]	
Trichocorixa minima (Abbott)	[2]	State Record
Trichocorixa sexcincta (Champion)	[6]	
Trichocorixa verticalis verticalis (Fieber)	[3]	
Family Gelastocoridae: toad bugs		
Gelastocoris oculatus oculatus (Fabricius)	[3]	
Family Gerridae: water striders		
Aquarius conformis (Uhler)	[2]	State Record
Gerris argenticollis Parshley	[2]	State Record
Gerris comatus Drake and Hottes	[7]	State Record
Gerris marginatus Say	[5]	
Limnoporus canaliculatus Say	[36]	
Neogerris hesione (Kirkaldy)	[9]	
Rheumatobates palosi Blatchley	[3]	
Rhematobates tenuipes Meinert	[1]	
Trepobates subnitidus Esaki	[7]	
Family Hebridae: velvet water bugs		
Merragata brunnea Drake	[1]	
Family Hydrometridae: water measurers		
Hydrometra australis Say	[1]	
Hydrometra hungerfordi Torre-Bueno	[3]	State Record
Hydrometra martini Kirkaldy	[7]	
Family Mesoveliidae: water treaders		
Mesovelia amoena Uhler	[2]	
Mesovelia cryptophila Hungerford	[7]	State Record
Mesovelia mulsanti White	[12]	

Family Naucoridae: creeping water bugs

Pelocoris carolinensis Torre-Bueno	[1]	
Pelocoris femoratus (Palisot)	[3]	

Family Nepidae: water scorpions

Curicta scorpio Montandon	[4]	
Ranatra australis Hungerford	[2]	
Ranatra buenoi Hungerford	[4]	

Family Notonectidae: backswimmers

Buenoa scimitra Bare	[4]	
Buenoa sp. A	[8]	
Buenoa sp. B	[2]	
Buenoa n. sp. 1	[9]	*State Record
Buenoa n. sp. 2	[2]	*State Record
Notonecta indica Linnaeus	[1]	
Notonecta irrorata Uhler	[11]	State Record
Notonecta raleighi Torre-Bueno	[1]	State Record
Notonecta uhleri Kirkaldy	[8]	State Record

Family Pleidae: pygmy backswimmers

Neoplea apopkana (Drake and Chapman)	[9]	State Record
Neoplea notana (Drake and Chapman)	[5]	State Record
Neoplea striola (Fieber)	[5]	

Family Saldidae: shore bugs

Pentacora sp. A	[11]	
Pentacora sp. B	[5]	
Pentacora sp. C	[1]	

Family Veliidae: small water striders (339 total individuals of *Microvelia*)

Microvelia albonotata Champion	[*]	
Microvelia americana (Uhler)	[*]	
Microvelia buenoi Drake	[*]	State Record
Microvelia hinei Drake	[*]	
Microvelia paludicola Champion	[*]	
Microvelia pulchella Westwood	[*]	
Microvelia torquata Champion	[*]	
Platyvelia brachialis (Stål)	[1]	
Rhagovelia rivale Torre-Bueno	[8]	
Steinovelia stagnalis (Burmeister)	[2]	