



University of Illinois
Institute of Natural Resource Sustainability
William Shilts, Executive Director

ILLINOIS NATURAL HISTORY SURVEY

Brian D. Anderson, Director
1816 South Oak Street
Champaign, IL 61820
217-333-6830

INVENTORY OF AQUATIC TRUE BUGS (INSECTA: HETEROPTERA: NEPOMORPHA,
GERROMORPHA, LEPTOPODOMORPHA) OF THE GREAT SMOKY MOUNTAINS
NATIONAL PARK, NORTH CAROLINA AND TENNESSEE, USA

Paul P. Tinerella

Prepared for: DISCOVER LIFE IN AMERICA, INC.

Grant / Project Number: DLIA2008-15



ILLINOIS
NATURAL
HISTORY
SURVEY

INHS Technical Report 2009 (22)
Date of issue: 14 August 2009

COVER PAGE FOR FINAL REPORT TO DISCOVER LIFE IN AMERICA, INC.
(Submit electronically with text of Final Report to jmorse@clemson.edu)

PROPOSAL #	DLIA2008-15
STARTING date:	1 April 2008
ENDING date:	1 March 2009
PRINCIPAL INVESTIGATOR (PI):	Dr. Paul P. Tinerella
PI DEPARTMENT:	Illinois Natural History Survey
PI ORGANIZATION:	University of Illinois
POSTAL ADDRESS:	1816 S Oak Street Champaign, IL 61820
PI ELECTRONIC MAIL:	ptinerll@illiois.edu
PI TELEPHONE:	217-244-2149
PI FAX:	217-333-4949

TITLE of Project: **INVENTORY OF AQUATIC TRUE BUGS
(INSECTA: HETEROPTERA: NEPOMORPHA,
GERROMORPHA, LEPTOPODOMORPHA) OF THE
GREAT SMOKY MOUNTAINS NATIONAL PARK,
NORTH CAROLINA AND TENNESSEE, USA**

GRANT AMOUNT: \$4946.00

SUMMARY of Activities and Results (200 words; Lay Language):

Research was conducted to document water bug (Insecta: Heteroptera: Nepomorpha, Gerromorpha, Leptopodomorpha) diversity of the Great Smoky Mountains National Park (GSMNP). Prior to this research, no water bug survey existed for GSMNP, with 13 total species historically recorded from the Park. One collecting trip of seven days (2-8 August 2008) was conducted in GSMNP, wherein 42 localities (lentic and lotic habitats) were sampled throughout the Park. Standard triangular dipnets were used for sampling, along with additional specialized methods for semiaquatic taxa. These taxa included toad bugs, riffle bugs, and shore bugs, where aspirators and aerial nets were utilized. The survey effort resulted in collection of 1,049 specimens, comprising 11 families, 23 genera, and 42 species of aquatic and semiaquatic true bugs. Of this total, 29 species are newly recorded for the GSMNP, with which 14 species are newly recorded for Tennessee and two species newly recorded for North Carolina. One possibly undescribed species (Corixidae) was also collected. Literature records indicate approximately 60 species of water bugs possible for Tennessee and North Carolina. As such, further survey efforts and specialized collecting will likely produce additional species records for GSMNP, particularly with the water boatmen (Corixidae), backswimmers (Notonectidae), and water striders (Gerridae).

DATA SUBMITTED to database manager Michael Kunze <michael_kunze@nps.gov> on 14-VIII-2008 (date) in MS Excel (format).

PRODUCTS PROMISED in Original Proposal and Their Current Status

1. Product: Process all available backlog specimens of GRSM water bugs from previous GRSM ATBI surveys

Current Status: To date, all available residue water bug specimens from other GRSM researchers have been processed, including taxonomic identifications. This includes specimens from Chuck Parker, Adriean Mayor, Mark Wetzel, and Becky Nichols. These specimens along with voucher specimens of material collected by PI Tinerella, will be deposited in the GSMNP Insect Collection.

