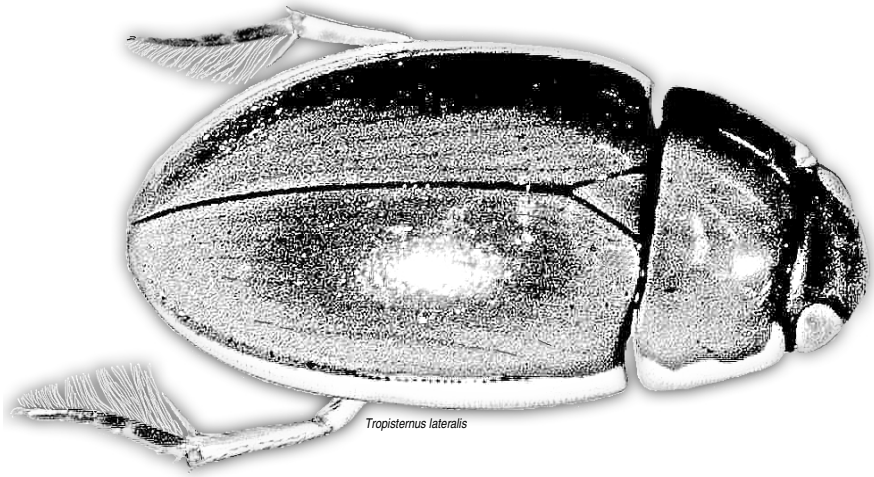
The

AQUATIC

COLEOPTERA

of North Carolina



Tropisternus lateralis

A Biologist's Handbook with

Standard Taxonomic Effort Levels

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Families and genera of true aquatic Coleoptera occurring in North Carolina

Introduction

With 71 genera and over 280 species, North Carolina has a very rich aquatic beetle fauna. Separating this number of beetles from each other can be daunting particularly for biologists as many beetle taxa are very similar to each other. Additionally, important morphological characters can be difficult to observe (e.g. microreticulations, coxal processes, color gradations) due to overall small size of a beetle, species variation, or even the intricacies of simply manipulating a specimen, presenting additional challenges to identification of species. Unlike many other aquatic insects, aquatic Coleoptera typically have multiple life stages occurring below the water surface thereby adding an additional level of complexity to identification.

North Carolina's Division of Water Quality Biological Assessment Unit (BAU) has one of the most rigorous macroinvertebrate sampling protocols in the nation and has over 30 years of long-term data on many North Carolina water bodies. Most large rivers and streams have been sampled extensively over this 30-year period, with many small headwater streams inventoried as well, resulting in over 6600 site records. This has yielded the discovery of several new beetle species from within the state, many of which are endemic to North Carolina. It is our hope that protections to our state's waters will facilitate the discovery of even more species, help associate life stages of existing species, and protect those species which are vulnerable to habitat loss and water degradation.

This document was created to help North Carolina Division of Water Quality biologists as well as biologists in independent labs identify the aquatic beetle taxa present in local North Carolina waters and to stay current on recent taxonomic changes (e.g. synonymies). There are, however, NO keys in this document (although many keys were consulted to generate taxa descriptions). This manual also provides information about beetle distributions within North Carolina's Level III ecoregions (BAU has historically recognized three Level III ecoregions: Mountains, Piedmont, and Coastal Plain) with some mention of taxonomically important Level IV ecoregions as well (Sand Hills, etc.). Maintaining a consistent level of taxonomic resolution is important for rigorous and defensible data sets and reproducible results between laboratories, therefore the suggested level of taxonomic resolution for each genus is noted. In the document's appendix table the tolerance value of each species, when appropriate, is also presented. Comparative material of related species is important to have while identifying aquatic insects; therefore a reference collection is maintained in-house. Notes on the absence or type of reference specimens for many taxa are included in the appendix as a way to update and improve the voucher collection stored at NC DWQ's Environmental Sciences Section laboratory.

How to Use this Manual

The target users of this manual are taxonomic workers in North Carolina and surrounding states. It is therefore assumed that the user has some basic knowledge of aquatic beetles including taxonomy, morphology, and life histories. Users not acquainted with these organisms are advised to familiarize themselves with the first eight chapters of An Introduction to the Aquatic Insects of North America (Merritt *et al*, 2008) which describes, to name a few, sampling techniques, ecology, and morphology of aquatic insects. Also, both the publications Water Beetles of South Carolina (Cielger, 2003) and The Water Beetles of Florida (Epler, 2010) are good references and include habitat descriptions, species descriptions, and species identification keys to adults (Epler, Ciegler) and to larvae (Epler). The following document is not intended as an exhaustive resource of beetles occurring within North Carolina (as lentic systems are not truly covered). Instead, it should be used in conjunction with other literature and be considered more of a quality control document. The user assumes all risk and responsibility in taxonomic determinations made in conjunction with this manual.

The higher order taxa contained herein are presented in phylogenic order based on that of Hansen (1999, Hydrophiloidea) and that followed by White and Roughley (2008). Genera within each family or subfamily are presented in alphabetical order. Along with recent primary literature, valid genus/species names were verified using the Integrated Taxonomic Information System (www.itis.gov) and The Taxinomicon (taxonomicon.taxonomy.nl) websites.

A family diagnosis for larvae and adults is followed by either a subfamily diagnosis (in the case of Dytiscidae) or a genus diagnosis. Each genus has an accompanying diagnosis for both larvae and adults with diagnostic characteristics for each genus *italicized.* The order in which the identification characters are listed typically follows that of the anterior regions to the posterior regions (head to tail) followed by surface features and/or overall body coloration. Distributional and general habitat notes are included with each genus and refer to the genus level only. The suggested level of taxonomic resolution is noted followed by the list of species known to occur in or around North Carolina. If the genus in question is to be identified to species, a list of species characteristic is given (unless only one species is present in North Carolina or it is a monotypic genus) along with known species level distributions and occurrences. A "Notes" section follows with comments on taxonomic difficulties, synonymies, or special status. Finally, a list of literature finishes each genus section with suggested keys denoted by an arrow (⇨). While most literature is on the BAU server, grayed out literature is not currently available. Many of the references are duplicated from genus to genus for convenience.

One final caveat: Typically, as with most published taxonomic descriptions, those presented here are often based on a series of mature specimens as well as available published literature. However, as variation among individuals and between populations is frequent in many insects, not every specimen will fit the appropriate description, particularly those that are damaged, encrusted, or immature (larvae only). Those situations may be times when the specimen in question is best left at genus. Often, ecoregion or seasonality data, in conjunction with the description may be helpful to verify the identity of the taxon. Other times the opinion of another taxonomist is needed. Sometimes it is prudent to simply take your losses and move on to the next specimen.

Additional symbols used with taxonomic epithets in this document are as follows:

( ) = published records for North Carolina but no BAU records, or is undescribed

* = no published records for North Carolina but may eventually be found (recorded from surrounding states)

Species names in grey have been synonymized or combined with other species but are still recognized by BAU.

A list of general taxonomic literature that may also be useful as well as regional checklists follows the taxonomic entries. Finally, an appendix table with list of species (alphabetical on Family then Genus then species), associated distributional and tolerance data, number of DWQ- BAU records, available reference specimens and important notes follows at the end of the manual.

GYRINIDAE

FAMILY DIAGNOSIS: Larvae – legs with 5 segments; tarsi with two claws; lateral gills on abdominal segments 1-9; four terminal hooks on tenth abdominal segment.

Adults – compound eyes separated into dorsal and ventral compound eyes; short clubbed antennae with third segment large and horn-like; forelegs long, middle and hind legs flattened and paddle-like; first abdominal sternite completely divided by metacoxae; males with brush of setae on foretarsi.

GENERA IN NC: *Dineutus, Gyrinus, *Spanglerogyrus*

NOTES: Whirligigs release a defensive oily compound when disturbed. This compound is relatively strong and contains secondary compounds that are distasteful to predators. This is a very gregarious group.

Dineutus

Genus Diagnosis: Larvae – see family diagnosis. *Head semi-circular with distinctly narrowed basal collum*.

Adults – *large, greater than 8 mm*; scutellum concealed; pronotum and elytra smooth and glabrous, with microreticulations; color dark.

Habitat: Lentic and lotic. Surface dwellers.

Distribution and Occurrence: Very common in all ecoregions virtually year round.

Species in NC: LEAVE AT GENUS – *(americanus), (angustus), (assimilis), (carolinus), (ciliatus), (discolor), (emarginatus), (horni), (nigrior), (robertsi), serrulatus*

Notes: Often many species within one aggregation.

Taxonomic references:

larvae and adults:

Sanderson, M. W. 1982. Gyrinidae. pp 10.29-10.38. *In* A.R. Brigham, W. U. Brigham, and A. Gnilka, editors. *Aquatic Insects and Oligochaetes of North and South Carolina*. Midwest Aquatic Enterprises, Mahomet, Illinois. 837pp.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Gyrinus

Genus Diagnosis: Larvae – see family diagnosis. *Head elongate without basal collum*.

Adults – *smaller, 4-7 mm*; scutellum visible; pronotum and elytra glabrous and shiny; elytra striate; color dark with metallic reflections.

Habitat: Lentic and lotic. Surface dwellers.

Distribution and Occurrence: Common in all ecoregions virtually year round.

Species in NC: LEAVE AT GENUS – *(aeneolus), (analis), (aquiris), (bifarius), (elevatus), (gibber), (marginellus), (pachysomus), (pectoralis), (pernitidus), (rockinghamensis), (sayi), (woodruffi)*

Notes: *Gyrinus frosti* was synonymized with *G. gibber* and *G. lugens* was synonymized with *G. sayi* (Oygar and Wolfe, 1991). *Gyrinus rockinghamensis* was first collected from Rockingham, NC, by LeConte.

Taxonomic references:

larvae and adults:

Sanderson, M. W. 1982. Gyrinidae. pp 10.29-10.38. *In* A.R. Brigham, W. U. Brigham, and A. Gnilka, editors. *Aquatic Insects and Oligochaetes of North and South Carolina*. Midwest Aquatic Enterprises, Mahomet, Illinois. 837pp.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Oygur, S. and G. W. Wolfe. 1991. Classification, distribution, and phylogeny of North American species of *Gyrinus* Müller (Coleoptera: Gyrinidae). Bulletin of the American Museum of Natural History. 207: 1-97.

GYRINIDAE

*Spanglerogyrus**

Genus Diagnosis: Larvae – unknown.

Adults – *small, less than 3 mm*; dorsal and ventral compound eyes separated by narrow ridge; scutellum large; pronotum and elytra pubescent laterally; *venter pure white*; middle and hind tarsi as long as broad.

Habitat: This genus may be collected from near or under undercut banks of moderately sized streams with heavy canopy.

Distribution and Occurrence: Rare. Recorded from the Piedmont and Sand Hills of SC and also recorded from TN and Washington DC.

Species in NC: MONOTYPIC – *albiventris**

Notes: Distinctive and weird, this taxon has been reported to hop on the water surface. Beer taxon.

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Folkerts, G. W. 1979. *Spanglerogyrus albiventris*, a primitive new genus and species of Gyrinidae (Coleoptera) from Alabama. The Coleopterists Bulletin. 33(1): 1-8.

HALIPLIDAE

FAMILY DIAGNOSIS: Larvae – short antennae; legs 5-segmented with a single tarsal claw; mandibles with internal groove; at least last instar with dorsal projections on abdominal tergites.

Adults – brightly colored; prosternum margined laterally; tarsi pentamerous; hind coxae expanded as broad, flattened plates that cover at least the first two or three basal abdominal sternites as well as the bases of the hind femora; fore and middle tarsi slightly widened in males.

GENERA IN NC: *Haliplus, Peltodytes*

NOTES: The crawling water beetles enlarged hind coxae are modified to store air as haliplids are poor swimmers.

Haliplus

Genus Diagnosis: Larvae – *forelegs weakly chelate* with fourth segment apically produced and with 2-3 spines; body with short dorsal spines; *tenth abdominal segment long and tapered.*

Adults – small size, 2-4.5 mm; hind coxae cover the first two or three basal abdominal sternites as well as the bases of the hind femora, not margined; *pronotum immaculate or with a single anteromedial blotch*.

Habitat: Occur in dense mats of vegetation and algae in both lotic and lentic waters.

Distribution and Occurrence: A widespread but uncommon taxon overall.

Species in NC: TAKE TO SPECIES – *(annulatus), (confluentus), fasciatus, (leopardus), (mutchleri), (pantherinus), (pseudofasciatus), (punctatus), (triopsis)*

(H. annulatus) – adult 2.0-2.5 mm; pronotum with deep and narrow basal transverse sulcus.

(H. confluentus) – adult 2.7-3.0 mm; pronotum entire without transverse impression; mid-metasternum with longitudinal furrows which contain small punctures.

H. fasciatus – adult 4.0-4.5 mm; pronotum immaculate; hind tibiae with a row of setigerous punctures on inner surface; apex of prosternal ridge subequal to base in width. Found in the Coastal Plain during the winter and early spring.

(H. leopardus) – adult 4.0-4.3 mm; anterior margin of pronotum with dark blotch; hind tibiae with row of punctures on inner surface that bear a long thin seta; middle trochanter with several deep punctures.

(H. mutchleri) – adult 3.0-3.8 mm; overall color rusty reddish brown; anterior margin of pronotum with dark blotch; prosternal ridge uniformly broad; punctuation coarse and deep; elytral maculations markedly confluent in most specimens; hind tibiae smooth, without punctures; male protarsal claws two thirds the length of the last tarsal segment.

(H. pantherinus) – adult 3.5-4.0 mm; overall color brownish yellow; anterior margin of pronotum with dark blotch; prosternal ridge as wide anteriorly as basally but with constriction between forecoxae; punctuation moderate; elytral maculations not markedly confluent in most specimens; hind tibiae smooth, without punctures; carina of metepisternum blackish, much darker than rest of venter.

(H. pseudofasciatus) – adult 3.3-3.5 mm; pronotum immaculate; hind tibiae without row of setigerous punctures on inner surface; apex of prosternal ridge wider than base.

(H. punctatus) – adult 3.8-4.0 mm; overall color rusty reddish brown; anterior margin of pronotum with dark blotch; prosternal ridge broader anteriorly than between forecoxae; punctuation coarse and deep; elytral maculations markedly confluent in most specimens; hind tibiae smooth, without punctures; male foretarsal claws less than half the length of the last tarsal segment. Recorded from the Dismal swamp, VA.

(H. triopsis) – adult 3.5-4.0 mm; overall color brownish yellow; anterior margin of pronotum with dark blotch; prosternal ridge widens gradually from base to anterior margin; punctuation moderate; elytral maculations not markedly confluent in most specimens; hind tibiae smooth, without punctures; carina of metepisternum, at most, only slightly darker than rest of venter.

Notes: *Haliplus* larvae are not separable to species at this time although adults are relatively easy to speciate. Co-occurs with *Peltodytes*.

Taxonomic references:

larvae and adults:

Brigham, W. U. 1982. Aquatic Coleoptera, Chapter 10 (136 pp.). In A.R. Brigham, W. U. Brigham, and A. Gnilka, editors. *Aquatic Insects and Oligochaetes of North and South Carolina.* Midwest Aquatic Enterprises, Mahomet, Illinois. 837pp.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

HALIPLIDAE

Peltodytes

Genus Diagnosis: Larvae – *forelegs strongly chelate* with fourth segment apically produced and with edge of small teeth; each body segment with 1-3 dorsal pairs of long, erect, *segmented and hollow dorsal filaments*; tenth abdominal segment not elongate.

