TEXAS J. SCI. 49(3) SUPPLEMENT:35-50 AUGUST, 1997

AQUATIC INSECTS OF THE BIG THICKET REGION OF EAST TEXAS

J. C. Abbott, K. W. Stewart and S. R. Moulton, II
Department of Biological Sciences, University of North Texas
Denton, Texas 76203

Abstract.—A survey of the aquatic insect orders Ephemeroptera, Odonata, Plecoptera and Trichoptera from the Big Thicket National Preserve and surrounding region of southeast Texas is presented. This area exhibits a diverse fauna of at least 249 resident species which includes 18 mayflies, 77 dragonflies, 34 damselflies, 18 stoneflies and 102 caddisflies. The dragonfly *Somatochlora margarita* and the caddisfly *Phylocentropus harrisi* are listed by the U.S. Fish and Wildlife Service as "species of concern." Endemicity and new Texas and Big Thicket distribution records are also discussed.

The Big Thicket Primitive Area of Southeast Texas has been referred to as the "Biological Crossroads of North America," (Gunter 1993, Peacock 1994). Although the diversity in this region has never been in question, the definite boundaries of the region itself have been. Ajilvsgi (1994) discussed the history of the geographical boundaries of this area. In this paper, reference to the Big Thicket Primitive Area follows that used by Peacock (1994). It includes an area from Pine Island Bayou south to the Sabine River on the east, north for approximately sixty or so miles, westward along a geological line that passes below Lufkin to about Roan's Prairie, then swings southward in a modified curve to the mixed-grass prairies of east Liberty County (Figure 1). This extensive woodland area is one of the largest of its kind in the southern United States (McLeod 1971). The segment within the area defined as the Big Thicket National Preserve was America's first sanctuary of nature to be declared a national preserve (Peacock 1994). It collectively includes fifteen fragmented units of land and water corridors, designated by the U.S. Congress as federal property protected for the education and enjoyment of the American public.

Although surveys have been conducted for plants and vertebrates in the Big Thicket (Parks et al. 1938; McLeod 1971; Peacock 1994), little is known about the diversity of its insect fauna. The preserve includes ten distinct ecosystems. The National Park Service identifies them as: Baygall, Beech/Magnolia/Loblolly, Cypress Slough, Longleaf Pine Upland, Oak/Gum Floodplain, Palmetto/Hardwood Flats, Pine Savannah Wetlands, River Edge, Roadside and Arid Sandylands (Peacock 1994). Each of these ecosystems is home to many aquatic insects and serves as a western boundary for the distributions of a largely eastern fauna.