2. Product: Process, identify, and curate all material from PI Tinerella's survey of GSMNP water bugs (2008)

Current Status: A total of 1,049 specimens of aquatic and semiaquatic Heteroptera are prepared, taxonomically identified, and curated for deposition into the GRSM insect collection and the INHS entomology collections. This material constitutes 11 families, 23 genera, and 49 species of water bugs for GSMNP.

3. Product: Relevant scientific publications will be prepared and submitted in a timely manner

Current Status: Presently, two manuscripts detailing survey and inventory findings from the water bug survey in GSMNP are prepared and will be submitted following submittal of this final report to DLIA. Both manuscripts will be submitted to peer-reviewed journals and upon publication, reprints will be forwarded to DLIA and GSMNP.

ADDITIONAL RESOURCES garnered to support this research

Total leveraged funds: **\$5515.00** Total value of in-kind resources donated: **\$5515.00**

Leveraged source #1 Salary- Tinerella: 10 field days **\$1703.00**

Leveraged source #2 Fringe Benefits: Tinerella: 35.61% of salary **\$606.00**

Leveraged source #3 Facilities and Administration Costs
(Tinerella: Salary + Fringe Benefits = \$2309.00) x 44.2% **\$1020.00**

Leveraged source #4 Unrecovered Facilities and Administration Costs
(44.2% of \$4,946.00) **\$2,186.00**

Report text

INTRODUCTION

Results are presented of research conducted to document water bug (Insecta: Heteroptera: Nepomorpha, Gerromorpha, Leptopodomorpha) diversity of the Great Smoky Mountains National Park (GSMNP). Prior to this research, no water bug survey existed for GSMNP, with 13 total species historically recorded from the Park. At present, approximately 409 species of aquatic true bugs are known from North America, representing 16 families and 69 genera (Henry and Froeschner 1988). Literature records indicate approximately 60 species of water bugs possible for Tennessee and North Carolina. Based on additional literature data of habitat requirements, life histories, and ecology, several additional water bug (Heteroptera) species are likely to be found within the boundaries of GSMNP.

MATERIALS AND METHODS

One collecting trip of seven days (2-8 August 2008) was conducted in GSMNP, wherein 42 localities (lentic and lotic habitats) were sampled throughout the Park (Appendix 1). Global positioning coordinates (UTM grid NAD83 datum) were collected at the time of sampling and accompany all individual specimens. Standard triangular dip nets were used for sampling in all areas, along with additional specialized collecting methods for semiaquatic taxa. These taxa included toad bugs (Gelastocoridae), riffle bugs (Veliidae), and shore bugs (Saldidae), where aspirators and aerial nets were utilized.

All samples were sorted in the field, preserved in 95% ethanol, and stored on ice until depositing into a -20°C freezer. Upon examination for taxonomic identification (all determinations made by PI Tinerella), voucher specimens of each species were retained in 95% ethanol, labeled with GSMNP coden labels, and stored in the INHS Entomology frozen tissue collection. All additional material was identified to the lowest taxonomic level possible, dried, and pinned or pointed appropriately. A voucher collection of all species from this research will be deposited in the GSMNP insect collection with the remainder of specimens deposited into the Illinois Natural History Survey entomology collections (INHS). All specimens bear GSMNP coden labels and are retrievable through the INHS Entomology Collections database. A data file of all locality, collection, and taxonomic information is submitted electronically with this final report.

RESULTS

The survey effort resulted in collection of 1,049 specimens, comprising 11 families, 23 genera, and 42 species of aquatic and semiaquatic true bugs. A checklist of water bug species is presented in Table 1, with complete collection data detailed in the electronically attached MS Excel data file. Of this total, 29 species are newly recorded for GSMNP, with which 14 species are newly recorded for Tennessee and two species newly recorded for North Carolina.

Specimens collected previous to this research and backlog aquatic true bug material were provided to the PI by Becky Nichols and Adriean Mayor (GSMNP) and Chuck Parker (USGS). To date, this backlog material has been taxonomically

Table 1. Checklist of aquatic true bugs (Heteroptera: Nepomorpha, Gerromorpha, Leptopodomorpha) collected from August 2008 survey in Great Smoky Mountains National Park.