Adults – small size, 3.0-4.0 mm; hind coxae cover the first five abdominal sternites, and margined; *posterior margin of pronotum with two dark blotches*, sometimes joined.

Habitat: Occur in dense mats of vegetation and algae in both lotic and lentic waters.

Distribution and Occurrence: Common in the Piedmont and Coastal Plain, uncommon in the Mountains.

Species in NC: LEAVE AT GENUS – *(bradleyi), (dietrichi), dunavani, duodecimpunctatus, (floridensis), (lengi), muticus, (oppositus), sexmaculatus, shermani*

Notes: *Peltodytes* larvae are not separable to species at this time. As of this time, the BAU is experimenting with identifying *Peltodytes* adults to species, although genus level only for the database. Speciation of adults relies on relatively variable color patterns, although additional characters may solidify the designation. Additionally, confirmation of species requires examination of the male aedeagus, often withdrawn in preserved specimens, although Ciegler (2003) has mostly eliminated the aedeagus as a key character in her key. Most *Peltodytes* species records in the BAU database are after the release of Ciegler (2003). Co-occurs with *Haliplus*.

Taxonomic references:

larvae and adults:

Brigham, W. U. 1982. Aquatic Coleoptera, Chapter 10 (136 pp.). In A.R. Brigham, W. U. Brigham, and A. Gnilka, editors. *Aquatic Insects and Oligochaetes of North and South Carolina.* Midwest Aquatic Enterprises, Mahomet, Illinois. 837pp.

Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

DYTISCIDAE

FAMILY DIAGNOSIS: Larvae – head visible; mandibles long, curved and with groove; legs apparently 5-segmented with two tarsal claws; 8 abdominal segments, last segment with urogomphi (cerci) typically longer than first abdominal segment.

Adults – compound eyes undivided; filiform antennae; maxillary palpi shorter than antennae; first abdominal sternite completely divided by metacoxae; hind tarsi flattened and with natatory setae; hind tarsi with single claw, if two claws then scutellum visible.

SUBFAMILIES & GENERA IN NC:

Copelatinae – *Copelatus*
Agabetinae – *Agabetes*
Laccophilinae – *Laccophilus*
Hydroporinae – *Anodocheilus, Bidessonotus, Celina, Desmopachria, (Heterosternuta), (Hydrocolus), Hydroporus, Hydrovatus, Hygrotus, Laccornis, Liodessus, Lioporeus, Neoporus, Stictotarsus, (Uvarus)*
Colymbetinae – *Agabus, Coptotomus, Hoperius, Ilybius, Matus, Rhantus*
Dytiscinae – *Acilius, Cybister, Dytiscus, (Graphoderus), Hydaticus, Thermonectus*

NOTES: Identification of predacious diving beetle larvae may be more difficult if the specimen in question is not instar III. Many characters within a genus vary from instar to instar. In the following descriptions, the instar is noted if important taxonomic characters in the diagnoses vary from instar to instar.

Subfamily Copelatinae

Subfamily Diagnosis: Larvae – *frontoclypeus without frontal projection*; broad, suboval maxillary stipes; *inner margins of large mandibles serrate*; last antennal segment of two unequal lobes (biramous); *legs without natatory setae*; abdominal segments 7-8 lacking lateral setal fringe; abdominal sternites 1-7 membranous, 8 fully sclerotized.

Adults – size small to moderate, 3.7-7.0 mm; elongate, oval, distinctly flattened dorsoventrally; *well developed transverse carina behind eyes*; pronotum with narrow lateral bead, not reaching apex in some specimens; *scutellum large and visible*; elytra with well developed striae; fore and middle tarsi pentamerous, male tarsomeres 1 and 3 moderately dilated with adhesive scales in four transverse rows on ventral surface; *metacoxal lines arcuate, almost touching posteromedially*; color pale brown to piceous, not black.

Copelatus

Genus Diagnosis: Larvae – see subfamily diagnosis.

Adults – see subfamily diagnosis.

Habitat: In temporary pools or ponds with organic sediments. See species accounts.

Distribution and Occurrence: Primarily collected from Piedmont and Coastal Plain. Uncommon.

Species in NC: TAKE TO SPECIES – *(caelatipennis), (chevrolati), (glyphicus), (punctulatus)*

(C. caelatipennis) – adult 3.9-5.0 mm; elytra with 10 discal striae (not including posterolateral submarginal stria); pronotum with lateral bead ending approximately at base of anterolateral angle; base of elytra lighter than pronotum and elytral disc, male foretibiae with deep ventrobasal emargination (apparent bend). Two subspecies occur, *C. c. princeps*, present in NC, and *C. c. angustatus*, present only in southern FL. A pioneer species of temporary pools. Prefer clear, unpolluted water.

(C. chevrolati) – adult 5.2-6.7 mm; two subspecies, *C. c. chevrolati* has elytra with 9 discal striae (not including posterolateral submarginal stria), the ninth stria short and near suture apically; male protibiae not markedly bent; color more or less uniformly reddish brown with base of elytra usually distinctly lighter than rest of disc; *C. c. renovatus*, has only 8 striae, lacking the short ninth stria. The two subspecies overlap in distribution but only *C. c. chevrolati* occurs in NC with the other subspecies generally occurring west of the Appalachians. A pioneer species of temporary pools.

(C. glyphicus) – adult 4.2-5.0 mm; body broader (L/W=1.9-2.0); pronotum with lateral bead ending at apical tip of anterolateral angle; elytra with 10 discal striae (not including posterolateral submarginal stria); elytra with intervals between striae inconspicuously punctate; male foretibiae with shallow ventrobasal emargination (bend); dorsal surface uniformly reddish brown. Very similar to *C. punctulatus*.

(C. punctulatus) – adult 4.3-5.0 mm; body narrower (L/W=2.00-2.15); pronotum with lateral bead ending at apical tip of anterolateral angle; elytra with 10 discal striae (not including posterolateral submarginal stria); elytra with intervals between striae punctate; male foretibiae with shallow ventrobasal emargination (bend); dorsal surface uniformly reddish brown. Previously considered a synonym of *C. glyphicus* but resurrected by Young (1963). This synonymy was restored by Nilsson (2001), though apparently without explanation.

Notes: Speciation of this genus is relatively straightforward. The BAU is currently not accepting *C. punctulatus* as a junior synonym of *C. glyphicus* until a reference with a suitable explanation for the synonymy is obtained. Interestingly, the larvae of *Copelatus* are the only dytiscids known that actually ingest chewed prey rather than the common dytiscid practice of injecting saliva through channeled mandibles and then withdrawing the liquefied portion of the prey.

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

⇨Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Nilsson, A. N. 2001. World Catalogue of Insects, Volume 3: Dytiscidae (Coleoptera) . Apollo Books. Stenstrup, Denmark . 395pp

Young, F. N. 1963. The nearctic species of *Copelatus* Erichson (Coleoptera: Dytiscidae). Quarterly Journal of the Florida Academy of Sciences 26: 56-77.

Subfamily Agabetinae

Subfamily Diagnosis: Larvae – anterior frontoclypeal margin without projection; elongate coronal suture about one-half length of head; broad maxillary stipes; *mandibles stout at base, slender and pointed apically*; tibiae and tarsi lacking anteroventral natatory setae; *abdominal segment 6 fully sclerotized ventrally* (instar III); abdominal segments 7-8 lacking lateral setal fringe; *short stout cerci* (urogomphi).

Adults – 6.0-7.5 mm; body ovate, broadest in basal half; *eyes emarginate anteriorly*; palpi without apical notch; pronotum apparently unmargined; scutellum visible; *elytra with dense sculpture of very short irregular grooves*; *five segmented fore and middle tarsi*; hind tarsal claws subequal; *last abdominal sternite with 2 subparallel grooves medially*; unicolorous overall.

Agabetes

Genus Diagnosis: Larvae – see subfamily diagnosis.

Adults – see subfamily diagnosis.

Habitat: Deciduous woodland pools and ponds, found in leaf litter.

Distribution and Occurrence: Apparently widespread but rarely collected.

Species in NC: TAKE TO SPECIES – *acuductus*

Notes: *Agabetes acuductus* is the only species known in North America.

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Subfamily Laccophilinae

Subfamily Diagnosis: Larvae – head ovate, gradually narrowing onto collum; *anterior frontoclypeal margin without process, convex with denticles*; frontoclypeus constricted submedially and truncate posteriorly (instar I only); broad maxillary stipes; maxillary palpi four segmented; mandible untoothed; *antenna biramous*, the two lobes unequal; *tibiae and tarsi with natatory setae*; abdominal sternites 1-6 membranous; sternites 7-8 sclerotized; abdominal segments7-8 lacking lateral setal fringe; *urogomphi longer than segment 8, two-segmented, and with primary and secondary setae*.

Adults – small 3.0-6.5 mm; body oval, dorsoventrally depressed; *eyes emarginate*; pronotum unmargined; *scutellum concealed; five segmented fore and middle tarsi*, tarsomeres 1-3 evidently dilated in male but not forming oval plate; prosternal process slender, acute apically and received into triangular mesocoxal cavity; metacoxal lines subparallel anteriorly, diverging posteriorly onto metacoxal lobes, with submedial tooth; metacoxal lobes broadly and shallowly emarginate medially; *hind tibiae with apically notched spines*; metatarsi strongly lobed posteroapically; *single metatarsal claw; some or all sterna with strigae*, sometimes appearing as darkened creases or scratches; color yellowish, with elytral pattern.

Laccophilus

Genus Diagnosis: Larvae – see subfamily diagnosis.

Adults – see subfamily diagnosis; *hind tibiae with apically notched spines*.

Habitat: In lentic conditions and in small streams. Pioneering taxon.

Distribution and Occurrence: Widespread and common.

Species in NC: TAKE TO SPECIES – *fasciatus, (gentilis), (maculosus), (proximus), (schwarzi)*

L. fasciatus – adult 4.3-5.2 mm; male with metacoxal file; elytra with irrorations and irregular transverse dark band across posterior half. *Laccophilus f. rufus* is the subspecies occurring in NC.

(L. gentilis) – adult 3.0-3.7 mm; prosternal process long, receiving groove extended posterior to margin of mesocoxae; lateral margin of sternite 6 with irregular row of setae; elytra without irrorations, with large maculate areas, sometimes banded. *Laccophilus g. gentilis* is the subspecies occurring in NC.

(L. maculosus) – adult 5.0-6.4 mm; male with metacoxal file; all sterna with strigae; elytra with irrorations but with 3-4 large maculations on lateral margin. *Laccophilus m. maculosus* is the subspecies occurring in NC.

(L. proximus) – adult 3.8-4.6 mm; male with metacoxal file; elytra with irrorations but poorly defined maculations on lateral margin or none.

(L. schwarzi) – adult 3.2-4.3 mm; prosternal process short, with mesosternal groove not extended past mesocoxae; metacoxal plate with lateral margin darkened; elytra without irrorations, irregular transverse basal band, often interrupted at suture, also with an apical pale spot and 2 large pale spots submedially.

Notes: Color patterns, though slightly variable, are reliable taxonomic characters for the southeastern species. Only three of the species occurring in NC, *L. fasciatus*, *L. maculosus*, and *L. proximus*, have been described as larvae.

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

Larson, D. J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Subfamily Hydroporinae

Subfamily Diagnosis: Larvae – *frontoclypeus with frontal projection (nasale)*; *apex of mandible distinctly curved upward*; maxillary galea and palpifer absent; abdominal segments 7-8 without lateral fringe of natatory setae; urogomphi two-segmented, variously long.

Adults – small, 1.1-6.8 mm; body shape and color variable; sculpture usually with punctation and often with microreticulate meshes; *eyes emarginate above bases of antennae*; *scutellum largely hidden* (exposed in *Celina*); pronotum with lateral bead; *fore and middle tarsi pseudotetramerous, tarsomeres 1 and 3 dilated, 4 small and partially concealed* (except easily visible in *Celina* and *Bidessonotus*); metatibial spurs acuminate apically; metatarsal claws similar in shape and size in most specimens.

Anodocheilus

Genus Diagnosis: Larvae – *broadly triangular nasale without notches; maxillary palpi 3-segmented; last labial palpomere longer than preceding*; abdominal segments 2-6 membranous ventrally; legs without natatory setae; *2-segmented urogomphi with basal segment shorter than basal segment*, with primary setae only; siphon.

Adults – *very small, 1.5-1.7 mm*; body generally ovate and coarsely punctate; thickened clypeal margin and with two upturned tubercles; *a transverse stria across the posterior occiput behind eyes*; *pronotal plicae converge anteriorly though do not meet*; *each elytron with a strong, longitudinal carina confluent with the basal pronotal plicae*; metatibiae with natatory setae.

Habitat: This taxon appears to be primarily lentic, sandy margins.

Distribution and Occurrence: Rare. A Coastal Plain taxon.

Species in NC: TAKE TO SPECIES – *exiguus*

Notes: *Anodocheilus exiguus* is the only North American species in this genus. The larval diagnosis is based on *A. maculata*. Larvae for *A. exiguus* remain unknown. *Anodecheilus* may be undersampled due to its very small size.

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Young, F. N. 1974. Review of the predaceous water beetles of genus *Anodocheilus* (Coleoptera: Dytiscidae: Hydroporinae). Occasional Papers of the Museun of Zoology, University of Michigan. No. 670: 1-28.

Bidessonotus

Genus Diagnosis: Larvae – unknown, most likely resemble *Liodessus* or *Uvarus*.

Adults – small, 1.7-2.3 mm; body elongate, twice as long as wide, moderately punctate and setose; clypeus at most slightly thickened, without tubercles; *a transverse stria across occiput behind eyes*; *pronotum with basal plicae meeting short plicae at base of elytra*; *fore and middle tarsi pentamerous*, fourth segment small but visible; *hind tibiae slightly arcuate*; metasternum with a pair of medial lines that converge anteromedially between metacoxa and then diverge posteriorly to connect with the subparallel coxal lines.

Habitat: Prefers slow rivers and swamps.

Distribution and Occurrence: Rarely collected. Primarily a Coastal Plain taxon.

Species in NC: LEAVE AT GENUS – *(inconspicuus), (longovalis), (pulicarius)*

Notes: Identification of *Bidessonotus* females is not possible without associated males as the size of the preapical elytral tooth on the outer margin appears to be variable within species (Epler, 2010).

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

⇨Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

DYTISCIDAE

Celina

Genus Diagnosis: Larvae – nasale unnotched; maxillary palpi 4-segmented; abdominal sterna 2-6 unsclerotized; legs without natatory setae; sclerotized, *dorsally recurved tracheal trucks that usually extend past the end of the urogomphi*.

Adults – small, 2.8-6.8 mm; body narrow, elongate, and subparallel; sparsely setose; scutellum large and visible; *elytra with apices produced into short acute spines*; fore and middle tibiae narrow basally and strongly widened apically; *fore and middle tarsi pentamerous*; color reddish brown.

Habitat: Lentic and deeper, slow moving waters with macrophytes. May burrow into sediments.

Distribution and Occurrence: Widespread but rarely collected.

Species in NC: LEAVE AT GENUS – *(angustata), (contiger), (grossula), (hubbelli), (imatatrix), (palustris), (slossoni)*

Notes: Accurate identification of most species requires examination of the male aedeagus. The apical elytral spines are used to pierce the stems or roots of plants to make use of intracellular air when burrowing. Similarly, the tracheal trunks are used by larvae to acquire air while burrowing.

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

⇨Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Young, F. N. 1979. A key to the nearctic species of *Celina* with descriptions of new species (Coleoptera: Dytiscidae). Journal of the Kansas Entomolgical Society 52: 820-830.