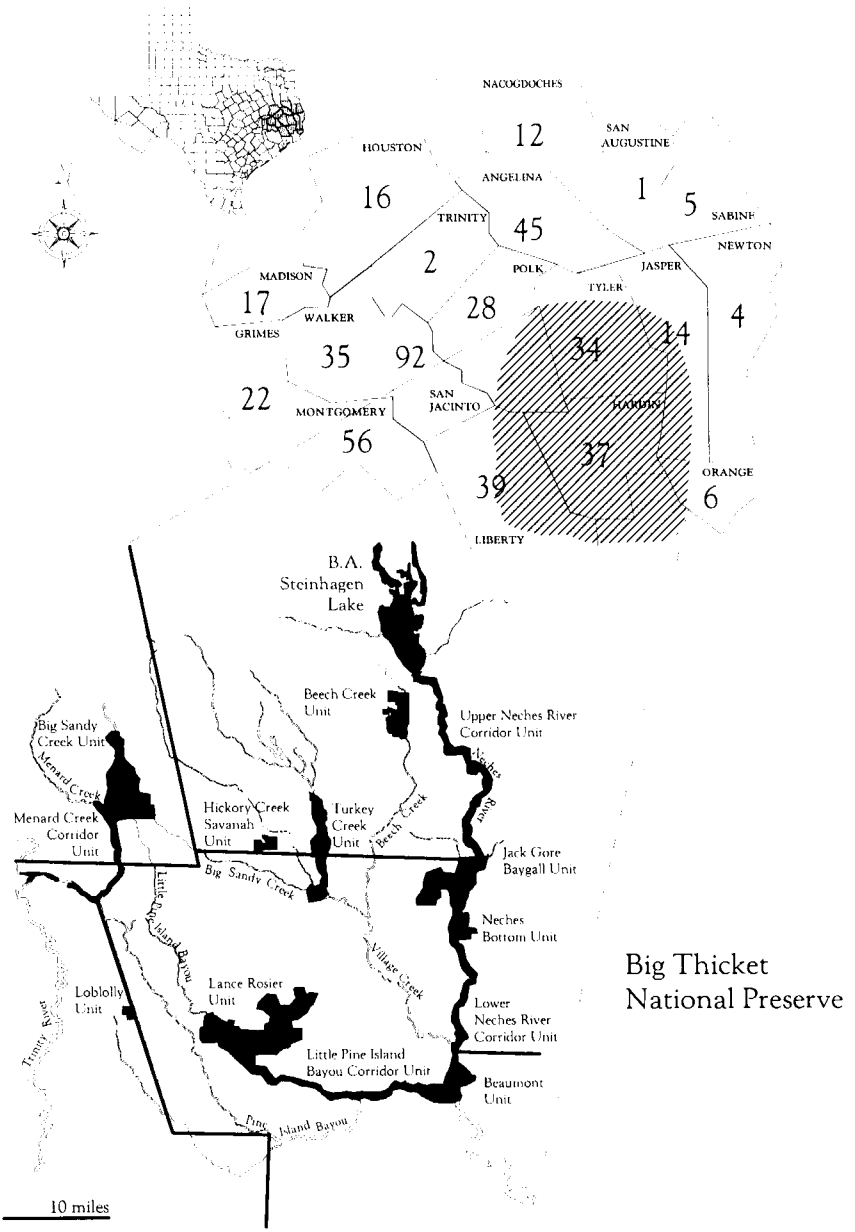

Figure 1. Species richness of Odonata in the Big Thicket Region and National Preserve. Numbers reflect species reported from each county within the region.

The authors have collected and studied aquatic insects in this area over the past 20 years, and intensively sampled its aquatic habitats since

1993, specifically, to assess the biodiversity of Ephemeroptera (mayflies), Odonata (dragonflies & damselflies), Plecoptera (stoneflies) and Trichoptera (caddisflies). These taxa are integral and important components of aquatic ecosystems throughout North America. Previous studies (Szczytko & Stewart 1977; Donnelly 1978; Moulton & Stewart 1997; Baumgardner et al. 1997) of aquatic insect species in Texas have included records from the Big Thicket Primitive Area.

Collection Methods

Ongoing collections of Ephemeroptera, Odonata, Plecoptera and Trichoptera have been made from over 100 sites within the Big Thicket Primitive Area since 1993 (Figure 1). Collections consisted of aquatic and terrestrial sampling from springs, streams and standing bodies of water, primarily of the Neches, Sabine and Trinity River watersheds. Locations having high species diversity were revisited seasonally. Extensive collecting trips, each approximately three days in duration, were made monthly except during the winter months of December through February.

Immature stages were collected with dipnets, sieves and by hand-picking. Specimens were fixed in Kahles solution in the field, and returned to the laboratory where they were rinsed and permanently preserved in 80% ethanol. Adults of many species of Ephemeroptera, Plecoptera and Trichoptera were effectively collected with the portable ultra-violet (UV) light traps described by Moulton & Stewart (1996). As many as eight traps were operated on a single night. Each trap consisted of a portable light, powered by D-cell batteries and outfitted with a long wavelength, 8 watt UV bulb (Sylvania F6T5BL). The UV light was situated over a white enamel tray containing 80% ethanol. Each trap was operated from up to one hour before dusk until two hours after dark. During the spring and fall, when evening air temperatures ranged from 7 to 15°C, the UV traps were operated all night to allow for longer flight periods. Adult Odonata were collected during the day (30 min to 2 hr per site) using special long-handled and standard aerial nets, and placed in glassine envelopes and submerged in 99% acetone for eight to ten hours. Afterwards they were dried and transferred to polyethylene envelopes. Collections were supplemented by use of sweep nets and 6 m malaise traps, equipped with alcohol collecting heads (Debbie Focks Co., Gainesville, Florida). All insect material is deposited in the University of North Texas Aquatic Entomology Collection.