Belostomatidae (giant water bugs)	Mesoveliidae (water treaders)
<i>Belostoma flumineum</i> Say	<i>Mesovelia amoena</i> Uhler
<i>Belostoma testaceum</i> (Leidy)	<i>Mesovelia mulsanti</i> White
Corixidae (water boatmen)	Nepidae (water scorpions)
<i>Hesperocorixa interrupta</i> (Say)	<i>Ranatra australis</i> Hungerford
<i>Sigara virginiensis</i> Hungerford	<i>Ranatra fusca</i> Palisot
<i>Trichocorixa calva</i> Say	<i>Ranatra kirkaldyi</i> Torre-Bueno
	<i>Ranatra nigra</i> Herrich-Schaeffer
Gelastocoridae (toad bugs)	Notonectidae (backswimmers)
<i>Gelastocoris oculus</i>	<i>Buenoa confusa</i> Truxal
<i>oculatus</i> (Fabricius)	<i>Buenoa margaritacea</i> Torre-Bueno
Gerridae (water striders)	<i>Notonecta irrorata</i> Uhler
<i>Aquarius conformis</i> (Uhler)	Saldidae (shore bugs)
<i>Aquarius nebularis</i> Drake & Hottes	<i>Micracanthia cf pumpila</i>
<i>Aquarius remigis</i> complex	<i>Micracanthia</i> species
<i>Gerris buenoi</i> Kirkaldy	<i>Pentacora</i> species
<i>Gerris comatus</i> Drake & Hottes	<i>Saldula</i> species
<i>Gerris insperatus</i> Drake & Hottes	<i>Salda</i> species
<i>Limnopus canaliculatus</i> (Say)	
<i>Metrobates hesperius</i> Uhler	Veliidae (broad-shouldered water striders)
<i>Rheumatobates</i> species	<i>Microvelia americana</i> (Uhler)
<i>Rheumatobates trulliger</i> Bergroth	<i>Microvelia austrina</i> Torre-Bueno
<i>Trepobates pictus</i> (Herrich-Schaeffer)	<i>Microvelia buenoi</i> Drake
<i>Trepobates subnitidus</i> Esaki	<i>Microvelia hinei</i> Drake
	<i>Microvelia paludicola</i> Champion
Hebridae (velvet water bugs)	<i>Microvelia pulchella</i> Westwood
<i>Hebrus</i> species	<i>Microvelia</i> species
Hydrometridae (water measurers)	<i>Rhagovelia obesa</i> Uhler
<i>Hydrometra australis</i> Say	<i>Rhagovelia oriander</i> Parshley
<i>Hydrometra martini</i> Kirkaldy	<i>Rhagovelia</i> species
	<i>Steinovelina stagnalis</i> (Burmeister)

determined and represents six additional species from GSMNP. One possible undescribed species (Corixidae: *Trichocorixa* sp.) has been identified from backlog material provided to the PI by GSMNP Curator Adriean Mayor. Additional specimens of this taxon are needed to further assess morphological variation and comparison with congeners.

Research results detailed in this report, as well as recorded natural history and ecological observational data will form the content for two peer-reviewed publications. The first will detail a checklist and new state records for aquatic true bugs of GSMNP. The second is a manuscript on habitat occurrence and ecological data for select species. At the time of this writing, both manuscripts are in preparation.

CONCLUSIONS

Further survey efforts and specialized collecting will likely produce additional aquatic true bug species records for GSMNP, particularly with the water boatmen (Corixidae), backswimmers (Notonectidae), and water striders (Gerridae). Most taxa collected during this survey were expected to be present due to literature records and published natural history information. The aforementioned groups, especially Corixidae are undoubtedly underrepresented from these survey results. During this research, three species of Corixidae were collected, though at least 15 species were expected. Likewise with the backswimmers (Notonectidae), three species of an expected 11 were collected. In addition, families such as the velvety shore bugs (Ochteridae) and pygmy backswimmers (Pleidae) were not collected during this research, attributed likely to the season and the single survey collection event.

Future survey efforts on aquatic true bugs should focus on different seasons, especially Spring, Summer, and Winter events. Additionally, seasonally focused light trapping (mercury vapor and black light) will undoubtedly prove effective for addition of unrecorded water bug species for GSMNP.