Desmopachria

Genus Diagnosis: Larvae – nasale broadly sub-rectangular, without lateral notches; *distinctly separate stemmata in rows*; labial palpi 3-segmented; *fore and middle tarsal claws less than two thirds the length of the tarsi*; legs with natatory setae; abdominal segments 2-8 sclerotized ventrally (instar III); siphon acutely pointed; *urogomphi distinctly longer than segment 8*; body lanceolate overall.

Adults – *very small, 1.1-1.8 mm*; body short, broadly oval; *labial palpi with terminal segment apically bifid*; *basal margin of pronotum sinuate laterally*; posterolateral angle acutely produced; prosternal process apically acute; *epipleuron with diagonal carina*; metatarsal claws unequal.

Habitat: Usually found in vegetation at the edge of pools or swampy areas.

Distribution and Occurrence: Rare. Piedmont and Coastal Plain.

Species in NC: LEAVE AT GENUS – *(convexa), granum, (leechi)*

(D. convexa) – adult 1.5-1.9 mm; body more convex, shiny; metacoxal plates finely punctate; elytra reddish yellow to reddish brown, concolorous, and not distinctly maculate.

D. granum – adult 1.3-1.5 mm; body less convex; metacoxal plates coarsely to imperceptibly punctate; sternite six glabrous and impunctate; yellowish brown, darker along base of pronotal and elytral suture.

(D. leechi) – adult 1.3-1.5 mm; ovate; metacoxal plates coarsely punctate; sternite six coarsely punctate and with pale setae; yellowish brown, darker along base of pronotal and elytral suture.

Notes: Due to their extreme small size and overall similarity, it is difficult to separate *D. granum*from *D. leechi.* This genus may be under sampled due to the large mesh size of sweep nets. BAU reference specimen is of *D. convexa* despite all BAU records being of *D. grana* (an incorrect version of *granum*, see Nilsson 2007).

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

⇨Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Miller, K. B. 2001. Descriptions of new species of *Desmopachria* Babington, 1841 (Coleoptera: Dytiscidae: Hydroporinae: Hyphydrini) with a reassessment of the subgenera and species groups and a synopsis of the species. Coleopterists Bulletin 55: 219-240.

Young, F. N. 1981a. Predaceous water beetles of the genus *Desmopachria*: the *convexa-grana* group (Coleoptera: Dytiscidae). Occasional Papers of the Florida State Collection of Arthropods Vol 2 : 1-11.

Young, F. N. 1981b. Predaceous water beetles of the genus *Desmopachria* Babington: the *leechi-glabricula* group (Coleoptera: Dytiscidae). Pan-Pacific Entomolgist 57: 57-64.

(Heterosternuta)

Genus Diagnosis: Larvae – nasale broadly triangular, with shallow anterolateral notches; *distinctly separate stemmata in rows*; maxillary palpi 3-segmented; legs without natatory setae; abdominal segments 2-6 membranous ventrally; abdominal segment 8 constricted posterior to insertion of urogomphi; urogomphi distinctly longer than segment 8; *first urogomphomere with secondary setae*; siphon blunt, without extended tracheal trunk.

Adults – small, 2.8-3.7 mm; body narrow, elongate, and subparallel medially, somewhat pointed apically; dorsal surface microreticulate and punctate, imperceptibly pubescent; *pronotum with lateral bead widened anteriorly*; male with small scales on ventral surface of protarsomere one; *metacoxal processes produced medially and moderately sinuate*; color variegated, ground color yellow to reddish; pronotum with anterior and posterior longitudinal maculations; elytra with medial and subapical maculae confluent with sutural stripe.

Habitat: Occur at margins of streams or lakes often in interstitial spaces between rocks.

Distribution and Occurrence: Unknown. There are no BAU records of any *Heterosternuta*.

Species in NC: TAKE TO SPECIES – *(alleghenianus), (pulcher), (wickhami)*

(H. alleghenianus) – adult 2.8-3.3 mm; prosternum lacking setae anterior to procoxae; metacoxal plates and sterna one and two coarsely punctate; body margins subparallel anteriorly, strongly depressed dorsoventrally.

(H. pulcher) – adult 3.2-3.7 mm; prosternum lacking setae anterior to procoxae; epipleuron, metacoxal plates and sterna one and two densely but finely punctate; ventral surface mostly yellow; some specimens nearly all black dorsally.

(H. wickhami) – adult 3.2-3.7 mm; male antennomeres 5-8 not dilated; prosternum with dense tufts of thick, erect setae anterior to procoxae; ventral surface black to reddish black. Recorded form Cataloochie Creek in GSMNP.

Notes: Due to the similarity of the dorsal coloration, *Heterosternuta* may be confused with *Lioporeus*. However, *Heterosternuta* is less apically pointed as *Lioporeus*, has an anteriorly widened pronotal lateral bead, and metacoxal plates that are only moderately sinuate (see *Lioporeus* entry). Larson *et al* (2000) indicate that *Heterosternuta* richness is greatest in the Appalachian Mountains. At least four other species, *H. jeanneae*, *H. ohionis*, *H. jenniferae*, and *H. laetus* additionally occur in TN and may eventually be found in the mountainous areas of NC. Server pictures of *Heterosternuta* are labeled as *Lioporeus*.

Taxonomic references:

larvae and adults:

Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Hydrocolus

Genus Diagnosis: Larvae – frontal projection broadly triangular, with shallow, lateral notches; *stemmata absent (instars I, II), or small (instar III)*; maxillary palpi 3-segmented; *antennomere 3 with anteroventral spinule and lateral pore*; abdominal segments 2-6 membranous ventrally; legs without natatory setae; abdominal segment 8 constricted posterior to insertion of urogomphi; urogomphi distinctly longer than segment 8; *urogomphi with primary setae only (seven hairs)*; siphon bluntly rounded, without extended tracheal trunk.

Adults – small, 2.6-4.7 mm; body elongate, oval to subparallel medially and depressed dorsoventrally; dorsal surface conspicuously punctate, setae sparse; males shiny, females duller with microreticulation; pronotum with broad lateral bead; *scutellum mostly concealed with apex visible*; elytra in lateral aspect with lateral margin strongly ascendant towards humeral angle; epipleuron without carina; *protibiae of male sinuate with basoventral emargination and greatly expanded apically*; metacoxal process produced medially and laterally, sinuate; color yellowish to reddish to dark brown dorsally, reddish brown to black ventrally though sometimes with conspicuous reddish lateral spots on sterna 3-6; elytra lighter at lateral margins, sometimes considerably so.

Habitat: Lentic and lotic, among mosses or dense emergent vegetation. Some species are found in seepage areas or in cool waters.

Distribution and Occurrence: Mountians. Rarely collected.

Species in NC: LEAVE AT GENUS – *deflatus*, (filiolus), (oblitus), paugus*, (persimilis), (stagnalis)*

Notes: The genus *Hydrocolus* was described by Larson *et al* (2000) from the *Hydroporus oblitus* group. Larvae of this species can be separated from *Hydroporus* and *Hygrotus* by the lack of or very small stemmata. Correct identification of adults of some species requires examination of the male aedeagus, although *H. deflatus* can normally be identified by its larger size (3.8-4.7 mm) and *H. stagnalis* by its very broad pronotal bead. Ciegler (2001) provides modified couplets for the species key in Larson *et al* (2000). *Hydrocolus deflatus* and *H. paugus* have been recorded from GSMNP.

Taxonomic references:

larvae and adults:

Ciegler, J.C. 2001. *Hydrocolus heggiensis*, a new species from Georgia and South Carolina (Coleoptera: Dytiscidae). Insect Mundi 15(4): 217-219.

Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Hydroporus

Genus Diagnosis: Larvae – frontal projection broadly triangular, with shallow, lateral notches; stemmata present and well defined; *maxillary cardo (small, basal, secondary lobe on maxilla) present*; maxillary palpi 3-segmented; *antennomere 3 with anteroventral spinule and lateral pore*; abdominal segments 2-6 membranous ventrally; legs without natatory setae; abdominal segment 8 constricted posterior to insertion of urogomphi; *urogomphi distinctly longer than segment 8*; *urogomphi with primary setae only (seven hairs)*; siphon bluntly rounded, without extended tracheal trunk.

Adults – small, 2.6-5.3 mm; body elongate, oval; dorsal surface variously punctate, conspicuously setose; pronotum with narrow to moderate lateral bead; elytra in lateral aspect with lateral margin straight to strongly ascendant; both males and females with adhesive vestiture on fore and middle tarsi; *metacoxal process truncate medially or barely produced, laterally produced*; color brown to black dorsally, predominately black ventrally, sometimes with pale spots on lateral margins of sterna; elytra sometimes with pale spots or vittae.

Habitat: Primarily lentic, but also in slow moving waters.

Distribution and Occurrence: Widespread but only commonly encountered in the Piedmont and Coastal Plain.

Species in NC: TAKE TO SPECIES – *(americanus), (brevicornis), niger, (pseudoniger), (rufilabris), (signatus)*

(H. americanus) – adult 3.7-4.0 mm; head and pronotum brownish red (rufous) with elytra darker to blackish; elytra moderately punctate, finely setose; antenna normal, length of antennomeres 4-10 almost two times their width.

(H. brevicornis) – adult 3.2-4.0 mm; head and pronotum brownish elytra blackish; elytra coarsely punctate, finely setose; sparsely pubescent; antenna unusually short, antennomeres 4-10 about as long as wide; male protarsi not distinctly widened.

H. niger – adult 4.4-5.0 mm; form ovate, widest near base of elytra; head brownish red with two infuscations on vertex, sometimes confluent; pronotum blackish, sides of pronotum and elytra obscurely brownish red; elytra finely and densely punctate, setose; black ventrally except laterally; claws of male protarsi moderately dilated and distinctly unequal, anterior claw of protarsi sinuate.

(H. pseudoniger) – adult 4.9-5.3 mm; form ovate, widest near base of elytra; head brownish red; sides of pronotum and elytra obscurely brownish red; black ventrally except laterally; claws of male protarsi subequal, anterior claw of protarsi slightly wider basally and more sinuate; females dull. Formerly *H. ruficeps*, the name was changed by Nilsson and Fery (2006) as *H. ruficeps* was previously occupied.

(H. rufilabris) – adult 4.0-4.7 mm; form ovate, widest near base of elytra; head brownish red; sides of pronotum and elytra obscurely brownish red; black ventrally except laterally; claws of male protarsi subequal, anterior claw of protarsi slightly wider medially and abruptly acuminate; females shiny.

(H. signatus) – adult 3.9-4.2 mm; form oval, widest at middle; head brownish red with two triangular infuscations on vertex; pronotum and elytra blackish with traces of pale spots laterally and elongate pale spot basally; dorsal surface distinctly punctate; claws of male protarsi subequal; very setose dorsally and ventrally. Two subspecies *H. s. signatus* is a boreal species and *H. s. youngi* occurs in the southeastern US.

Notes: Larval *Hydroporus* may be confused with larval *Hygrotus* or *Hydrocolus***.** Color patterns should be used in conjunction with other attributes for accurate species identification, though these species may still be difficult to separate. Ciegler (2003) has all species occurring in NC but the Larson *et al* (2000) and Epler (2010) keys are easier to use and have better figures.

DYTISCIDAE

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

⇨Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Nilsson, A.N. & H. Fery. 2006. World Catalogue of Dytiscidae – corrections and additions, 3 (Coleoptera: Dytiscidae). Koleopterologische Rundschau 76: 55-74.

Hydrovatus

Genus Diagnosis: Larvae – nasale unnotched; labial palpi 3-segmented; legs without natatory setae; legs lacking natatory setae; *abdominal segments 2-6 sclerotized ventrally (instar III)*; siphon acutely pointed; *urogomphi shorter than segment 8, with primary setae only*; *body lanceolate overall*.

Adults – small, 2.2-3.0 mm; body short and broad, subglobose; elytra distinctly punctate, with microsculpture of isodiametric meshes; elytra with apices produced and acuminate; *epipleuron with diagonal carina near base*; prosternal process rounded at apex, as wide as space between procoxae; metacoxae coarsely punctate; *metacoxal processes tripartite with lateral lobes separated from medially emarginate apical lobe by deep emarginations*; dorsal color yellowish brown to reddish brown; ventral surface reddish brown.

Habitat: In lentic or swamp waters.

Distribution and Occurrence: Widespread but relatively rare.

Species in NC: TAKE TO SPECIES – *pustulatus*

H. pustulatus – adult 2.2-3.0 mm; pronotum with ventrobasal, transverse dark band that follows base of elytra; elytra with large dark maculate areas, a wide basal, medial and subapical band often coalesced and obscured, some specimens may be very dark; male antennae not modified. The only species in NC, *H. pustulatus* is also widely distributed within the southeastern US.

Notes: *Hydrovatus pustulatus* has two subspecies *H. p. compressus* and *H. p. pustulatus*, both of which occur in NC. This genus can be confused with *Desmopachria*.

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Hygrotus

Genus Diagnosis: Larvae – nasale broadly triangular, with shallow, lateral notches; stemmata present and well defined; maxillary palpi 3-segmented; *antennomere 3 lacking anteroventral spinule and lateral pore*; abdominal segments 2-6 membranous ventrally; tibiae and tarsi with natatory setae; abdominal segment 8 constricted posterior to insertion of urogomphi; *urogomphi subequal to or longer than segment 8*; *urogomphi with secondary setae*; siphon bluntly rounded, without extended tracheal trunk.

Adults – small, 2.1-4.7 mm; subglobose or elongate-oval; elytra distinctly punctate, regularly or irregularly; pronotal lateral bead moderately wide; *elytra in lateral view strongly ascendant to humeral angle*; *epipleuron with diagonal carina near base*; *fore and middle tarsi tetramerous*; prosternal process pointed at apex; metacoxal processes apically truncate or slightly emarginate each side of middle (appearing slightly sinuate) with lateral lobes covering bases of trochanters.

Habitat: Prefers openly sunny lentic and slow lotic waters, particularly in algal mats.

Distribution and Occurrence: Widespread but rarely collected.

Species in NC: TAKE TO SPECIES – *farctus, (nubilus)*

H. farctus – adult 2.1-2.3 mm; body subglobose; head and pronotum yellowish; elytra dark reddish brown, with scattered large punctures, some coalesced into wormlike grooves, and small punctures in between; ventral surface yellowish to reddish; male with two small spines arising from anterior margin of a marked excavation on sternite 6.

(H. nubilus) – adult 3.8-4.7 mm; body elongate and oval, shiny; dorsal surface yellowish; head may have a small dark transverse band near occipital margin; pronotum with a small medial discal spot, often obscured, and sometimes a V-shaped spot basally; elytra variably vittate, normally one subsutural vitta and one submedial vitta merge with a posterior blotch; elytra with sublateral carina, larger serial punctures and fine, close punctures; metacoxae and sternites coarsely punctate; male without marked excavation on sternite 6; ventral surface black, except yellowish prosternum and mesocoxae. Recorded from Cataloochee Creek in GSMNP.

Notes: *Hygrotus* larvae are variable in some attributes such as the presence of natatory setae or of secondary setae on the urogomphi. For reasons of clarity and to facilitate accuracy in the separation of larval dytiscids, the above genus description for larvae is based solely on the species occurring in NC. Separation of the two adult species can be done simply based on size, with *H. nubilus* much larger than *H. farctus.* The *Hygrotus* subgenus *Coelambus* (which includes *H. nubilus*) was elevated to generic status by Miller et al. (2006). However, widespread recognition of this transfer has not been embraced; therefore the BAU is taking a conservative approach by leaving *H. nubilus* within *Hygrotus*.