RESULTS AND SPECIES LIST

The Big Thicket Primitive area, with its unique habitats, is home to nearly one-half (249 species) of the 511 species of Ephemeroptera, Odonata, Plecoptera and Trichoptera presently known to occur in Texas. This work has shown that three species in these groups are endemic to the Big Thicket region and several species, especially Trichoptera, are endemic to the entire western Gulf Coastal Plain area; the Big Thicket serves as the western boundary for their distributions.

The following species list follows the nomenclature established in each order as follows: Ephemeroptera (McCafferty 1996), Odonata (Garrison 1991), Plecoptera (Stark et al. 1986; updated 1997 on WWW) and Trichoptera (Moulton & Stewart 1997). Three species of stone-flies previously unreported from the state are noted with an asterisk (*). The dragonfly *Somatochlora margarita* and the caddisfly *Phylocentropus harrisi* are currently listed as "species of concern" by the U.S. Fish and Wildlife Service. This federal listing identifies species "for which information now in the possession of the Service indicates that proposing to list as endangered or threatened is possibly appropriate, but for which persuasive data on biological vulnerability and threat are not currently available to support proposed rules" (USFWS 1996). Numbers in parentheses represent the number of species for each taxa.

ORDER EPHEMEROPTERA (18)

Family Leptophlebiidae (3)

Choroterpes basalis (Banks)
Leptophlebia bradleyi Needham
Paraleptophlebia volitans (McDunnough)

Family Polymitarcidae (1)

Campsurus decoloratus (Hagen)

Family Ephemeridae (1)

Hexagenia limbata (Serville)

Family Caenidae (3)

Caenis amica (Hagen)
Caenis hilaris (Say)
Caenis latipennis (Banks)

Family Ephemerellidae (1)

Eurylophella doris (Traver)

Family Baetidae (2)
Acerpenna pygmaea (Hagen)
Labiobaetis dardanus (McDunnough)

Family Isonychiidae (2)
Isonychia arida (Say)
Isonychia sayi Burks

Family Heptageniidae (5)
Leucrocuta maculipennis (Walsh)
Stenacron interpunctatum (Say)
Stenonema femoratum (Say)
Stenonema mexicanum integrum (Ulmer)
Stenonema modestum (Banks)

Likely to Occur in Big Thicket
Tortopus primus (McDunnough) (Polymitarcidae)
Tortopus puella (Pictet) (Polymitarcidae)

ORDER ODONATA (111)
SUBORDER ZYGOPTERA (34)
Family Calopterygidae (4)
Calopteryx dimidiata Burmeister
Calopteryx maculata (Beauvois)
Hetaerina americana (Fabricius)
Hetaerina titia (Drury)

Family Lestidae (3)
Lestes disjunctus australis Walker
Lestes inaequalis Walsh
Lestes vigilax Hagen

Family Coenagrionidae (27)
Argia apicalis (Say)
Argia bipunctulata (Hagen)
Argia fumipennis violacea (Hagen)
Argia immunda (Hagen)
Argia moesta (Hagen)
Argia nahuana Calvert
Argia sedula (Hagen)
Argia tibialis (Rambur)
Argia translata Hagen in Sélys
Enallagma basidens Calvert
Enallagma civile (Hagen)

Enallagma daeckii (Calvert)
Enallagma divagans Sélys
Enallagma dubium Root
Enallagma exsulans (Hagen)
Enallagma geminatum Kellicott
Enallagma signatum (Hagen)
Enallagma traviatum westfalli Donnelly
Enallagma vesperum Calvert
Ischnura hastata (Say)
Ischnura kellicotti Williamson
Ischnura posita posita (Hagen)
Ischnura prognata (Hagen)
Ischnura ramburii (Sélys)
Nehalennia integricollis Calvert
Telebasis byersi Westfall
Telebasis salva (Hagen)

SUBORDER ANISOPTERA (77)

Family Petaluridae (1)

Tachopteryx thoreyi (Hagen in Sélys)

Family Aeshnidae (7)

Anax junius (Drury)
Anax longipes (Hagen)
Basiaeschna janata (Say)
Boyeria vinosa (Say)
Coryphaeschna ingens (Rambur)
Epiaeschna heros (Fabricius)
Nasiaeschna pentacantha (Rambur)

