

Survey and Inventory of Gyrinids in Big Thicket Wetlands (Continued Survey)

Principal Investigator:

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Background:

The present proposal outlines a continuing study of gyrinids (Coleoptera: Gyrinidae) from the east Texas Primitive Big Thicket. Collecting efforts for this Taxonomic Working Inventory Group (TWIG) have already led to many exciting discoveries, including: a published research paper on gyrinid behavior, collection of 10 species representing 3 genera (Appendix A), discovery of a potential new species and over 1,200 voucher specimens deposited at the Sam Houston State University Entomology collection (SHSUEC). Other results include 8 species new to the preserve, 7 new county records and 1 new state record. All data has been shared with the Big Thicket National Preserve (BITH).

I propose a continued gyrinid survey of the BITH that focuses on new collection sites, including the Canyon lands Unit and Neches River (Appendix B). Trained Kountze High School students will help intensively collect beetles. Two lectures and four surveys will be conducted. All detailed data will be summarized in an excel sheet and all beetles will be catalogued and deposited at the SHSUEC.

This proposal addresses wetland species identification of gyrinids for baselines in ecosystem analysis.

Justification:

Gyrinids are a diverse family of beetles that can be found worldwide. There are approximately 700 species in 13 genera. Gyrinid adults are expert swimmers and commonly found in very large groups on the surface of water. Smaller genera are often found in groups under over hanging branches and creek banks. Gyrinids offer an embarrassment of riches to the researcher, as they have several aquatic adaptations: (i) highly streamlined and lubricated body, (ii) toxic defense secretion, (iii) anti-predatory aggregating behavior (iv) specialized divided eyes, and (v) the ability to navigate the environment by precisely detecting waves using a Johnston's organ located at the base of the antennae.

Gyrinid research conducted in the BITH (Realzola *et al.* 2007) was cited in a study which provided the first example of self-assembly at the inter-organism level (i.e., the spontaneous formation of organized structures in local or global equilibrium) (Voise *et al.* 2011). Static self-assembly was documented in gyrinid aggregations and had previously only been recorded at lower organizational levels (e.g., the folding of polypeptide chains into proteins and the rod-shaped helical protein coat of the tobacco mosaic virus).

I will work with secondary students in the field using the BITH as an outdoor laboratory. Students will assist in the collecting process. Gyrinids are commonly found in large aggregations that can include thousands of beetles representing several species from multiple genera. A larger collection effort will provide valuable information about the composition of these groups. In addition, I will assess the environment of the gyrinids for invasive water plants, such as Giant Salvinia (*Salvinia molesta*) and Hydrilla (*Hydrilla verticillata*). Invasive species are a significant threat to nearly half of the native US species listed under the federal endangered species act. (Union of Concerned Scientists, 2003).

Participation in the Thicket of Diversity All Taxa Bio-Diversity Inventory (ToD ATBI) is an exciting opportunity to enhance science education while performing service through inventory work. The benefits of

“Hands On” activity based learning over textbooks were documented in an analysis of 57 studies involving 13,000 students in 1,000 classrooms over a 15 year period. (Bredderman, 1982). This analysis provided, “evidence indicating that activity-based science programs substantially improve performance in science process/creativity; modestly increase performance on tests of logic, perception, language development, science content, and mathematics; modestly improve attitude toward science and science class; and have pronounced benefits for disadvantaged students, less or none for advantaged students.” (Bredderman, 1982).

This continued survey will enrich an already strong effort and lead to a more complete understanding of gyrenid diversity, behavior and abundance throughout the BITH.

Total funds requested are \$15,050

Methods:

The procedure to collect, process and the disposition of specimens is as follows: Gyrenids will be collected with dip nets from lotic and lentic aquatic sites. The smaller genera (*Gyretes* and *Gyrinus*) will most likely be found close to the water’s edge, under over hanging branches and banks. The larger genera *Dineutes* are common on open water. All specimens will be preserved in 85-95% ethanol for identification and processing. Specimens will be identified using guides by Wood (1996), Oygur and Wolfe (1991) and Babin and Alarie (2004). Identification will rely on morphological features, including elytra apices and genitalia shape. Representative voucher specimens from all localities will be deposited in collections at the SHSUEC.

GPS (UTM) coordinates will be recorded for each collection site. Observations will on species abundance and behavior will also be recorded. Observations on the presence and abundance of invasive water plants such as Giant Salvinia (*Salvinia molesta*) and Hydrilla (*Hydrilla verticillata*) will also be recorded. .

Guidelines for Collecting GPS data and the Guidelines for Submitting Data will be followed. Data will be shared with TWIG leader, Dr. Jerry Cook, for his review prior to submission to the ToD ATBI. Progress Reports and a Final Report will be filed.

Dates will be coordinated and scheduled with the ToD ATBI, the Park Service and Kountze ISD. I will lead 4 inventories, two as an independent and two as a group leader guiding 25 biology Kountze High School students. Collection sites will include the Canyon lands unit and Neches River.

I will spend a day at the High School providing an overview to 125 students on my research and scientific methodology and how both relate to the ToD ATBI. This lecture will serve as training on gyrenid TWIG work. Students will analyze research and reflect on the value of inventory work. I will share a Science Café on board the Cardinal boat for the public. Data will be disseminated on the ToD website, in a checklist, and through press releases.

Working in cooperation with the Thicket of Diversity Director, the researcher will produce a checklist of inventoried species including common name, synonymy and status. The project will be disseminated in a minimum of 5 newspapers and on e-calendars, in the Big Thicket Association’s newsletter, The Reporter, its website and on the Thicket of Diversity’s Facebook. Press releases and photographs will document student involvement in Service Learning in Inventory and Wetland Ecosystem Analysis, announce events and share results.