Taxonomic references:

larvae and adults:

⇨Ciegler, J. C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Larson, D. J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Miller, K. B., G. W. Wolfe, and O. Biström. 2006. The phylogeny of the Hydroporinae and classificationof the genus *Peschetius* Guinot, 1942 (Coleoptera: Dytiscidae). *Insect Systematics and Evolution* 37:257-279.

Laccornis

Genus Diagnosis: Larvae – *nasale broadly rounded with shallow notches*; maxillary palpi 4-segmented; stemmata large; abdominal sterna 2-6 membranous; legs without natatory setae; dorsally recurved tracheal trucks absent; *urogomphi 2-segmented, much shorter than abdominal segment 8*, with primary setae only.

Adults – small, 5.4-6.4 mm; body narrow, elongate, and subparallel, somewhat pointed posteriorly; middle antennomeres of male modified; pronotal lateral bead narrow, complete; *fore and middle tibiae narrow basally and strongly widened apically*; metepisternum contacting mesocoxal cavity; *metacoxal lobes produced apicolaterally over trochanter, margin indented mesally*; base of metafemur extending to and contacting metacoxal lobe; metatarsal claws subequal; dorsal surface glabrous, punctate with microsculpture; color dark brownish, head reddish brown, ventral surface mostly reddish yellow to brown.

Habitat: Forested pools and ponds in leaf litter.

Distribution and Occurrence: Collected from Piedmont and Coastal Plain waters. Rarely collected by BAU.

Species in NC: TAKE TO SPECIES – *differmis*

L. differmis – adult 5.4-6.4 mm; male antennomeres 3-5 wider; front tarsi dilated.

Notes: *Laccornis differmis* is the only species in NC. It is similar to *Celina* but without the acute spines at apical edge of elytra.

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Liodessus

Genus Diagnosis: Larvae – broadly triangular nasale without notches; maxillary palpi 3-segmented; labial palpomere 2 slightly longer than palpomere 1; abdominal segments 2-6 membranous ventrally; legs without natatory setae; *very long 2-segmented urogomphi with basal segment longer than last abdominal segment*, with primary setae only; siphon bluntly rounded.

Adults – small, 1.5-2.1 mm; *body elongate, at least twice as long as wide*; pronotum wider medially than basally making overall lateral outline discontinuous; *a transverse stria across occiput behind eyes*; *pronotum with short basal plicae meeting short plicae at base of elytra or elytral plicae absent*; metasternal lines not converging anteriorly; sternum 6 subtriangular and impressed basolaterally; color various, patterned or not.

Habitat: Lentic or in shallow stream margins among vegetation of filamentous algae.

Distribution and Occurrence: Rare overall, but more commonly collected in the Piedmont and Coastal Plain. See species accounts.

Species in NC: LEAVE AT GENUS – *(affinis), (crotchi), (flavicollis), (noviaffinis)*

(L. affinis) – adult 1.7-2.1 mm; basal plicae of elytra well developed; pronotum with central dark spot merged with basal pronotal band; elytra yellowish with 2-3 irrorate longitudinal brown vittae, often partly coalesced, or dark brown with paler spots; metatibiae yellowish with apical third darkly infuscate; metacoxal with fine punctuation, often rugose.

(L. crotchi) – adult 1.7-2.0 mm; basal plicae of elytra developed but much shorter than pronotal plicae; metacoxae coarsely punctate, punctures mostly confined to center of metacoxal plate. Recorded from Oconoluftee River. Previously known as *L. fuscatus.* The name *fuscatus* was preoccupied by *Hydroporus* and therefore *L. fuscatus* was renamed *L. crotchi* (Nilsson, 2001).

(L. flavicollis) – adult 1.5-1.8 mm; basal elytral plicae reduced to small impression or absent; elytra densely punctate with punctures separated by less than their diameter, setose; elytra irrorate, reddish brown with one subbasal, one postmedial, one apical pale transverse band interrupted at suture; metacoxae coarsely punctate, punctures mostly absent from posterior fourth of plate. An adult was collected from Lake Waccamaw in September, 2010. Also, recorded from VA and SC.

(L. noviaffinis) – adult 1.7-2.1 mm; basal plicae of elytra well developed; basal plicae of elytra well developed; pronotum with central dark spot sometimes obscured with basal pronotal band; elytra yellowish with 3-5 narrow, irrorate, longitudinal brown vittae, often coalesced medially and apically, or dark brown with paler spots; metatibiae yellowish with apical third darkly infuscate; metacoxal plates coarsely punctate. May inhabit waters with high salinity.

Notes: *Liodessus* is similar to *Bidessonotus* and *Uvarus*. Identification to species may be difficult given the small sizes of *Liodessus*. *Liodessus noviaffinis* was split out from *Liodessus affinis* by Miller (1998). Color patterns between the two species are similar and may only be separated definitively by the shape of male aedeagus, although Ciegler (2003) isolates these two species geographically with *L. affinis* in the Mountains and *L. noviaffinis* in the Piedmont and Coastal Plain.

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

⇨Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Miller, K. B. 1998. Revision of the Nearctic *Liodessus affinis* (Say, 1823) species group (Coleoptera: Dytiscidae, Hydroporinae, Bidessini). Entomological Scandinavica, 29: 281-314.

Nilsson, A. 2001. Review of Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska.Annals of the Entomological Society of America 94(5):769-770. *with errata*

Lioporeus

Genus Diagnosis: Larvae – unknown, most likely resemble *Heterosternuta* or *Neoporus*.

Adults – small, 3.4-4.4 mm; body narrow, elongate, narrowly pointed apically; dorsal surface microreticulate and finely punctate, imperceptibly setose; *male antennomeres 4 or 4-5 modified*; pronotum with lateral bead very narrow and parallel; protarsomere one of male with cupule with sensillae; *metacoxal processes produced medially and strongly sinuate*; color variegated, ground color yellow to reddish; pronotum with anterior and posterior longitudinal maculations; elytra usually with medial and subapical maculae confluent with sutural stripe, outline of maculae mostly regular; females tend to be lighter.

Habitat: Along margins or undercut banks of small, clear streams.

Distribution and Occurrence: Common and widespread but rarely collected in the mountains.

Species in NC: TAKE TO SPECIES – *pilatei, triangularis*

L. pilatei – adult 3.7-4.4 mm; male antenna with antennomere 4 and 5 distinctly broadened apically; pronotum almost entirely dark, possibly with obscured pale area centrally.

L. triangularis – adult 3.4-4.3 mm; male antennomere 4 distinctly widened; disc of pronotum almost entirely light with infuscate areas narrowly restricted to apical and basal margins.

Notes: Very similar to *Heterosternuta*, but *Lioporeus* have elytra more pointed at apex, elytral maculae less irregular in outline; and ventral surface with fewer coarse punctures. The elytral pattern of both species of *Lioporeus* is highly variable whereas pronotal coloration is less so and therefore more weight should be given to the pronotal coloration than elytral pattern when making species determinations for females. Some photos on the server are of *Heterosternuta*.

Taxonomic references:

larvae and adults:

Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Neoporus

Genus Diagnosis: Larvae – head patterned; *nasale broadly triangular, with anterolateral notches*; *antennomere 2 without dorsomedian seta*; maxillary palpi 3-segmented; legs with natatory setae; abdominal segments 2-6 membranous ventrally; abdominal segment 8 constricted posterior to insertion of urogomphi; *urogomphi distinctly longer than segment 8, without secondary setae*; siphon blunt, without extended tracheal trunk.

Adults – small, 2.2-6.4 mm; body usually ovate to subovate; punctation variable, *conspicuously setose*; *male protarsal claws distinctly unequal*; *metacoxal processes produced but angulate medially but not noticeably emarginate each side of midline, moderately sinuate*; color variegated, ground color yellow to reddish; elytra variously maculate.

Habitat: A mostly lotic genus usually found in depositional or protected areas.

Distribution and Occurrence: Widespread. Most commonly encountered dytiscid in NC.

Species in NC: LEAVE AT GENUS – *(aulicus), (blanchardi), (carolinus), (cimicoides), (clypealis), (dilatatus), dimidiatus*, (dixianus), effeminatus*, (gaudens), (hybridus), (lobatus), (lynceus), mellitus, mixtus*, (shermani), spurius*, sulcipennis*, (striatopunctatus), (undulatus), (venustus), (vittatipennis)*

Notes: *Neoporus* is morphologically similar to *Heterosternuta* but can be separated based on presence of longitudinal interconnectivity between the various transverse elytral maculae. Due to the sheer number of possibly occurring species in NC and the overall similarity in dorsal coloration of many species, speciation of this genus is not recommended. In many cases, accurate species identification of adults requires examination of the male aedeagus. There are over 200 BAU records of *N. mellitus*, the smallest of the *Neoporus* species occurring in NC. *Neoporus dilatatus* was collected from the New River in Onslow County (9 June 2010).

Taxonomic references:

larvae and adults:

Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Wolfe, G. W. 1984. A revision of the *vittatipennis* species group of *Hydroporus* Clairville, subgenus *Neoporus* Guignot (Coleoptera: Dytiscidae). Transactions of the American Entomological Society 110: 389-433.

Stictotarsus

Genus Diagnosis: Larvae – frontal projection broadly triangular, with shallow, lateral notches; maxillary palpi 3-segmented; *maxillary cardo (small, basal, secondary lobe on maxilla) absent*; *antennomere 3 lacking anteroventral spinule and lateral pore*; abdominal segments 2-6 membranous ventrally; legs with natatory setae; abdominal segment 8 constricted posterior to insertion of urogomphi; *urogomphi much longer than segment 8*; *urogomphi with primary and secondary setae*; siphon bluntly rounded, without extended tracheal trunk.

Adults – small, 3.9-5.2 mm; body elongate, oval; dorsal and ventral surface finely and densely punctate; pronotum with broad lateral bead; *elytra in lateral aspect with lateral margin broadly ascendant towards humeral angle*; *metacoxal process slightly produced laterally but medially emarginate, midline incised*; color various, most vittate.

Habitat: A lentic and lotic genus. Generally occur over hard mineral substrates where vegetation is sparse.

Distribution and Occurrence: Widespread overall. Relatively common in the Piedmont and Coastal Plain.

Species in NC: TAKE TO SPECIES – *griseostriatus*

S. griseostriatus – adult 3.9-5.2 mm; densely punctate; ground color yellowish usually with seven interconnected black vittae although some specimens mostly yellowish to almost completed blackish; ventral surface mostly black. Only species in occurring in NC.

Notes: *Stictotarsus griseostriatus* is highly a highly variable species in size, shape, and coloration over much of its North American range. Previously *Deronectes*, Nillson and Angus (1992) transferred all North American *Deronectes* species to *Stictotarsus* and *Nebrioporus*. The *Stictotarsus grisiostriatus* species group was then erected as a new genus *Boroeonectes* (Angus, 2010). As *S. griseostriatus* is the only occurring species in NC, the BAU is currently maintaining *Stictotarsus griseostriatus* as valid until *Boreonectes* is widely accepted.

Taxonomic references:

larvae and adults:

Angus, R. A. 2010. Boreonectes gen. n., a new genus for the Stictotarsus griseostriatus (De Geer) group of sibling species (Coleoptera: Dytiscidae), with additional karyosystematic data on the group. Camparative Cytogenetics 4(2): 123-131.

Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Nilsson, A. N. and R. B. Angus. 1992. A reclassification of the *Deronectes*-group of genera (Coleoptera: Dytiscidae) based on a phylogenetic study. Entomologica Scandinavica 23:275-288.

Zimmerman, J. R. and A. H. Smith. 1975. A survey of the *Deronectes* (Coleoptera: Dytiscidae) of Canada, the United States and northern Mexico. Transactions of the American Entomological Society. 101: 651-722

Uvarus

Genus Diagnosis: Larvae – broadly triangular nasale without notches; maxillary palpi 3-segmented; *labial palpomere 1 distinctly longer than palpomere 2*; abdominal segments 2-8 membranous ventrally; legs without natatory setae; *2-segmented urogomphi less than two times the length of abdominal segment 8, with primary setae only*; siphon bluntly rounded, subequal to or longer than segment 8.

Adults – small, 1.5-2.0 mm; body oval to elongate; *pronotum with short basal plicae meeting short plicae at base of elytra*; *hind tibiae weakly arcuate*; hind tarsal claws equal; metasternal lines not converging anteriorly; *sternum 6 subtriangular*; color yellowish brown to reddish brown.

Habitat: Found in small streams and swamps.

Distribution and Occurrence: Coastal Plain. Rarely collected.

Species in NC: TAKE TO SPECIES GROUP (provisional) – *(falli), (granarius), (inflatus), lacustris, (rogersi)*

U. granarius group: body broadly ovate, L: W = 1.5-1.9; elytra longitudinally strongly convex; dorsal surface more coarsely punctate.

(U. falli) – adult 1.6-2.0 mm; elytra reddish brown; dorsal surface highly polished.

(U. granarius) – adult 1.5-1.7 mm; elytral plicae much longer than pronotal plicae.

(U. inflatus) – adult 1.5 mm; elytra reddish brown; lateral margins of elytra carinate, greatly expanded transversely at midpoint.

(U. rogersi) – adult 1.3-1.6 mm; elytral plicae subequal to pronotal plicae.

U. lacustris group: body narrower and more elongate, L: W = 1.85-2.10; elytra longitudinally evenly convex and not carinate.

U. lacustris – adult 1.5-2.0 mm; elytra yellowish brown; dorsum finely punctate.

Notes: Similar to other Bidessini beetles, *Uvarus* speciation may be difficult due to the relative small size of the beetles. Retaining group names (after Larson *et al*, 2000) may be easiest. These beetles may have been misidentified as *Liodessus* or other similar beetles in older samples. The Ciegler key (2003) may be easier to use than Epler's revised 2010 key although his photos are certainly helpful.

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

⇨Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Subfamily Colymbetinae

Subfamily Diagnosis: Larvae – *head suboval to quadrate, usually with a distinct collum*; anterior frontoclypeal margin without process though may be variously modified; *mandible channeled, not curved upward apically*; *maxillary galea present with 1-segmented finger-like maxillary palpifer*; abdominal segments 7-8 without lateral fringe of natatory setae (except present laterally on segment 8 in *Coptotomus*); urogomphi one or two-segmented.

Adults – small to moderate, 5.0-14.0 mm; body shape and color various; *eyes emarginate above bases of antennae*; *scutellum visible*; *prosternum with apex contacting metasternum and narrowly separated mesocoxae*; metacoxae with lobes variously produced but usually coving bases of femora; *five segmented fore and middle tarsi*; male protarsomeres 1 and 3 variously dilated but not forming a oval or round plate.

Agabus

Genus Diagnosis: Larvae – patterned overall; head quadrate; *anterior frontoclypeal margin convex with crenulations*; broad maxillary stipes with two short spine-like structures on inner margin; *apically bifid ligula*; posterolateral margin of head with temporal spines directed obliquely dorsoventrally; abdominal sternites 1-5 membranous, *sternite 6 narrowly membranous*; *spiracle distant from weakly defined ventrolateral margin of dorsal plate*; sternites 7-8 sclerotized; *urogomphi 2-segmented, with setae in two whorls, basally and apically*.

Adults – variable in size 5.0-12.5 mm; body generally ovate and variously depressed; pronotum with lateral bead; *hind femur with linear group of setae on posterior apical angle*; *hind tarsal claws equal*; color various, sterna dark.

Habitat: Lentic or lotic depending on species.

Distribution and Occurrence: Widespread but uncommon.