Family Gomphidae (21)

Aphylla angustifolia Garrison
Aphylla protracta (Hagen *in* Sélys)
Arigomphus lentulus (Needham)
Arigomphus maxwelli (Ferguson)
Arigomphus submedianus (Hagen)
Dromogomphus spinosus Sélys
Dromogomphus spoliatus (Hagen *in* Sélys)
Erpetogomphus designatus Hagen *in* Sélys
Gomphus (Gomphurus) externus Hagen *in* Sélys
Gomphus (Gomphurus) hybridus Williamson
Gomphus (Gomphurus) modestus Needham
Gomphus (Gomphurus) vastus Walsh

Gomphus (Gomphus) apomyius Donnelly
Gomphus (Gomphus) exilis Sélys
Gomphus (Gomphus) lividus Sélys
Gomphus (Gomphus) militaris Hagen *in* Sélys
Gomphus (Gomphus) oklahomensis Pritchard
Hagenius brevistylus Sélys
Progomphus obscurus (Rambur)
Stylurus laurae (Williamson)
Stylurus plagiatus (Sélys)

Family Cordulegastridae (2)
Cordulegaster maculata Sélys
Cordulegaster obliqua obliqua (Say)

Family Corduliidae (10)
Macromiinae (3)
Didymops transversa (Say)
Macromia illinoiensis georgina (Sélys)
Macromia taeniolata Rambur

Corduliinae (7)
Epitheca (Epicordulia) princeps (Hagen)
Epitheca (Tetragoneuria) cynosura (Say)
Epitheca (Tetragoneuria) semiaquea (Burmeister)
Helocordulia selysii (Hagen)
Neurocordulia alabamensis Hodges
Somatochlora linearis (Hagen)
S. margarita Donnelly

Family Libellulidae (36)
Brachymesia gravida (Calvert)
Brachymesia herbida (Gundlach)
Celithemis amanda (Hagen)
Celithemis elisa (Hagen)
Celithemis eponina (Drury)
Celithemis fasciata Kirby
Celithemis ornata (Rambur)
Celithemis verna Pritchard
Dythemis fugax Hagen
Dythemis velox Hagen
Erythemis simplicicollis (Say)
Erythemis vesiculosa (Fabricius)
Erythrodiplax berenice berenice (Drury)
Erythrodiplax minuscula (Rambur)

Erythrodiplax umbrata (Linnaeus)
Libellula auripennis Burmeister
Libellula cyanea Fabricius
Libellula deplanata Rambur
Libellula flavida Rambur
Libellula incesta Hagen
Libellula luctuosa Burmeister
Libellula lydia Drury
Libellula needhami Westfall
Libellula semifasciata Burmeister
Libellula vibrans Fabricius
Miathyria marcella (Sélys)
Orthemis ferruginea (Fabricius)
Pachydiplax longipennis (Burmeister)
Pantala flavescens (Fabricius)
Pantala hymenaea (Say)
Perithemis tenera (Say)
Sympetrum ambiguum (Rambur)
Sympetrum corruptum (Hagen)
Tramea carolina (Linnaeus)
Tramea lacerata Hagen
Tramea onusta Hagen

Likely to Occur in Big Thicket
Enallagma durum (Hagen) (Coenagrionidae)
Aphylla williamsoni (Gloyd) (Gomphidae)
Epitheca (Tetragoneuria) petechialis (Muttkowski) (Corduliidae)
Libellula pulchella Drury (Libellulidae)

ORDER PLECOPTERA (18)

Family Taeniopterygidae (2)
Taeniopteryx burksi Ricker & Ross
Taeniopteryx lonicera Ricker & Ross

Family Nemouridae (1)
Amphinemura texana Baumann

Family Capniidae (1)
Allocapnia malverna Ross

Family Leuctridae (1)
Zealeuctra claasseni (Frison)

Family Perlodidae (4)
Hydroperla crosbyi (Needham & Claassen)
Isoperla coushatta Szczytko & Stewart
Isoperla mohri Frison
Isoperla sagittata Szczytko & Stewart