APPENDIX 1. Site Names, UTM position, and locality data for all collections:
aquatic true bugs 2-8 August 2008, P. P. Tinerella DLIA2008-15

Grid	UTM	GRSM: Water Bugs (Insecta: Heteroptera): UTM Coordinates all sites				
Datum	NAD83	2-8 VIII-2008	Paul P. Tinerella			
Site Name	Position	Altitude	Date	State	County	Locality
PPT08-081	17 S 312138 3940032	4820 ft	8/2/08	NC	Haywood	Great Smoky Mountains Nat. Park: Appalachian Highlands Learning Research Center; Purchase Knob FRS;
PPT08-082	17 S 312168 3938938	4352 ft	8/2/08	NC	Haywood	Great Smoky Mountains Nat. Park: North Purchase Tributary to Hemphill Creek;
PPT08-083	17 S 290764 3936487	2108 ft	8/2/08	NC	Swain	Great Smoky Mountains Nat. Park: sewage lagoon; nr Smokemont Riding Stable;
PPT08-084	17 S 291369 3935820	2218 ft	8/2/08	NC	Swain	Great Smoky Mountains Nat. Park: Stream Pool in Oconaluftee River;
PPT08-085	17 S 288431 3938542	2416 ft	8/2/08	NC	Swain	Great Smoky Mountains Nat. Park: Oconaluftee River & Collins Creek;
PPT08-086	17 S 289288 3937650	2328 ft	8/2/08	NC	Swain	Great Smoky Mountains Nat. Park: beaver pond adjacent to Oconaluftee River;
PPT08-087	17 S 312226 3939556	4626 ft	8/3/08	NC	Swain	Great Smoky Mountains Nat. Park: spring & pumphouse nr Ferguson Cabin;
PPT08-088	17 S 312237 3939523	4616 ft	8/3/08	NC	Swain	Great Smoky Mountains Nat. Park: spring/flowing stream below Ferguson Cabin;
PPT08-089	17 S 303349 3935085	4641 ft	8/3/08	NC	Swain	Great Smoky Mountains Nat. Park: Blue Ridge Parkway; spring run, Balsam Knob; small seep;
PPT08-090	17 S 302953 3938852		8/3/08	NC	Swain	Great Smoky Mountains Nat. Park: Bunches Creek, standing pool;
PPT08-091	17 S 279142 3944734	4089 ft	8/3/08	TN	Sevier	Great Smoky Mountains Nat. Park: tributary of Coles Creek;
PPT08-092	17 S 279133 3944763	4121 ft	8/3/08	TN	Sevier	Great Smoky Mountains Nat. Park: Coles Creek;
PPT08-093	17 S 270593 3952238	1488 ft	8/3/08	TN	Sevier	Great Smoky Mountains Nat. Park: west prong Pigeon River, @ park hdqtrs.;
PPT08-094	17 S 270138 3952193	1510 ft	8/4/08	TN	Sevier	Great Smoky Mountains Nat. Park: spring on Fighting Creek trail;
PPT08-095	17 S 259633 3951250	1666 ft	8/4/08	TN	Sevier	Great Smoky Mountains Nat. Park: Little River, off Little River road;
PPT08-096	17 S 244803 3943877	1782 ft	8/4/08	TN	Blount	Great Smoky Mountains Nat. Park: Cades Cove: Methodist Church Pond;
PPT08-097	17 S 248625 3943164	1952 ft	8/4/08	TN	Blount	Great Smoky Mountains Nat. Park: Cades Cove Cmpgrnd (spot C-62); Fluorescent lantern/white light;
PPT08-098	17 S 247884 3943723	1858 ft	8/5/08	TN	Blount	Great Smoky Mountains Nat. Park: Cades Cove: stream adjacent to sewage pond;
PPT08-099	17 S 244812 3943887	1816 ft	8/5/08	TN	Blount	Great Smoky Mountains Nat. Park: Cades Cove: Methodist Church Pond;