Species in NC: LEAVE AT GENUS – *(ambiguus), (astrictovittatus), (bifarius), (disintegratus), (erythropterus), (flavovittatus), (gagates), (johannis), (obtusatus), (punctatus), (seriatus), (stagninus), (xyztrus)*

Notes: A very speciose genus with over one hundred North American species and at least 13 NC species. First instar larvae of *Agabus* may be very difficult to separate from first instar Ilybius. Generally, segment 8 is less than 0.6x the width of the head within *Agabus* and much more than that within *Ilybius*. Larson and Wolfe (1998) split the genus *Platambus* out from the *Agabus semivittatus* group and synonymized it with *Agabinus*. It is now a valid genus (www.ITIS.gov) of which the species *astrictovittatus*, *flavovittatus*, *johannis*, *obtusatus*, and *stagninus* are now members. However, neither Larson *et al* (2000) or Ciegler (2003) recognize *Platambus* (or White and Roughley, 2008 for that matter) and instead use *Agabinus*. Additionally, Nilsson (2001) transferred *Agabus seriatus* to *Ilybiosoma*. However, as we do not take this genus to species, for the time being the BAU does not recognize *Platambus* or *Ilybiosoma* as valid genera. *Agabus aeruginosus* was split into a northern species, *A. aeruginosus*, and a southern species *A. xyztrus* which occurs in NC (Larson *et al*, 2000).

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Larson, D. J. and R. W. Wolfe. 1998. Revision of North American *Agabus* (Coleoptera: Dytiscidae): The *semivittatus*-group. Canadian Entomologist. 130: 27-53.

Nilsson, A. N. 2001. World Catalogue of Insects, Volume 3: Dytiscidae (Coleoptera) . Apollo Books. Stenstrup, Denmark . 395pp

Coptotomus

Genus Diagnosis: Larvae – head quadrate; *frontoclypeal margin with a distinct, short, anteromedial horn or lobate process*; posterolateral margins of head keeled with temporal spines; prothorax subparallel in anterior half then dramatically dilated posteriorly; fore and middle tibiae and tarsi without natatory setae; *abdominal segments 1-6 with lateral tracheal gills*; abdominal sternites 1-6 membranous, 7 weakly sclerotized, 8 fully sclerotized (instars II and III); abdominal segment 8 with lateral fringe of natatory setae (instars II and III).

Adults – small to moderate, 5.6-8.6 mm; body elongate, oval, somewhat pointed posteriorly; *palpi notched apically*; pronotum with lateral bead; metacoxal lines diverging anteriorly and subparallel with anterior margin of metasternum; metatarsal claws subequal; color patterned, pronotum yellowish with posterior dark maculations and often with anterior maculations continuous onto back of head; elytra ground yellow with black irrorations, subtly variable within species.

Habitat: Prefers slower, deeper waters.

Distribution and Occurrence: Relatively common in the Piedmont and Coastal Plain.

Species in NC: TAKE TO SPECIES – *(interrogatus), (longulus), (loticus), (venustus)*

(C. interrogatus) – adult 5.7-7.2 mm; metasternal wing less than 0.30 mm at narrowest point adjacent to mesocoxa; pale sutural spot at base of elytra broader, shorter; irrorata areas of elytral disc small, mostly absent; subhumeral spot solid or nearly so; submarginal stripe deep brown and approximately four fifths the length of the elytra, originating distally; pale stripe along submarginal stripe mostly uninterrupted.

(C. longulus) – adult 6.8-8.2 mm; metasternal wing greater than 0.35 mm at narrowest point adjacent to mesocoxa; pale sutural spot at base of elytra longer, narrower, about one third the length of the elytra; irrorate areas of elytra present, confined to mostly medial area of disc; a thin submarginal stripe may be entire or broken into a longitudinal series of dots. Larson *et al* (2000) placed *Coptotomus lenticus* as a subspecies of *C. longulus.*

(C. loticus) – adult 6.8-8.1 mm; metasternal wing less than 0.30 mm at narrowest point adjacent to mesocoxa; pale sutural spot at base of elytra broader, short and with two posteriorly directed points; subhumeral blotch irrorate; margins of elytra yellowish.

(C. venustus) – adult 6.4-7.5 mm; metasternal wing less than 0.30 mm at narrowest point near mesocoxa; posterior margin of head broadly black; pronotum with anterior and posterior maculations confluent; pale sutural spot at base of elytra broader, shorter; irrorate areas of elytral disc present but not extensive; subhumeral spot solid or nearly so; submarginal stripe black, interrupted by a postmedial blotch.

Notes: *Coptotomus venustus* may be difficult to separate from *C. interrogatus* but pronotal differences and more extensive pale markings on the elytral disc should separate the two species, although they may eventually prove to be color variants or subspecies.

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

Hillsenhoff, W. L. 1980. Coptotomus (Coleoptera:Dytiscidae) in eastern North America with descriptions of two new species. Transactions of the American Entomological Society 105: 461-471.

⇨Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Hoperius

Genus Diagnosis: Larvae – head subquadrate; maxillary stipes elongate; *basal segment of labial palpi much shorter than maxillary stipes*; *fourth antennal segment more than two thirds the length of the third segment*; tibiae and femora without natatory setae; basal half of tarsal claw without spinulae; abdominal segments 7-8 without lateral fringe of setae; urogomphi with seven primary hairs and with secondary setae.

Adults – moderately large, 12-14 mm; body oval, depressed, shiny; pronotum with wide lateral bead; flat prosternal process; hind tarsal claws unequal; color mostly brown; *elytra with reticulate etchings and with abruptly defined yellow margin*.

Habitat: Swamps and woodland ponds.

Distribution and Occurrence: A Coastal Plain species.

Species in NC: MONOTYPIC – *planatus*

Notes: *Hoperius planatus* is endemic to the southeastern US.

Taxonomic references:

larvae and adults:

Alerie, Y and S. Hughs. 2006. Re-descriptions of larvae of *Hoperius* and *Meladema* and phylogenetic implications for the tribe Colymbetini (Coleoptera: Dytiscidae). Memorie della Societa Entomologica Italiana. 85: 307-334.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

Ilybius

Genus Diagnosis: Larvae – head quadrate; anterior frontoclypeal margin convex with crenulations; broad maxillary stipes with two short spine-like structures on inner margin; apically bifid ligula; *lateral margin of head more or less compressed to form a keel, with temporal spines directed mostly anteroposteriorly*; legs without natatorial setae; abdominal sternites 1-6 membranous; *spiracles near to the well defined ventrolateral margin of dorsal plates*; sternites 7-8 sclerotized; urogomphi 2-segmented, with setae in two whorls, basally and apically; *patterned overall*.

Adults – moderate, 8.7-10.7 mm; body elongate-oval, strongly convex dorsally; pronotum with lateral bead; *hind femur with linear group of setae on posterior apical angle*; *hind tarsal claws variably unequal*; female sternum 6 emarginate apically; color blackish, some specimens with a metallic reflection; head often paler or with pale spots; *elytron with a postmedial sublateral elongate spot and a subapical spot*; elytra with microreticulation.

Habitat: Lentic or slow lotic waters and swamps. Usually among dense emergent vegetation.

Distribution and Occurrence: Widespread but rarely collected.

Species in NC: TAKE TO SPECIES – *(biguttulus), (incarinatus), (oblitus)*

(I. biguttulus) – adult 8.8-10.5 mm; male with abdominal sternite 6 with posteromedial longitudinal keel; female with wide metacoxal wings, WC/WS less than 4.5 (see figure 5.74 in Ciegler, 2003); female with longest hind tarsal claw subequal to or longer than tarsomeres 5.

(I. incarinatus) – adult 8.7-9.9 mm; male without keel and with broad metasternal wing, WC/WS 2.7 -3.5; male with prosternal process long and acuminate; female with wide metacoxal wings, WC/WS less than 4.5; female with longest hind tarsal claw shorter than tarsomeres 5.

(I. oblitus) – adult 8.9-10.7 mm; metasternal wing narrow, WC/WS 5.1-6.8, male without keel, with prosternal process short and broad.

Notes: Larvae of *Ilybius* and *Agabus* may be difficult to separate although Hicks and Larson (2000) and Barman et al (2001) provide additional features for separation of the two genera. Species identification of *Ilybius* adults is relatively straightforward but requires careful measurements.

Taxonomic references:

larvae and adults:

Barman, E.H., M.E. Blair & M.A. Bacon. 2001.Biology of *Ilybius oblitus* (Coleoptera: Dytiscidae) with a description of its mature larva and an evaluation of diagnostic characters for separation of southeastern *Ilybius* and *Agabus* larvae. J. Elisha Mitchell Sci. Soc. 117: 81-89.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Hicks, B. J. and D. J. Larson. 2000. Descriptions and recognition of larvae of some northern North American species of *Ilybius* Erichdon (Coleoptera: Dytiscidae). The Coleopterists Bulletin 54(1): 36-59.

Larson, D. J. 1987. Revision of the North American species of Ilybius Erichson 9Coleoptera: Dytiscidae) with systematic notes on Palaearctic species. Journal of the New York Entomological Society 95(3): 341-413.

Larson, D. J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Matus

Genus Diagnosis: Larvae – head suboval; frontoclypeal margin broadly and evenly convex; maxillary stipes narrow and elongate; *antennae biramous with lobes unequal*; *mandible with inner margin scalloped*; *prothorax subparallel in anterior half then dramatically dilated posteriorly, anterior margin about half the width of the basal margin; fore and middle legs pseudochelate*; legs with natatory setae; abdominal sternites 1-6 membranous, 7-8 fully sclerotized; *urogomphi with secondary setae, very short, length less than that of segment 8*.

Adults – moderate, 7.0-9.4 mm; body elongate, oval; dorsal surface microreticulate with small punctures, in series on elytra; clypeus emarginate medially; pronotum with lateral bead; *prosternum long and pointed with a deep medial longitudinal groove*; mesosternal receiving cavity pointedly triangular; metasternal wing very narrow and strap-like laterally; *hind margins of metatarsi 1-4 lobate*; metatarsal claws unequal; color reddish to reddish brown, femora yellow.

Habitat: Primarily a lentic taxon but may be in slower, deeper lotic waters.

Distribution and Occurrence: Occurs in the Piedmont and Coastal Plain. Rarely collected.

Species in NC: TAKE TO SPECIES – *(bicarinatus), ovatus*

(M. bicarinatus) – adult 5.7-7.2 mm; body more elongate and tapered posteriorly; metacoxal plates without microreticulation, smooth and shiny though sparsely punctate.

M. ovatus – adult 6.8-8.2 mm; body evenly ovate; metacoxal plates with fine isodiametric microreticulation; elytra often darker than head and pronotum. Two subspecies may occur in NC, *M. o. ovatus* and *M. o. blatchleyi* though differentiation between the two subspecies is difficult.

Notes: The microreticulations may be difficult to see on the metacoxal plates.

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

⇨Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Rhantus

Genus Diagnosis: Larvae – head suboval; *antenna subequal to or longer than length of head* (instar III); maxillary stipes broad; basal segment of labial palpi much shorter than maxillary stipes; *fourth antennal segment more than two thirds the length of the third segment*; *tibiae and femora with natatory setae*; *basal half of tarsal claw with spinulae*; abdominal segment 8 elongate (instar III of *R. calidus* only); urogomphi shorter than segment 8 (slightly in instar I to much in instar III), with primary setae (instar I and III of *R. calidus* only).

Adults – moderately large, 10-14 mm; body oval, dorsoventrally compressed; pronotum with lateral bead; *prosternal process convex to subcarinate, pointed*; *metasternaum with anteromedial triangular emargination to receive prosternal process*; hind tarsal claws unequal; *color mostly yellowish brown with distinct maculations, occiput between eyes usually dark*; elytra finely punctate with irregular microreticulate etchings.

Habitat: Lentic. Found in sunny, open ponds or swampy areas. This genus also occurs in saline waters.

Distribution and Occurrence: Found in Piedmont and Coastal Plain waters but rarely collected.

Species in NC: TAKE TO SPECIES – *(calidus)*

(R. calidus) – adult 11-14 mm; pronotum dark medially with broad pale margins; elytra variegated. This is only probable species in NC.

Notes: Brigham (1982) reports *Rhantus binotatus* as occurring in either NC or SC. However, that record is most likely in error as all other distributional accounts of *R. binotatus* suggest MD is the southern limit to this species. *Rhantus binotatus* is smaller than *R. calidus* (10-12 mm) and has two medial pronotal spots. See Alarie *et al* (2009) for illustrations of *R. calidus*.

Taxonomic references:

larvae and adults:

Alarie, Y., M.C. Michat, A.N. Nilsson, M. Archangelsky and L. Hendrich. 2009. Larval morphology of *Rhantus* Dejean, 1833 (Coleoptera: Dytiscidae: Colymbetinae): descriptions of 22 species and Phylogenetic considerations. Zootaxa 2317: 1-102.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Zimmerman, J. R. and R. L. Smith. 1975. The genus *Rhantus* (Coleoptera: Dytiscidae) in North America. Part I. General account of the species. Transactions of the American Entomological Society. 101: 33-123.

Subfamily Dytiscinae

Subfamily Diagnosis: Larvae – large; frontoclypeal margin not developed into a projection; maxillary galea absent or present; abdominal segments 1-6 fully sclerotized dorsally, segment 7 sclerotized ventrally (membranous in *Cybister*); *abdominal segments 7-8 with lateral fringe of natatory setae* (absent on segment 7 in instar I); *urogomphi one-segmented, short, with lateral setal fringe*.

Adults – moderate to large, 9-33 mm; body shape oval to elongate; color various; *eyes not emarginate above antennal bases*; pronotum usually lacking bead; scutellum visible; *pro- and mesotarsi pentamerous*; *male protarsomeres strongly dilated forming an oval to circular plate (palette), with adhesive discs and setal vestiture*; upper face of metatibia with apically emarginate setae; metacoxae with lobate process covering bases of trochanters.

Acilius

Genus Diagnosis: Larvae – anterior margin of frontoclypeus smoothly convex; maxillary stipes broadly rectangular with dorsal row of spinelike setae; *apically deeply bifid ligula*; antero- and posterodorsal stemmata larger than other four; *occipital foramen deeply indented dorsally*.

Adults – moderately sized, 10.2-17.0 mm; *body broadly ovate with point of maximum width past middle*; male palette a roundish plate with one large basal and two smaller suction cups; *posterior margins of first four hind tarsomeres bearing a dense golden fringe of setae*; densely punctate dorsally and ventrally; dorsal surface yellow with dark markings; *pronotum with an anteromedial and posteromedial transverse black bands*.

Habitat: Lentic but also may be found in sand bottom streams or in temporary pools.

Distribution and Occurrence: Primarily a Piedmont and Coastal Plain taxon. Rarely collected.

Species in NC: LEAVE AT GENUS – *(confusus), (fraternus), (mediatus), semisulcatus**

Notes: As the smallest NC occurring *Acilius*, *A. mediatus* is readily identifiable by its small size at 10-12.5 mm. The two other NC species, *A. confusus* and *A. fraternus* are 13-15.5 mm in total length. *Acilius confusus* was described in 2005 by Bergston and Miller as the intermediate form between *A. semisulcatus* and *A. fraternus.* Due to prior confusion between the three species it is currently unknown whether or not *A. semisulcatus* is actually present in NC. Bergston and Miller (2005) exclude any state further south of MD and Larson *et al* (2000) exclude any state further south of VA in their distribution maps of *A. semisulcatus*.