Family Perlidae (9)
Acroneuria arenosa (Pictet)
Acroneuria evoluta Klapálek
**Acroneuria frisoni* Stark & Brown
**Neoperla catharae* Stark & Baumann
Neoperla clymene (Newman)
Paragnetina fumosa (Banks)
**Perlesta bolukta* Stark
Perlesta decipiens (Walsh)
Perlinella drymo (Newman)

Likely to Occur in Big Thicket
Taeniopteryx maura (Pictet) (Taeniopterygidae)

ORDER TRICHOPTERA (102)
Family Brachycentridae (1)
Brachycentrus numerosus (Say)

Family Glossosomatidae (1)
Protoptila maculata Hagen

Family Helicopsychidae (1)
Helicopsyche borealis (Hagen)

Family Hydropsychidae (12)
Diplectrona modesta Banks
Cheumatopsyche burksi Ross
Cheumatopsyche campyla Ross
Cheumatopsyche passella Ross
Cheumatopsyche pettiti (Banks)
Hydropsyche bidens Ross
Hydropsyche decalda Ross
Hydropsyche mississippiensis Flint
Hydropsyche orris Ross
Hydropsyche rossi Flint, Voshell & Parker
Macrostemum carolina (Banks)
Potamyia flava (Hagen)

Family Hydroptilidae (33)
Hydroptila abbotti Moulton & Harris
Hydroptila ajax Ross
Hydroptila alabama Harris & Kelley
Hydroptila angusta Ross
Hydroptila berneri Ross
Hydroptila hamata Morton
Hydroptila grandiosa Ross
Hydroptila morsei Sykora & Harris
Hydroptila novicola Blickle & Morse
Hydroptila quinola Ross
Hydroptila remita Blickle & Morse
Hydroptila scolops Ross
Hydroptila waubesiana Betten
Mayatrichia ayama Mosely
Neotrichia sp. nr. riegeli Ross
Neotrichia mobilensis Harris
Neotrichia vibrans Ross
Ochrotrichia tarsalis (Hagen)
Orthotrichia aegerfasciella Chambers
Orthotrichia baldufi Kingslover & Ross
Orthotrichia cristata Morton
Orthotrichia curta Kingslover & Ross
Orthotrichia instabilis Denning
Oxyethira elerobi (Blickle)
Oxyethira glasa Ross
Oxyethira janella Denning
Oxyethira lumosa Ross
Oxyethira novasota Ross
Oxyethira pallida (Banks)
Oxyethira roberti Roy & Harper
Oxyethira ulmeri (Mosely)
Oxyethira verna Ross
Oxyethira zeronia Ross

Family Lepidostomatidae (1)
Lepidostoma morsei Weaver

Family Leptoceridae (26)
Ceraclea flava (Banks)
Ceraclea maculata (Banks)
Ceraclea nepha (Ross)
Ceraclea ophioderus (Ross)

Ceraclea protonepha Morse & Ross
Ceraclea tarsipunctata (Vorhies)
Ceraclea transversa (Hagen)
Leptocerus americanus (Banks)
Nectopsyche candida (Hagen)
Nectopsyche exquisita (Walker)
Nectopsyche pavida (Hagen)
Oecetis avara (Banks)
Oecetis cinerascens (Hagen)
Oecetis ditissa Ross
Oecetis georgia Ross
Oecetis inconspicua (Walker)
Oecetis nocturna Ross
Oecetis osteni Milne
Oecetis persimilis (Banks)
Oecetis sphyra Ross
Triaenodes ignitus (Walker)
Triaenodes injustus (Hagen)
Triaenodes ochraceus (Betten & Mosely)
Triaenodes pernus Ross
Triaenodes smithi Ross
Triaenodes tardus Milne

Family Limnephilidae (4)
Ironoquia punctatissima (Walker)
Pycnopsyche anticai (Walker)
Pycnopsyche indiana (Ross)
Pycnopsyche lepida (Hagen)

Family Molannidae (2)
Molanna tryphena Betten
Molanna ulmerina Navás

Family Philopotamidae (5)
Chimarra aterrima Hagen
Chimarra feria Ross
Chimarra moselyi Denning
Chimarra obscura (Walker)
Chimarra parasocia Lago & Harris

Family Phryganeidae (3)
Agrypnia vestita (Walker)
Ptilostomis ocellifera (Walker)
Ptilostomis postica (Walker)