Timeline:

Oct. 2014–Nov. 2014- Organize project, update Permit, secure insurance, schedule dates, and begin individual collections by researcher

Oct. 2014-Apr. 2015- Presentation to Kountze High School Science Classes; 2 field trips using KHS honor or environmental science students to inventory

March 2015- Media Release sharing KHS work and upcoming Science Cafe

June 2015- Science Café on Gyrenids on board the Neches River Adventure boat for the public

July- Nov. 2015- Analysis of Data
 Dec. 2015- Submission of Annual Report with data to date (or Final)
 Jan. 2015- Media Release sharing results of research
 Jan. -Apr. 2016- Continued Analysis of Data if necessary
 May 2016- Final Report with submission of all data
 June-Sept. 2016- Input of data

Milestones:

Kountze High School Inventory Experience
 Gyrinid Science Café on board the Cardinal boat
 Submission of data and inclusion in the Thicket of Diversity Taxa Tally

Budget:

Gyrinid TWIG:	\$6500
TWIG Researcher Edward Realzola (Contract worker):	
7 days to collect specimens independently	
1 day of presentations at Kountze High School on Thicket of Diversity project and Gyrinid Beetles (approximately 125 students)	
3 days as leader of small group of Kountze High School students to inventory Gyrinids (approximately 25 students) Two trips will be on board the Cardinal boat.	
1 Science Café on board the Cardinal boat for the public	
*Time needed to identify species is included in the daily rate.	
12 days @ \$475= \$5700	
Travel- 6 trips @ state rate, \$.57 mile; \$500	
Consultation with Dr. Jerry Cook, Sam Houston State University; \$300	
 Intern (Contract worker):	
Assist with data management and on field trips	
500 hours X \$12/ hr	\$6000
 Neches River Adventures- Cardinal Boat	
2 trips @ \$300	\$600
 Kountze ISD	
School Bus Rental, 3 days @ \$450 (Includes driver, Sub for teacher)	\$1350
 3 ads to promote volunteerism and Science Cafe, 3 @ \$200= \$600	\$600
TOTAL	\$15,050

(Inkind- Teacher Salary 8 hrs x \$35/hr x 3days- \$840)

Literature Cited.

Babin, J., and Y. Alarie, 2004. Taxonomic Revision of Genus *Gyretes* Brulle (Coleoptera: Gyrinidae) from America North of Mexico. The Coleopterists Bulletin 58(4): 538-567.

Bredderman, T. 1982. What research says: Activity science- the evidence shows it matters. Science and

Children, 20(1), 39-41. (ERIC Document Reproduction service No. ED 216 870).

Davis, G.E. 1993. Design elements of monitoring programs: The necessary ingredients of success. *Environmental Monitoring and Assessment* 26, 99-105.

Grabber, D. 2002. Scientific values of public parks. *Once Again, Why Public Parks?* 19 (2): 63-66.

Oygur, S. and G.W. Wolfe. 1991. The Classification, Distribution and Phylogeny of North American (North of Mexico) Species of *Gyrinus Müller (Coleoptera: Byrrhinidae)*. *Bulletin of the American Museum of Natural History* 207: 1-97.

Realzola, E., Cook, J. L., Cook, T. J., & Clopton, R. E. (2007). Composition of gyridid aggregations in the east Texas primitive big thicket (Coleoptera: Gyrididae). *The Coleopterists Bulletin*, 61(4), 495-502.

Union of Concerned Scientists. 2003. Invasive Species Texas. Retrieved from https://insects.tamu.edu/fireant/materials/factsheets_pubs/pdf/texas1.pdf

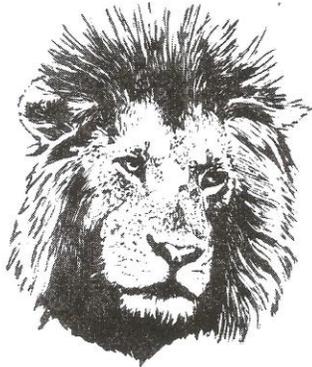
Voise, J., Schindler, M., Casas, J., & Raphaël, E. (2011). Capillary-based static self-assembly in higher organisms. *Journal of The Royal Society Interface*, 8(62), 1357-1366.

Wood, F.E. 1962. A synopsis of the genus *Dineutus (Coleoptera: Gyrididae)* in the Western Hemisphere. Ph.D. thesis, University of Missouri, Columbia MO. 99 pp +8 plates.

Collaborators:

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October 31, 2013

Dear Thicket of Diversity Science Committee,

Kountze ISD is eager to participate in the Survey and Inventory of Gyrinids in Big Thicket Wetlands under the guidance of Edward Realzola. Significant parcels of the Big Thicket National Preserve are located in close proximity to Kountze. These lands can be tapped as an outdoor learning laboratory.

We believe that every student should have the opportunity to learn by discovering. Opportunities for students to learn of actual research being performed in the field and to participate through "Hands-On" activities will strengthen acquisition of skills for KHS students in science while enhancing appreciation of the unique resources in our back yard.

In the spring of 2013 KHS teacher, Mary Catherine Johnston, was the recipient of a scholarship to attend Discover Life in America Conference in Gatlinburg, Tennessee. She attended workshops and learned of many examples where students have been involved in All Taxa Biodiversity Inventory activities at Great Smoky Mountains National Park. She is eager to facilitate replication of these efforts through involvement with the Thicket of Diversity on our campus.

Your support of funding is sincerely appreciated.

Mary Catherine Johnston,
KHS Language Teacher, Project Facilitator

Laurie Overstreet
KHS Biology Teacher

Craig Ruby,
Kountze High School Principal

Reece Briggs,
Kountze ISD Superintendent