Taxonomic references:

larvae and adults:

Bergston, J. and K. B. Miller. 2005. Taxonomic revision of the Holarctic diving beetle genus *Acilius* Leach (Coleoptera: Dytiscidae). Systematic Entomology. 31: 145-197. *Adults only*

Brigham, W. U. 1982. Aquatic Coleoptera, Chapter 10 (136 pp.). In A.R. Brigham, W. U. Brigham, and A. Gnilka, editors. *Aquatic Insects and Oligochaetes of North and South Carolina*. Midwest Aquatic Enterprises, Mahomet, Illinois. 837pp.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Cybister

Genus Diagnosis: Larvae – *frontoclypeal margin indented and appearing trilobed*; long and slender maxillary stipes; 4-segmented maxillary palpi; tarsi without natatory setae; *abdominal segments 1-6 mostly membranous dorsally, segment 7 membranous ventrally*; *urogomphi absent*.

Adults – *very large, body 26-33 mm*; body oval, *wedge shaped with maximum width well behind middle*; body heavily sclerotized; male palette oval with adhesive discs; metatibiae short, broad and with large apical spurs that are longer that first metatarsomere; *metatarsi with one claw* and natatory setae; dorsal color greenish to dark brown to black with a yellow lateral marginal stripe on pronotum and elytra; *head greenish; prosternum green with metallic reflections*.

Habitat: Deeper more open lentic waters and slow lotic waters.

Distribution and Occurrence: *Cybister f. crotchi* is primarily a Coastal Plain taxon while *C. f. fimbriolatus* is reportedly only a Mountains and Piedmont taxon.

Species in NC: TAKE TO SPECIES – *fimbriolatus*

Notes: *Cybister fimbriolatus* is the largest dytiscid in North America. Both subspecies *C. f. crotchi* and *C. f. fimbriolatus* occur in NC. Identification of the subspecies is difficult and inconsistent and should not be attempted.

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Dytiscus

Genus Diagnosis: Larvae – *larger, head greater than 2.0 mm*; frontoclypeal margin strongly arcuate; long and slender maxillary stipes; 4-segmented maxillary palpi; *stemmata subequal in size*; *antennae uniramous*; tarsi without natatory setae.

Adults – *very large, 22-27 mm*; body oval, maximum width behind middle; body heavily sclerotized; male pallete circular, with two large basal adhesive discs; metatibiae slender, with apical spurs subequal, of similar width and evenly narrowed; *metatarsi with two claws* and with natatory setae; dorsal color reddish brown to black with a yellow lateral margin on pronotum and elytra; prosternum yellowish.

Habitat: Lentic and open waters. Primarily permanent ponds or lakes with organic detritus.

Distribution and Occurrence: Widespread but uncommonly sampled.

Species in NC: TAKE TO SPECIES – *(carolinus), (hybridus)*

(D. carolinus) – adult 22-27 mm; middle tarsus of male without glabrous area dividing adhesive setae; ventral surface yellowish to reddish with black fasciae; female with sulcate elytra. Previously recorded as *D. fasciaventris*, but *D. carolinus* was split out by Roughly (1990).

(D. hybridus) – adult 24-28 mm; middle tarsus of male with median glabrous area dividing adhesive setae; female elytra not sulcate; ventral surface dark red to black.

Notes: If you misidentify this genus you ought to be fired or at least made to eat one!

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

⇨Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

Roughly, R. E. 1990. A systematic revision of Dytiscus (Linnaeu (Coleoptera: Dytiscidae). Part 1. Classification based on the adult stage. Quaestiones Entomologicae. 26:383-557.

(Graphoderus)

Genus Diagnosis: Larvae – head narrowed posteriorly; *occipital margin deeply indented dorsally*; frontoclypeal margin lacking frontal projection, smoothly convex; maxillary stipes broad with dorsal row of spinelike setae middorsally; labium slightly longer than broad with spinosa ligula subequal to basal labial palpomere; *antero- and posterodorsal stemmata larger than other four*; *prothorax elongate, dilated posteriorly with length at least twice the greatest width*.

Adults – moderately sized, 10.4-15.0 mm; body broadly ovate, depressed; male palatte a roundish plate; *mesofemur with basal half of posteroventral margin with 4-8 stiff setae, length approximately half the width of the femur*; apex of outer spur of hind tibia notched; elytra finely punctate; ground color yellow, elytra with black reticulate maculations; ventral surface yellowish to reddish.

Habitat: This taxon prefers forested waters.

Distribution and Occurrence: Unknown. No BAU records.

Species in NC: TAKE TO SPECIES – *(liberus)*

(G. liberus) – body 10.4-12.4 mm; head and pronotum entirely yellow to reddish brown, without maculations; male protarsi 1-3 with three large adhesion discs basally and many small ones distally.

Notes: This is the only *Graphoderus* species in the southeastern US.

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

(Hydaticus)

Genus Diagnosis: Larvae – *smaller, head less than 2.0 mm*; head slightly narrowed posteriorly; occipital margin slightly indented dorsally; maxillary stipes long and slender; *basal labial palpomere much longer than width of labiam*; *labium without ligula, but with two projecting lobes on anterior margin separated from each othe by more than their basal width*; *stemmata subequal in size*; *antennae biramous*; prothorax dilated posteriorly with length about 1.5 times the greatest width; tarsi lacking anteroventral natatory setae; urogomphi with primary setae only.

Adults – moderately sized, 12.4-15.4 mm; body elongate, oval, and subparallel medially and moderately convex dorsoventrally; *prosternal process finely margined laterally, rounded apically and broadly contacting metasternum*; male palette with adhesion discs; *outer margins of metasternal wings straight*; hind legs robust with metatibial spurs acuminate; *posterior (upper) surface of hind femur with an irregular line of moderately large punctures*; metatarsal claws unequal; usually bicolorous, often reddish-brown with bold yellow or reddish lateral markings.

Habitat: Lentic, in shallow, densely vegetated margins, particularly in eutrophic conditions.

Distribution and Occurrence: Widespread. Rarely collected.

Species in NC: TAKE TO SPECIES – *(aruspex), (cinctipennis)*

(H. aruspex) – adult 12.4-15.4 mm; pronotum with posterolateral angle not strongly produced, nearly right angled; base of pronotum weakly sinuate; metatibiae with row of spines on posterior surface strait; dorsal color black, frons black with pair of sharply defined yellow to reddish frontal spots; elytra with sharply delimited lateral, yellow stripes; some females vittate. Recorded from GSMNP.

(H. cinctipennis) – adult 12.8-14.7 mm; pronotum with posterolateral angle not strongly produced, nearly right angled; base of pronotum weakly sinuate; metatibiae with row of spines on posterior surface strait; dorsal color reddish brown, frons brownish with frontal spots poorly defined; elytra with sharply delimited lateral, yellow stripes at least on basal half; some specimens may have a subbasal transverse yellowish to reddish stripe.

Notes: *Hydaticus bimarginatus was* transferred to the Hydaticini genus *Prodaticus* by Miller *et al* (2009) thereby eliminating any BAU records of *Hydaticus*. Epler (2010) has a couplet dedicated to *Hydaticus/Prodaticus* but it differs from that of Miller *et al* (2009) in that Epler replaces "posterior" with "anterior" although everything else, including figures, appears correct. For identification purposes, this is a difficult character to observe as the posterior face is facing the body (i.e. when looking at the ventral surface of the beetle you are looking at the anterior face of the femur); therefore one must either remove the hind leg or carefully pry it away from the sternal face. However the two genera can also be separated based on size as *Hydaticus* is larger and overlap between the two genera is minimal. *H. modestus* is a junior synonym of *Hydaticus aruspex.* Ciegler (2003) claims that records of *H. modestus* in Brigham (1982) are in error. However, *H. aurespex* has been reported from GSMNP in TN and therefore Brigham records of *H. modestus* may be correct.

Taxonomic references:

larvae and adults:

Barman, E. H., B. P. White, R. Jackson and G. W. Wolfe. 2008. Identification of mature larvae of *Hydaticus cinctipennis* and *H. bimarginatus* (Coleoptera: Dytiscidae) based on morphology and breeding seasons. Florida Entomologist 91: 315-316.

Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

⇨ Miller, K. B., Bergsten, J., & M. F. Whiting. 2009. Phylogeny and classification of the tribe Hydaticini (Coleoptera: Dytiscidae): partition choice for Bayesian analysis with multiple nuclear and mitochondrial protein-coding genes. Zoologica Scripta, 38(6): 591-615.

Roughley, R. E. and D. H. Pengelly. 1981. Classification , phylogeny, and zoogeography of *Hydaticus* Leach (Coleoptera: Dytiscidae) of North America. Quaestiones Entomologicae 17: 249-309.

DYTISCIDAE

Prodaticus

Genus Diagnosis: Larvae – *smaller, head less than 2.0 mm*; head slightly narrowed posteriorly; occipital margin slightly indented dorsally; maxillary stipes long and slender; *basal labial palpomere shorter than withth of labiam*; *labium without ligula, but with two projecting lobes on anterior margin that are conjoined*; *stemmata subequal in size*; *antennae biramous*; prothorax dilated posteriorly with length about 1.5 times the greatest width; tarsi lacking anteroventral natatory setae; urogomphi with primary setae only.

Adults – moderately sized, 10.9-13.1 mm; body elongate, oval, and subparallel medially and moderately convex dorsoventrally; *prosternal process finely margined laterally, rounded apically and broadly contacting metasternum*; male palette with adhesion discs; *outer margins of metasternal wings straight*; hind legs robust with metatibial spurs acuminate; *posterior (upper) surface of hind femur with a regular dense series of setigerous punctures in a curved line*; metatarsal claws unequal; usually bicolorous, often black with bold yellow or reddish markings.

Habitat: Lentic, in shallow, densely vegetated margins, particularly in eutrophic conditions.

Distribution and Occurrence: Piedmont and Coastal Plain. Rarely collected.

Species in NC: TAKE TO SPECIES – *bimarginatus*

P. bimarginatus – adult 10.9-13.1 mm; pronotum with posterolateral angle strongly produced and acute; base of pronotum strongly sinuate; metatibiae with row of spines on posterior surface curving inwards basally, not parallel to outer tibial margin; pronotum with basal black band usually restricted to basal third; sublateral stripe of elytra without inward extension near middle.

Notes: *Prodaticus bimarginatus* was transferred from *Hydaticus* by Miller *et al* (2009) and is the only species to occur in NC. Epler (2010) has a couplet dedicated to *Hydaticus/Prodaticus* but it differs from that of Miller *et al* (2009) in that Epler replaces "posterior" with "anterior" although everything else, including figures, appears correct. For identification purposes, this is a difficult character to observe as the posterior face is facing the body (i.e. when looking at the ventral surface of the beetle you are looking at the anterior face of the femur); therefore one must either remove the hind leg or carefully pry it away from the sternal face. However the two genera can also be separated based on size as *Hydaticus* is larger and overlap between the two genera is minimal. However the two genera can also be separated based on size. All former BAU records referred to *H. bimarginatus*.

Taxonomic references:

larvae and adults:

Barman, E. H., B. P. White, R. Jackson and G. W. Wolfe. 2008. Identification of mature larvae of *Hydaticus cinctipennis* and *H. bimarginatus* (Coleoptera: Dytiscidae) based on morphology and breeding seasons. Florida Entomologist 91: 315-316.

Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

⇨ Miller, K. B., Bergsten, J., & M. F. Whiting. 2009. Phylogeny and classification of the tribe Hydaticini (Coleoptera: Dytiscidae): partition choice for Bayesian analysis with multiple nuclear and mitochondrial protein-coding genes. Zoologica Scripta, 38(6): 591-615.

Roughley, R. E. and D. H. Pengelly. 1981. Classification , phylogeny, and zoogeography of *Hydaticus* Leach (Coleoptera: Dytiscidae) of North America. Quaestiones Entomologicae 17: 249-309.

Thermonectus

Genus Diagnosis: Larvae – anterior margin of frontoclypeus smoothly convex; maxillary stipes broadly rectangular with dosal row of spine-like setae; *apically shallowly bifid ligula with 2 elongate spine-like setae, shorter than first segment of labial palp*; *antero- and posterodorsal stemmata larger than other four*; *occipital foramen deeply indented ventrally and dorsally*.

Adults – moderately sized, 9.0-13.0 mm; body broadly ovate with point of maximum width past middle; male palette an oval plate with numerous adhesive discs, three larger; *posterior margins of first four hind tarsomeres bearing a dense golden fringe of setae*; *hind margin of mesofemur with a series of stiff setae as long or longer than width of respective femur*; outer spur (short spur) of hind tibia notched; females with deep, elongate grooves on elytra basally; surface finely punctate dorsally and nearly impunctate ventrally.

Habitat: Lentic, found in temporary pools, with some species tolerant of brackish conditions.

Distribution and Occurrence: Primarily a Piedmont and Coastal Plain taxon. Rarely collected by BAU.

Species in NC: TAKE TO SPECIES – *(basillaris), (nigrofasciatus)*

(T. basillaris) – adult 9.0-11.5 mm; dorsal surface mostly blackish with pale yellow lateral margins and transverse fascia, one at base of elytra, sometimes interrupted, and one at midpoint of pronotum; elytra vermiculate sublaterally and apically; dark reddish brown to black venter, except for yellowish pro- and mesocoxal and lateral margin.

(T. nigrofasciatus) – adult 10-13 mm; elytron yellowish with numerous black speckles; ventral surface bright orange. *Thermonectes ornaticollis* was downgraded to a subspecies of *T. nigrofasciatus* by Larson *et al* (2000).

Notes: Larval separation using the characters in Brigham (1982) is apparently suspect as the original larval descriptions were incorrect. Hilsonhoff (1993) uses different characters for larval separation, but those characters for the two NC species still rely on the original descriptions of the larvae (Barman and Epler, 2005).

Taxonomic references:

larvae and adults:

Barman, E. H. and J. H. Epler. 2005. Errors in Descriptions of Larvae of *Thermonectus* Dejean (Coleoptera: Dytiscidae). Southeastern Naturalist 4(1): 119-120.

Brigham, W. U. 1982. Aquatic Coleoptera, Chapter 10 (136 pp.). In A.R. Brigham, W. U. Brigham, and A. Gnilka, editors. *Aquatic Insects and Oligochaetes of North and South Carolina.* Midwest Aquatic Enterprises, Mahomet, Illinois. 837pp.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

Larson, D.J., Y. Alarie and R. E. Roughly. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. NRC Research Press, Ottawa.

NOTERIDAE

Family Diagnosis: Larvae – body form cylindrical or subcylindrical in cross section, tapered at anterior and posterior ends; head partially hidden by pronotum; mandibles with enlarged molar portion; legs short, stout and with five segments, adapted for digging; tarsi with two claws; eight telescoping abdominal segments with last abdominal segment with pair of terminal spiracles.

Adults – small; antennae filiform; maxillary palpi shorter than antennae; scutellum concealed; prosternal process nearly truncate apically; 5-segmented fore and middle tarsi; hind tarsi with two equal claws; mesosternum, metasternum, and metacoxal plates continuous in lateral outline and in same plane forming a distinct wedge shape.

Genera in NC: *Hydrocanthus, Notomicrus, Suphis, Suphisellus*

Notes: Easily confused with Dytiscidae, noterid beetles (burying water beetles) have a distinct ventral surface modified for burrowing into mud. Like dytiscids, adults are predaceous.

Hydrocanthus

Genus Diagnosis: Larvae – body cylindriform; *third antennal segment about 3 times as long as fourth segment*; mandibles simple (not serrulate); last abdominal segment long, conical with a short dorsal projection.