Family Polycentropodidae (11)
Cernotina calcea Ross
Cernotina spicata Ross
Cyrnellus fraternus (Banks)
Neureclipsis crepuscularis (Walker)
Neureclipsis melco Ross
Paranyctiophylax affinis (Banks)
Paranyctiophylax serratus (Lago & Harris)
Phylocentropus harrisi Schuster & Hamilton
Phylocentropus placidus (Banks)
Polycentropus cinereus Hagen
Polycentropus crassicornis Walker

Family Psychomiidae (1)
Lype diversa (Banks)

Family Sericostomatidae (1)
Agarodes libalis Ross & Scott

DISCUSSION

Ephemeroptera.—Eighteen species of mayflies, comprising 20% of the known Texas fauna have been documented from the Big Thicket. Baumgardner et al. (1997) listed six species previously unreported from Texas (Figure 2a). These included *Eurylophella doris*, a broad-ranging eastern North American species that constituted the first report of the family Ephemerellidae in Texas. The Big Thicket presumably represents the western distributional limit of this species. Based on indeterminate subimagos two additional polymitarcids, *Tortopus primus* and *T. puella*, are likely to occur in the Big Thicket.

Odonata.—The 111 species of Odonata occurring in the Big Thicket account for 57% of the total Texas fauna (195 species) and nearly a quarter (22.6%) of the North American fauna. Ninety-two species are recorded from the Big Creek drainage and vicinity in Sam Houston National Forest, San Jacinto County alone (Figure 1). This high species richness is due in part to the extensive collections by Donnelly (1978) in the area. This represents the greatest diversity of odonates in any specific area within the Big Thicket and undoubtedly represents one of the highest levels of diversity in the Odonata anywhere in the U.S.

Two species recently reported from the Big Thicket had previously been undocumented west of the Mississippi River (Figure 2b). *Gomphus exilis* was reported from Texas for the first time by Abbott (1996) based