PPT08-100	17 S 242956 3942739	1716 ft	8/5/08	TN	Blount	Great Smoky Mountains Nat. Park: Cades Cove: Abrams Creek oxbow, nr. cemetery;
PPT08-101	17 S 242255 3942564	1732 ft	8/5/08	TN	Blount	Great Smoky Mountains Nat. Park: Cades Cove- Abrams Creek, from shallows;
PPT08-102	17 S 242286 3942485	1730 ft	8/5/08	TN	Blount	Great Smoky Mountains Nat. Park: Cades Cove: Big Limestone Springs;
PPT08-103	17 S 247133 3942529	1875 ft	8/5/08	TN	Blount	Great Smoky Mountains Nat. Park: Cades Cove: small stream adjacent to Gorley Pond;
PPT08-104	17 S 253488 3947065	1515 ft	8/5/08	TN	Blount	Great Smoky Mountains Nat. Park: Cades Cove: bridge @ Laurel Creek;
PPT08-105	17 S 234247 3944756	865 ft	8/6/08	TN	Blount	Great Smoky Mountains Nat. Park: Abrams Creek Campgrnd; fluorescent lantern/white light;
PPT08-106	17 S 234125 3944581	1132 ft	8/6/08	TN	Blount	Great Smoky Mountains Nat. Park: Abrams Creek Campgrnd; downstream Abrams Creek;
PPT08-107	16 S 771205 3939396	947 ft	8/6/08	TN	Blount	Great Smoky Mountains Nat. Park: Chilogatee Branch of Chilhowee Lake;
PPT08-108	16 S 771425 3939527	987 ft	8/6/08	TN	Blount	Great Smoky Mountains Nat. Park : Chilogatee Branch;
PPT08-109	17 S 256266 3947618	1376 ft	8/6/08	TN	Blount	Great Smoky Mountains Nat. Park: Tremont Sewage Lagoon;
PPT08-110	17 S 256374 3947618	1381 ft	8/6/08	TN	Blount	Great Smoky Mountains Nat. Park: Middle Prong of Little River, downstream of Tremont;
PPT08-111	17 S 273585 3952090	1963 ft	8/7/08	TN	Sevier	Great Smoky Mountains Nat. Park: spring at Twin Creeks Station;
PPT08-112	17 S 273593 3952109	1950 ft	8/7/08	TN	Sevier	Great Smoky Mountains Nat. Park: Twin Creeks Station: LeConte Creek, behind building;
PPT08-113	17 S 275388 3954773	1831 ft	8/7/08	TN	Sevier	Great Smoky Mountains Nat. Park; Land of a Thousand Seeps; from rock faces;
PPT08-114	17 S 291062 3960045	1807 ft	8/7/08	TN	Sevier	Great Smoky Mountains Nat. Park: Texas Creek, HWY 321 @ park bndry;
PPT08-115	17 S 299542 3962175	1689 ft	8/7/08	TN	Cocke	Great Smoky Mountains Nat. Park: Cosby Creek on Cosby Park road & HWY 32;
PPT08-116	17 S 312175 3940002	4935 ft	8/8/08	NC	Haywood	Great Smoky Mountains Nat. Park: Appalachian Highlands Learning Research Center; Purchase Knob FRS;
PPT08-117	17 S 312178 3947412	2574 ft	8/8/08	NC	Haywood	Great Smoky Mountains Nat. Park: Fish ponds @ Cataloochee Group Campsite
PPT08-118	17 S 312146 3947308	2582 ft	8/8/08	NC	Haywood	Great Smoky Mountains Nat. Park: stream trib. off Cataloochee Creek; nr. old fish ponds: Cataloochee Valley Grp Campsite
PPT08-119	17 S 312366 3948976	2573 ft	8/8/08	NC	Haywood	Great Smoky Mountains Nat. Park: Cataloochee Creek, nr. USGS flow station; Cataloochee Divide area;
PPT08-120	17 S 312420 3948539		8/8/08	NC	Haywood	Great Smoky Mountains Nat. Park: Cataloochee Road; from spring/seep in rock face;
						All Collected by: P. P. Tinerella & S. J. Taylor