Adults – small, 3.7-5.2 mm; *body form elongate oval, most specimens more than twice as long as wide*; *apical segment of maxillary palpi truncate to shallowly notched*; pronotal process wider than long, apex of broadly truncate; *large curved spine on apex of foretibiae;* angular cilia present on inside apical edge of hind femora; males with set of adhesive discs at apex of first protarsal segment; color yellowish brown to black, some species bicolored with head and pronotum yellowish and elytra darker.

Habitat: Primarily lentic, particularly swamps. Typically found on floating mats of algae or near vegetated margins.

Distribution and Occurrence: Primarily a Coastal Plain taxon. Relatively uncommon.

Species in NC: LEAVE AT GENUS – *(atripennis), (iricolor), (oblongus)*

Notes: Speciation of *Hydrocanthus* relies on examination of the male aedeagus and on traits which vary within species such as punctation and coloration. *Hydrocanthus atripennis* and *H. iricolor* are purported to intergrade in the Appalachians (Young, 1985). *Hydrocanthus iricolor* recorded from GSMNP.

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Miller, K. B. 2009. On the systematics of Noteridae (Coleoptera: Adephaga: Hydradephaga): phylogeny, description of a new tribe, genus and species, and survey of female genital morphology. Sytematics and Biodiveristy, 7(2): 191-214.

Nilsson A.N. 2006. A World Catalogue of the Family Noteridae or the Burrowing Water Beetles (Coleoptera, Adephaga). Online Version 16.VII.2006 at http:// www.emg.umu.se/biginst/andersn/WCN/wcn_index.htm

Young, F. N. 1985 A key to the American species of *Hydrocanthus* Say, with descriptions of new taxa (Coleoptera: Noteridae). Proceedings of the Academy of Natural Sciences of Philadelphia 137: 90-98.

Notomicrus

Genus Diagnosis: Larvae – undescribed.

Adults – *very small, 1.2-1.4 mm*; body form elongate oval, most specimens more than twice as long as wide; *foretibiae without large apically curved spine on apex but with large setae*; pronoutum deeply microreticulate; color bicolored with head and pronotum orange brown and elytra darker.

Habitat: Primarily lentic but also found on the margins of slow moving streams and rivers. Collected from debris and rootmats.

Distribution and Occurrence: Primarily a Coastal Plain taxon. Rarely collected.

Species in NC: TAKE TO SPECIES – *nanulus*

Notes: *Notomicrus nanulus* is the only species in NC. Extremely small, *Notomicrus* is likely undersampled. One *Notomicrus nanulus* specimen (verified and retained by Kelly Miller) was collected from the Neuse River, Lenoir County (2010). Previously recorded only from FL, GA and LA in the Southeast, this record is a northern extension for *Notomicrus nanulus.*

NOTERIDAE

Taxonomic references:

Miller, K. B. 2009. On the systematics of Noteridae (Coleoptera: Adephaga: Hydradephaga): phylogeny, description of a new tribe, genus and species, and survey of female genital morphology. Sytematics and Biodiveristy, 7(2): 191-214.

Young, F. N. 1978. The New World species of the water-beetle genus *Notomicrus* (Noteridae). Systematic Entomology, 3: 285-293.

*Suphis**

Genus Diagnosis: Larvae – body globular; *third antennal segment about 12 times as long as fourth segment*; mandibles serrulate.

Adults – small, 3.0-3.5 mm; *body form very broad, hemispherical, most specimens at most 1.5 times as long as wide*; apex of prosternal process rounded; *large curved spine on apex of foretibiae*; angular cilia present on hind femora; *hind coxae separate*; *color opaque black with some irregular reddish maculations on the elytra*.

Habitat: Lentic, found in swamps, often in water of low pH.

Distribution and Occurrence: Most likely coastal though not yet recorded from NC. Possibly in Carolina Bay Lakes.

Species in NC: TAKE TO SPECIES – *inflatus**

Notes: *Suphis inflatus* is the only species in North America. This genus has been recorded from SC. Literature references to NC records (i.e Jasper & Vogtsberger 1996, Nilsson 2006) are based on Brigham (1982) which does not distinguish which state, NC or SC, *Suphis* may actually occur in. There have been no confirmed records of *Suphis* in NC in recent literature.

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Jasper S.K. & Vogtsberger R.C. 1996: First Texas records of five genera of aquatic beetles (Coleoptera: Noteridae, Dytiscidae,Hydrophilidae) with habitat notes. Entomological News 107(1):49-60.

Miller, K. B. 2009. On the systematics of Noteridae (Coleoptera: Adephaga: Hydradephaga): phylogeny, description of a new tribe, genus and species, and survey of female genital morphology. Sytematics and Biodiveristy, 7(2): 191-214.

Nilsson A.N. 2006. A World Catalogue of the Family Noteridae or the Burrowing Water Beetles (Coleoptera, Adephaga). Online Version 16.VII.2006 at http:// www.emg.umu.se/biginst/andersn/WCN/wcn_index.htm

Suphisellus

Genus Diagnosis: Larvae – body cylindriform; *third antennal segment not longer than fourth segment*; mandibles with stout preapical tooth.

Adults – *small, 1.9-3.0 mm*; *body form elongate oval, most specimens about twice as long as wide*; *apical segment of maxillary palpi deeply notched*; apex of prosternal process not wider than long, apex broadly truncate; *large curved spine on apex of foretibiae*; angular cilia present on inside apical edge of hind femora; pronotal color reddish yellow to brownish, elytra darker sometimes with irregular light spots.

Habitat: Slow moving waters such as swamps and backwaters, in decaying matter and among root mats.

Distribution and Occurrence: Primarily a Coastal Plain taxon. Rarely collected.

Species in NC: TAKE TO SPECIES – *(bicolor), gibbulus*, puncticollis*

(S. bicolor) – adult 2.4-2.8 mm; last abdominal sternite impressed longitudinally on either side, more deeply in female; elytra coarsely and densely punctate, faintly microreticulate; dorsal surface reddish yellow and not noticeably bicolorous, elytral barely darker. *Suphisellus bicolor punctipennis* is the subspecies that occurs in NC. Recorded from GSMNP.

*S. gibbulus** – adult 1.9-2.8 mm; last abdominal sternite with either an oval impression near middle or shallow transverse impression basally; elytra coarsely and regularly punctate, faintly microreticulate; pronotum may have faint, obscure medial splotch; dorsal surface shiny, slightly to noticeably bicolored with elytra darker, light brown to reddish brown. Recorded from the Dismal Swamp in VA and from SC.

S. puncticollis – adult 2.7-3.0 mm; pronotum and elytra with close moderately coarse punctures with strongly impressed microreticulations between punctures; pronotum with an anteromedial dark blotch; elytra dark brown to piceous with a submedial transverse band of irregular light spots.

NOTERIDAE

Notes: *Suphisellus* speciation is relatively straightforward although the shallow impressions may be difficult to see given the small size.

Taxonomic references:

larvae and adults:

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Miller, K. B. 2009. On the systematics of Noteridae (Coleoptera: Adephaga: Hydradephaga): phylogeny, description of a new tribe, genus and species, and survey of female genital morphology. Sytematics and Biodiveristy, 7(2): 191-214.

Nilsson A.N. 2006. A World Catalogue of the Family Noteridae or the Burrowing Water Beetles (Coleoptera, Adephaga). Online Version 16.VII.2006 at http:// www.emg.umu.se/biginst/andersn/WCN/wcn_index.htm

Young, F. N. 1979. Water beetles of the genus *Suphisellus* Crotch in the Americas north of Columbia (Coleoptera: Noteridae). The Southeastern Naturalist 24(3): 409-429.

HELOPHORIDAE

FAMILY DIAGNOSIS: Larvae – six stemmata on each side of head, well separated; *labroclypeus symmetrical with median triangular tooth (nasale), with lateral lobes prominent and projecting farther than nasale*; labium without ligula; mandibles symmetrical, each with apical tooth serrate distally and two inner teeth; 4-segmented legs (not including claw); *abdomen with all nine complete segments sclerotized*, segment ten terminal, but distinct; *urogomphi long, 3-segmented*

Adults – small, 2.6-4.5 mm; body elongate; eyes protuberant; *granulate pronotum with seven longitudinal irregular grooves (including lateral grooves)*; elytra with ten coarsely punctate regular striae; head and pronotum dark brown though somewhat metallic, elytra brownish with some punctures darker.

GENERA IN NC: *Helophorus*

NOTES: Previously classified as a subfamily of the Hydrophilidae, Helophoridae is now considered a separate family. It is a monotypic family with *Helophorus* the only genus contained within.

Helophorus

Genus Diagnosis: Larvae – see Family diagnosis.

Adults – see Family diagnosis.

Habitat: Larvae are sub-aquatic and found at the vegetated margins of streams. Adults are aquatic and are found crawling on aquatic vegetation at stream edges.

Distribution and Occurrence: Mountains and Piedmont.

Species in NC: TAKE TO SPECIES – *(linearis), (lineatus), (marginicollis)*

(H. linearis) – adult 2.6-3.8 mm; antennae 8-segmented; maxillary palpomere 4 long, about as long as width of eye dorsally; stem of epicranial suture widened anteriorly; second pronotal interval (on each side) approximately same width throughout though slightly narrower medially; pronotum wider anteriorly than at base. Recorded from GSMNP.

(H. lineatus) – adult 3.0-4.5 mm; antennae 9-segmented; maxillary palpomere 4 shorter than diamerter of eye dorsally; stem of epicranial suture widened anteriorly; width of pronotum anteriorly subequal to width at base. Recorded from GSMNP.

(H. marginicollis) – adult 1.8-3.8 mm; antennae 9-segmented; stem of epicranial suture narrow, not widened anteriorly; second pronotal interval (on each side) about twice as wide anteriorly as at base.

Notes: There are no published records for *Helophorus marginicollis* in NC, although BAU has a reference specimen of this species from the French Broad River (1977). It has been officially recorded from SC, TN, and VA. Photos of *Helophorus* larvae on the BAU server appear to be misidentified as neither the clypeus nor mandibles fit those described for *Helophorus*.

Taxonomic references:

larvae and adults:

- Archangelsky, M. 1997. Studies on the biology, ecology & systematic of the immature stages of the New World Hydrophiloidea (Coleoptera: Staphyliniforma). Ohio Biological Survey Bulletin XII(1). New Series. 207 pp. *Larvae only*
- Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*
- Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

HYDROCHIDAE

FAMILY DIAGNOSIS: Larvae – labroclypeus symmetrical, without prominent nasale; antennae inserted near the anterolateral margin of the head; *mandibles symmetrical, distally serrate and strongly curved and bearing an apical seta*; *mandible with two inner teeth a spinose pseudo-molar region, the basal tooth short and acute, the distal long and slender*; 4-segmented legs (not including claw); abdomen with 8 complete segments sclerotized dorsally and ventrally, *segments 9-10 reduced and modified into a spiracular atrium*; urogomphi long, 3-segmented.

Adults – small, 2.2-6.1 mm; body elongate; *eyes protuberant*; *head and pronotum coarsely and deeply punctate*; *pronotum with 5-7 sulci of varying width and depth, widest in apical third, and with lateral margins crenulate; base of pronotum distinctly narrower than elytral bases*; elytra costate, some may be interrupted, with coarse strial punctures; venter pubescent and covered with large punctures and pits (foveae); body shining between punctures, piceous to reddish brown though somewhat metallic, elytra with costae lighter than striae and sulci; venter rufous to brownish.

GENERA IN NC: *Hydrochus*

NOTES: Previously classified as a subfamily of the Hydrophilidae, Hydrochidae is now considered a separate family. It is a monotypic family with *Hydrochus* the only genus contained within.

Hydrochus

Genus Diagnosis: Larvae – see Family diagnosis.

Adults – see Family diagnosis.

Habitat: Larvae and adults are aquatic and found crawling on aquatic vegetation at the vegetated margins of slow moving waters and swamps.

Distribution and Occurrence: Widespread but primarily Piedmont and Coastal Plain. Uncommon and scarce in number.

Species in NC: LEAVE AT GENUS – *(excavatus), (foveatus), (rufipes), rugosus*, (simplex), (subcupreus), (sp. 2), (sp. 4), (sp. 5), (sp. 6)*

Notes: This genus is in major need of revision. Lack of proper species names, inadequately described species, questionable synonymy, as well as the possibility of undescribed species makes species identification dubious at best. One pseudo-taxonomist (Makhan) has apparently destroyed the systematics of *Hydrochus* through incompetence and malice and, to date, no hydrophilid workers have accepted his revisions due to his publication's poor quality and lack of peer review (Epler, 2010, Jäch 2006). *Hydrochus inaequalis* was synonymized with *H. foveatus* (ITIS) by Hansen (1999).

Taxonomic references:

larvae and adults:

- Archangelsky, M. 1997. Studies on the biology, ecology & systematic of the immature stages of the New World Hydrophiloidea (Coleoptera: Staphyliniforma). Ohio Biological Survey Bulletin XII(1). New Series. 207 pp. *Larvae only*
- Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*
- Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Hansen, M. 1999: World Catalogue of Insects 2: Hydrophiloidea (Coleoptera). – Stenstrup: Apollo Books, 416 pp.

Jäch M.A. 2006. Taxonomy and nomenclature threatened by D. Makhan. Koleopterologische Rundschau 76: p 360.

HYDROPHILIDAE

FAMILY DIAGNOSIS: Larvae – There is considerable variation between the larval forms of the different genera within Hydrophilidae although some morphological characters are shared by most members of this group (unless otherwise noted in the genus diagnoses) and are as follows: head visible from dorsal aspect; body subcylindrical; labrum fused with clypeus; include the presence of a ligula; 5-segmented maxillae palpiform, without galea (or mala) and lacinia, appearing as segment of palpus; if legs present then with four segments and a single claw; 3-segmented biramal antennae spiracles; abdomen typically with eight apparent segments, segments 9 and 10 reduced, with short, 1-segmented urogomphi, if with nine or ten apparent segments then urogomphi long and 2- or 3-segmented.

Adults – very small to moderately large, 1-20 mm; antennae clubbed, three pubescent segments past cupule; maxillary palpi subequal to or longer than antennae; protarsi with five segments; five abdominal sternites, the first not divided by metacoxae.

SUBFAMILIES & GENERA IN NC:

Hydrophilinae – *Anacaena, Berosus, Cymbiodyta, Derallus, Enochrus, Helobata, Helochares, Helocombus, Hydrobiomorpha, Hydrobius, Hydrochara, Hydrophilus, Laccobius, Paracymus, Sperchopsis, Tropisternus*

NOTES: Staphylinidae larvae are similar to hydrophilids (water scavenger beetles) but have a maxillary galea as well as ring shaped spiracles. Archangelsky (1997) refers to hydrophilid larvae as having 5-segmented legs which includes the claw. Additionally, most diagnostic characters for larvae in the identification key center on the ligula, mandibles, and the labroclypeus. Some BAU larval specimens seem to have a combination of characters from several genera (some larvae have sclerotized dorsal plates that differ from the depictions – which may be species specific except in those taxa that are obviously monotypic) so reliance on the ligula, mandibles and the labroclypeus, rather than dorsal sclerotization, is emphasized to maintain internal consistency. Also, larval diagnoses are based on third instar larvae but it should be noted that earlier instars may, for example, differ in number of antennal segments or the shape of labroclypeus.

Subfamily Hydrophilinae

Subfamily Diagnosis: Larvae – All members in this group *lack a hypopharyngeal lobe at the base of the labium* (in contrast to the Sphaeridiinae) but otherwise vary in characters detailed in the family diagnosis.

Adults – very small to large, 1.5-20.0 mm; body shape oval to elongate; *sclerotized labrum*; *long maxillary palpi*; head and pronotum not granulate; dorsal surface typically with only elytral striae and/or punctures; *antennomere 8 typically modified into a cupule*.