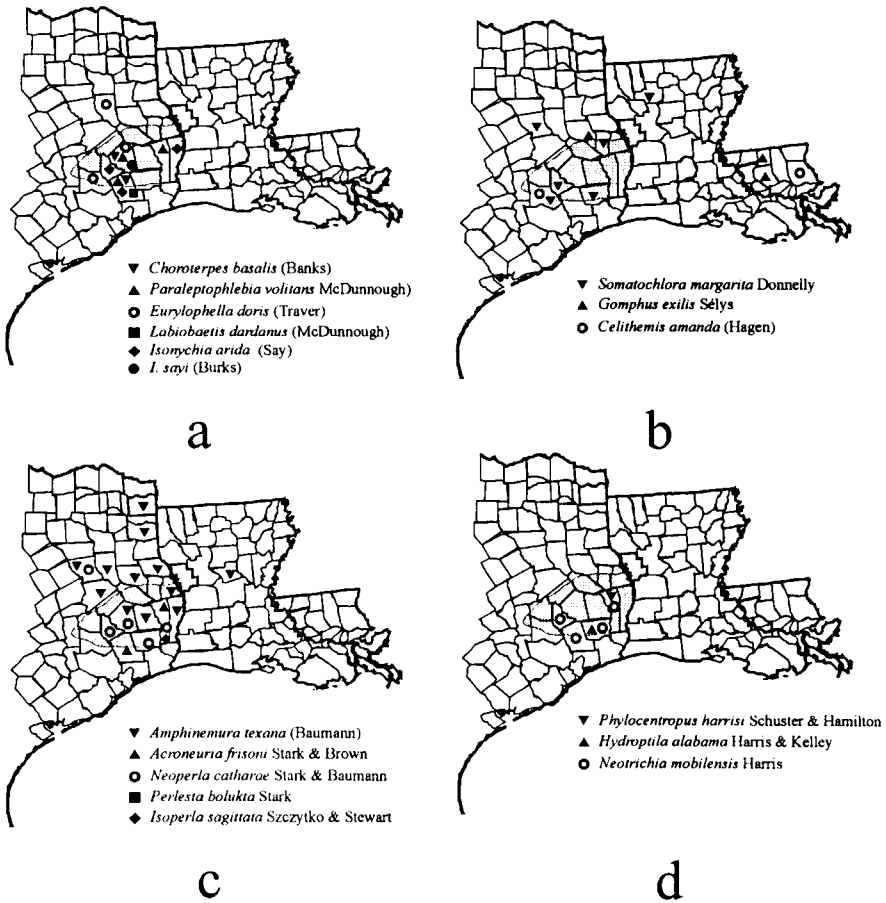

Figure 2. Interesting and unique species of West Gulf Coastal Plain aquatic insects; (a) Ephemeroptera, (b) Odonata, (c) Plecoptera, and (d) Trichoptera. Shaded areas represent Big Thicket Primitive Area (after Peacock 1994).

on a previously unpublished record from Nacogdoches County. Orr (1993) recently reported *Celithemis amanda*, from the Jones State Forest, Montgomery County, collected by Bob Honig.

The Texas or Big Thicket Emerald, *Somatochlora margarita*, is endemic to the Piney Woods of East Texas. This species is presently listed by the U.S. Fish and Wildlife Service as a "species of concern." *Somatochlora margarita* was previously known only from a few counties in Big Thicket (Figure 2b), but the senior author has taken it from as far northwest as Engeling Wildlife Management Area, in Anderson County,

Texas. The nymph of this relatively rare species is undescribed.

The Big Thicket represents the western distributional limit for several other odonate species. These include *Calopteryx dimidiata, Ischnura prognata, Nehalennia integricollis, Telebasis byersi, Tachopteryx thoreyi, Arigomphus maxwelli* and *Helocordulia selysii.* Based on their current range, species such as *Enallagma durum* (Coenagrionidae), *Aphylla williamsoni* and *Gomphus militaris* (Gomphidae), *Epitheca petechialis* (Corduliidae), and *Libellula pulchella* (Libellulidae), all having habitat requirements similar to those found in the Big Thicket (ranging from rivers to soft-bottomed lakes and bayous), may eventually be documented in the region.

Plecoptera.—The currently documented 18 species of Plecoptera occurring in the Big Thicket comprise 58% of the total known Texas stonefly fauna (Szczytko & Stewart 1977). Included are three new state records of species in the family Perlidae: *Neoperla catharae, Perlesta bolukta* and *Acroneuria frisoni* (Figure 2c). The current listing of *A. frisoni* is due to revision of *A. evoluta* by Stark & Brown (1991); previous records in Texas for both of these species were listed only as *A. evoluta.* The three species of *Acroneuria* occurring in the thicket are sympatric and all three were collected in a single night at Hickory Creek in Hardin County (Figure 1). *Perlesta bolukta*, previously known only from Oklahoma and Missouri, was collected at a single locality, Boykin Springs in Jasper county (Figure 2c). *Neoperla catharae* was collected at several locations within the thicket (Figure 2c).

Baumann (1996) described, *Amphinemura texana* from east Texas, based partially on material previously collected by us. He noted that *A. texana* seems to be restricted to the Piney Woods of east Texas and the adjacent area in the Kisatchie National Forest of Louisiana. This species had previously been reported from the state and region by Szczytko & Stewart (1977) as *A. nigritta*, a complex of sibling species included in Baumann's (1996) revision. A second stonefly endemic to the thicket, *Isoperla sagittata*, is rare and known only from Little Cow Creek in Newton County (Figure 2c). Adults have a short emergence period in February, and are therefore seldom collected. Based on its known distribution and habitat preference reported by Fullington & Stewart (1980), *Taeniopteryx maura* should occur in the thicket, but has not yet been encountered there.

Trichoptera.—The diversity of caddisflies in Texas was partially documented by Edwards (1973), who listed only 91 species, mainly

from the Edwards Plateau and limited collection sites in East Texas and the Trans Pecos area. A systematic survey was begun in 1990 by Moulton & Stewart (1997) to more thoroughly document the biodiversity of this important order in the state and specifically for the Big Thicket and surrounding area.

As part of this survey, intensive collections over the past seven years in the Big Thicket Primitive Area have produced 102 caddisfly species that represent over half of the 199 species now known from Texas (Moulton & Stewart 1997). Most of these species, including *Neotrichia mobilensis, Hydroptila alabama* and *Phylocentropus harrisi* (Figure 2d), are endemic to the Gulf Coastal Plain and the Big Thicket area represents their western distributional limit. There are no species endemic to the Big Thicket. *Phylocentropus harrisi* is presently treated by the U.S. Fish and Wildlife Service as a "species of concern."

ACKNOWLEDGMENTS

We are grateful to the National Science Foundation (DEB-9200895, DEB-9347758, DEB-9442550) and the Faculty and Entomological Research Funds of the University of North Texas for providing funding. We also thank J.H. Kennedy for providing identifications and records for many of the mayflies. K.D. Alexander aided in the identification of recent collections of Plecoptera. J.W. Chirhart, K.V. Moore, J.O. Martinez, M.V. Passanante and A. West assisted in the collection of specimens.

LITERATURE CITED

Abbott, J. C. 1996. New and interesting records from Texas and Oklahoma. Argia. 8(4):14-15.

Ajilvsgi, G. 1979. Wildflowers of the Big Thicket, east Texas, and western Louisiana. Texas A&M Univ. Press. College Station, TX 360 pp.

Baumann, R. W. 1996. Three new species of *Amphinemura* (Plecoptera: Nemouridae) from eastern North America. Entomol. News. 107(5):249-254.

Baumgardner, D. E., J. H. Kennedy & B. C. Henry. 1997. New and additional records of Texas mayflies (Insecta: Ephemeroptera). Trans. Amer. Entomol. Soc., 123 (1,2):55-69.

Donnelly, T. W. 1978. Odonata of the Sam Houston National Forest and vicinity, east Texas, United States, 1960-1966. Notul. Odonatol. 1(1):1-16.

Edwards, S. W. 1973. Texas Caddisflies. Tex. J. Sci., 24(4):491-516.

Fullington, K. E. & K. W. Stewart. 1980. Nymphs of the stonefly genus *Taeniopteryx* (Plecoptera: Taenipterygidae) of North America. J. Kans. Entomol. Soc., 53(2):237-259.

Garrison, R. W. 1991. A synonymic list of the new world Odonata. Argia, 3(2):1-30.

Gunter, P. A. Y. 1993. The Big Thicket: an ecological reevaluation. Univ. North Texas Press. Denton, TX. 229 pp.

McCafferty, W. P. 1996. The Ephemeroptera species of North America and index to their complete nomenclature. Trans. Amer. Entomol. Soc., 122(1):1-54.

McLeod, C. A. 1971. The Big Thicket Forest of East Texas. Texas J. Sci. 22(2):221-233.

Moulton II, S. R. & K. W. Stewart. 1996. Caddisflies (Trichoptera) of the Interior Highlands of North America. Mem. Amer. Entomol. Inst. No. 56. 313 pp.

Moulton II, S. R. & K. W. Stewart. 1997. A preliminary checklist of Texas Caddisflies (Trichoptera). Proc. 8th International Symp. Trich. Ohio Biol. Surv., 349-353.

Orr, R. 1993. *Celithemis amanda* from Texas. Argia. 4(4):11.

Parks, H. B., V. L. Cory & others. 1938. Biological Survey of the East Texas Big Thicket Area, 2nd ed. 51 pp.

Peacock, H. 1994. Nature Lover's Guide to the Big Thicket. Texas A&M University Press. College Station, Texas, 170 pp.

Stark, B. P., S. W. Szczytko & R. W. Baumann. 1986. North American stoneflies (Plecoptera): systematics, distribution, and taxonomic references. Great Basin Nat., 46:383-397. (Updated 1997, at http://www/mc.edu/~stark/stonefly.html).

Stark, B. P. & L. D. Brown. 1991. What is *Acroneuria evoluta* Klapálek (Plecoptera: Perlidae)? Aquatic Insects., 13(1):29-32.

Szczytko, S. & K. W. Stewart. 1977. The stoneflies (Plecoptera) of Texas. Trans. Amer. Entomol. Soc., 103(4):327-378.

USFWS, United States Department of Interior. 1996. Endangered and threatened wildlife and plants; review of plant and animal taxa that are candidates for listing as endangered or threatened. Federal Register 61:7596-7613.

JCA at: jabbott@gab.unt.edu