Anacaena

Genus Diagnosis: Larvae – *labroclypeus slightly asymmetrical, with four median teeth*; ligula longer than basal segment of labial palpi; basal segment of labium with numerous spines widely distributed; *mandibles symmetrical, with three inner teeth*; front sulci U-shaped; legs developed, short.

Adults – very small, 1.5-3.0 mm; body oval, convex; *fine punctures on dorsal surface not in distinct rows*; apical segment of maxillary palpi much longer than penultimate segment; tarsi pentamerous with first tarsi of middle and hind legs shorter than the second segment; elytra with sutural stria present on apical two-thirds; *mesosternum with transverse arcuate protuberance*; *basal portion of metafemora densely pubescen*t; color darkish overall.

Habitat: Lotic, in pools and on vegetated margins.

Distribution and Occurrence: Widespread but rarely collected.

Species in NC: TAKE TO SPECIES – *(limbata), (suturalis)*

(A. limbata) – adult 2.0-3.0 mm; metafemora with pubescence throughout; metatarsi together shorter than or subequal to metatibia; dorsal color dark brown to fuscous, with lateral margins of pronotum not slightly lighter than discal areas; ventral surface blackish.

(A. suturalis) – adult 1.5-2.0 mm; metafemora with pubescence along lateral margins; metatarsi together longer than metatibia; dorsal color piceous, shiny, with lateral margins of pronotum and elytra yellow.

Notes: *Anacaena* can be easily confused with *Paracymus*. However, *Anacaena* does not have metallic reflections, and the sternal carination is different. The apparent rarity may be associated to the difficulty in collecting this genus due to its very small size. Both species of *Anacaena* have been recorded from GSMNP. The genus *Crenitulus* referred to in some older publications has been synonymized with *Anacaena*.

Taxonomic references:

larvae and adults:

- ⇨Archangelsky, M. 1997. Studies on the biology, ecology & systematic of the immature stages of the New World Hydrophiloidea (Coleoptera: Staphyliniforma). Ohio Biological Survey Bulletin XII(1). New Series. 207 pp. *Larvae only*
- ⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*
- ⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Berosus

Genus Diagnosis: Larvae – *labroclypeus strongly asymmetrical, nasale short with several small teeth*; left lateral lobe (epistome) projecting further than nasale, covering base of left mandible, with several apical spines; *mandibles asymmetrical, different in shape and number of teeth, right mandible with one large distal tooth and 1-2 inner teeth, left with three small irregular basal teeth*; *abdominal segments 1-7 with long, lateral tracheal gills* (4-7 in *Berosus pugnax*), urogomphi reduced.

Adults – very small to small, 2.0-6.5 mm; body sub-oval, convex; coarsely and densely punctate dorsally; elytral striae deeply impressed and coarsely punctate with intervals finely punctate; *eyes protuberant*; *scutellum at least twice as long as wide*; *pronotum not continuous in outline with elytra*; *meso- and metasternum without a ventral keel produced into a posterior spine*; males with pentamerous front tarsi dilated at base; *meso- and meta tibiae and tarsi fringed with long natatory hairs*; pentamerous meso- and metatarsi with basal tarsomere shorter than the second; color yellowish brown to brown, some species with metallic reflections on head; pronotum with two elongate submedial spots sometimes apically removed; elytra with several maculae.

Habitat: Lentic and lotic, in pools and slow waters on vegetation or detritus.

Distribution and Occurrence: Widespread and very common although less so in the mountains.

Species in NC: LEAVE AT GENUS – *(aculeatus), (corrini), (exiguus), (fraternus), (infuscatus), (ordinatus), (pantherinus), (peregrinus), (pugnax), (sayi)*

Notes: Species key to adults in the Southeast appear to work relatively well, however, as larvae are mostly undescribed and they co-occur with adults in BAU samples, it is best to leave *Berosus* at genus. *Berosus striatus* was synonymized with *B. sayi* (Hansen, 1999).

Taxonomic references:

larvae and adults:

- Archangelsky, M. 1994. Description of the immature stages of three Nearctic species of the genus *Berosus* Leach (Coleoptera: Hydrophilidae). Internationale Revue gesamten Hydrobiologie 79(3): 357-372.
- ⇨Archangelsky, M. 1997. Studies on the biology, ecology & systematic of the immature stages of the New World Hydrophiloidea (Coleoptera: Staphyliniforma). Ohio Biological Survey Bulletin XII(1). New Series. 207 pp. *Larvae only*
- ⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*
- ⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..
- Hansen, M. 1999: World Catalogue of Insects 2: Hydrophiloidea (Coleoptera). – Stenstrup: Apollo Books, 416 pp.

Cymbiodyta

Genus Diagnosis: Larvae – *labroclypeus slightly asymmetrical, nasale usually with seven small teeth, with right side projecting further teeth then appearing to be on an angle*, some teeth may be grouped or bifid; *mandibles slightly asymmetrical, two inner teeth at midlength with distal tooth larger and appearing almost truncate, inner margin serrated*; *ligula subequal to or slightly longer than segment one of the labial palpi; sulci irregularly V-shaped;* abdominal segments 1-7 with 3-4 intersegmental folds, each segment with a pair of small, narrow transverse sclerotized plates those on segment 1 larger; segment 8 with a large suboval dorsal plate.

HYDROPHILIDAE

Adults – very small to small, 2.0-6.5 mm; body sub-oval, convex; finely punctate dorsally; *maxillary palpi elongate and slender, shorter than or subequal to width of head, segment 2 (pseudobasal segment) with anterior face (or inside face when extended),* and last segment shorter or subequal to preceding segment; meso- and metasternum not fused into a common keel; mesosternum with a low, transverse ridge mediobasally; *protarsi pentamerous, meso- and meta tarsi tetramerous*; tarsal claws lacking a basal tooth; *each elytron with a sutural stria;* color yellowish brown to black, some with lateral margins lighter.

Habitat: Lentic and lotic, in pools and slow waters on vegetation or detritus.

Distribution and Occurrence: Widespread. Relatively rare.

Species in NC: LEAVE AT GENUS – *(blanchardi), (chamberlaini), (eumera), (rotunda), (semistriata), (vindicata)*

Notes: Coloration and size can be used to separate species. However setation may be difficult to observe and small differences in setation patterns of the hind femur can make speciation difficult. Additionally, some species have multiple color patterns (e.g. *C. chamberlaini*). Larvae can be mistaken for *Helochares* larvae. The ligula drawing in the larval key in Epler (1996) differs from that in Archangelsky (1997) and appears to be slightly too long. The figure was replaced in Epler's recent 2010 edition with Archanelsky's own drawing. *Cymbiodyta* may be more common than data indicates as many larvae are misidentified as *Helocombus* in the BAU database.

Taxonomic references:

larvae and adults:

- Archangelsky, M. 1997. Studies on the biology, ecology & systematic of the immature stages of the New World Hydrophiloidea (Coleoptera: Staphyliniforma). Ohio Biological Survey Bulletin XII(1). New Series. 207 pp. *Larvae only*
- Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*
- Epler, J. H. 1996. Identification Manual for the Water Beetles of Florida (Coleoptera: Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Hydraenidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae). Floridae Department of Environmental Protection, Tallahassee.

Smetana, A. 1974. Revision of the genus *Cymbiodyta* Bed. (Coleoptera: Hydrophilidae). Memoirs of the Entomological Society of Canada 93: 1-113.

Derallus

Genus Diagnosis: Larvae – *labroclypeus symmetrical, nasale short, with many small teeth*; mandibles symmetrical, long and slender, with two inner teeth on basal half, distal tooth larger; *frontal sutures parallel with epicranial suture absent*; *abdominal segments 1-7 with 1-5 pairs of setiferous projections, three laterally and two closer to dorsal midline*.

Adults – very small, 1.5-2.0 mm; body oval, strongly convex; coarsely and densely punctate dorsally; *elytral striae deeply impressed and coarsely punctate*; scutellum longer than wide; prosternum finely carinate between coxae; mesosternum with median longitudinal carina raised posteriorly to a high keel; metasternum sharply carinate medially but not produced a posterior spine; *meso- and metatibiae and tarsi fringed with long natatory setae*; *dorsal color shiny black with coppery reflections.*

Habitat: Lentic and lotic, in ponds and slow moving streams or rivers, occurs on grass and organic debris at edges of standing water.

Distribution and Occurrence: Widespread but rare.

Species in NC: TAKE TO SPECIES – *altus*

Notes: Apparently, larvae of *Derallus* are easily confused with *Tropisternus* larvae as recent NC records of *Derallus altus* have turned out to be misidentifications of *Tropisternus*. The abdominal projections of *Derallus* are much longer and spinier than those of *Tropisternus*. Also, the shape of the sulci and the truncate distal inner tooth of *Tropisternus* should help separate these two genera. Epler (1996) states that the antennae for *Derallus* are uniramal, in direct contradiction to Archangelsky (1997) although Epler (2010) rectified the error.

Taxonomic references:

larvae and adults:

- Archangelsky, M. 1997. Studies on the biology, ecology & systematic of the immature stages of the New World Hydrophiloidea (Coleoptera: Staphyliniforma). Ohio Biological Survey Bulletin XII(1). New Series. 207 pp. *Larvae only*
- Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*
- Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Hansen, M. 1999: World Catalogue of Insects 2: Hydrophiloidea (Coleoptera). – Stenstrup: Apollo Books, 416 pp.

Enochrus

Genus Diagnosis: Larvae – *labroclypeus slightly asymmetrical with left side lower than right side, nasale usually with a row of six or seven irregular teeth*, some may be grouped or bifid; epistome also asymmetrical with left side usually truncate and right side pointed (may appear to be last tooth on labroclypeus); *mandibles strongly asymmetrical, left with two inner teeth, right with one inner tooth at midlength, distal margins serrated*; *sternites 2-, 3-7 each with pair prominent tubercles with curved spines on ventral surface;* tergites 1-7 with 3-4 intersegmental folds, segment one with a pair of narrow, transverse sclerotized plates; segment 8 with a large suboval dorsal plate.

Adults – small to moderate, 2.2-8.2 mm; body sub-oval, convex; finely punctate dorsally; *maxillary palpi elongate and slender, longer than antennae, with posterior face (or outside face when extended) of segment 2 (pseudobasal segment) concave*, and with last segment shorter or subequal to preceding segment; meso- and metasternum not fused into a common keel although mesosternum has a mesal, longitudinal crest; meso- and meta tarsi pentamerous; *each elytron with a sutural row of coarse deeply impressed punctures, disjunct in basal fifth, some darkened punctures in longitudinal series, with intervals wide;* color yellowish brown to black, some with lateral margins lighter.

Habitat: Lentic and lotic, in pools and slow waters on vegetation or detritus.

Distribution and Occurrence: Widespread. Commonly collected.

Species in NC: TAKE TO SPECIES – *(blatchleyi), (cinctus), (consors), (consortus), (fimbriatus), (hamiltoni), (interruptus), ochraceus, (pygmaeus), (reflexipennis), sayi, (sublongus)*

(E. blatchleyi) – adult 3.0-4.4 mm; prosternum not carinate; apex of sternite 5 deeply and distinctly emarginate; mesosternal crest large, notched but not undercut at posterior base; dorsal surface yellow to brown, ventral surface piceous.

(E. cinctus) – adult 4.9-7.5 mm; strongly convex in cross section; apex of sternite 5 deeply emarginate; mesosternal crest undercut at posterior edge; body very dark to black, dorsally and ventrally.

(E. consors) – adult 6.8-8.2 mm; palpi piceous; medial area of clypeal emargination straight; apex of sternite 5 emarginate; mesosternal crest large, slightly toothed anteriorly; body very dark to black.

(E. consortus) – adult 6.0-7.6 mm; palpi yellow to brown with palpomere 2 darkened; medial area of clypeal emargination rounded; apex of sternite 5 emarginate; body very dark to black with margins of pronotum and elytra yellowish to brown.

(E. fimbriatus) – adult 4.2-6.0mm; weakly convex in cross section; apex of sternite 5 very shallowly and widely emarginate, stiff golden setae may be most apparent; mesosternal crest with a few setae, with posterior edge roughened; body very dark to black with lateral margins of pronotum and elytra slightly paler. *Enochrus perplexus* is a junior synonym of *Enochrus fimbriatus* (Hansen, 1999).

(E. hamiltoni) – adult 4.3-6.1 mm; apex of sternite 5 not emarginate, smoothly rounded; posterior edge of elytra normal, not reflexed (subapical area convex in lateral view); body yellow with dark pronotal medial spot to piceous with lateral margins yellow, ventral surface dark to piceous.

(E. interruptus) – adult 4.8-6.0 mm; weakly convex in cross section; apex of sternite 5 shallowly but distinctly emarginate; mesosternal crest without setae, with posterior edge smooth; body very dark to black, except corners of clypeus and margins of pronotum and elytra.

E. ochraceus – adult 2.5-4.0 mm; apex of sternite 5 with moderate to large but deep emargination; mesosternal crest small and rounded, without posterior tooth; head mostly black with remainder of dorsal surface yellowish to brown, ventral surface mostly yellowish to brownish with epipleuron mostly darkened. Probably the most common species of *Enochrus* in NC.

(E. pygmaeus) – adult 3.4-4.2 mm; prosternum carinate; apex of sternite 5 deeply emarginate; mesosternal crest large and acutely triangular; epipleuron and prosternum dark; ventral surface piceous.

(E. reflexipennis) – adult 3.4-5.0 mm; apex of sternite 5 not emarginate, smoothly rounded; posterior edge of elytra reflexed (subapical area concave in lateral view) and expanded; body totally yellow.

E. sayi – adult 3.5-4.1 mm; prosternum carinate; apex of sternite 5 deeply emarginate; mesosternal crest large with an anterior tooth and with posterior hump; epipleuron pale except for medial edge; head dark, pronotum and elytral yellow to brown, ventral surface piceous.

(E. sublongus) – adult 2.2-2.7 mm; apex of sternite 5 with very small but deep emargination; mesosternal crest small and rounded, without posterior tooth; epipleuron pale; dorsal and ventral surfaces yellowish.

Notes: The key to *Enochrus* adults in Ciegler (2003) is straightforward, although the figures can be confusing. See Epler (2010) for photos and better drawings. Larvae are not separable to species.

Taxonomic references:

larvae and adults:

- Archangelsky, M. 1997. Studies on the biology, ecology & systematic of the immature stages of the New World Hydrophiloidea (Coleoptera: Staphyliniforma). Ohio Biological Survey Bulletin XII(1). New Series. 207 pp. *Larvae only*
- Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*
- Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Hansen, M. 1999: World Catalogue of Insects 2: Hydrophiloidea (Coleoptera). – Stenstrup: Apollo Books, 416 pp.

Helobata

Genus Diagnosis: Larvae – *labroclypeus symmetrical, nasale absent, appearing as a large medial notch; mandibles symmetrical, two inner teeth with distal tooth larger, teeth separated and strongly serrate both in between and distally;* maxillae large with segment 1 swollen; ligula shorter than segment 1 of the labial palpi; abdomen tapered overall; segments 1-8 divided by a transverse fold and bearing a lateral tubercle with a long apical seta, segment 8 with a large irregular dorsal plate with four lobes on caudal margin.

Adults – small, 4-6 mm; body sub-oval, convex; finely punctate dorsally (obsolete on elytral intervals); *maxillary palpi elongate and slender, longer than antennae, with posterior face (or outside face when extended) of segment 2 (pseudobasal segment) concave*, and with last segment shorter or subequal to preceding segment; meso- and metasternum not fused into a common keel although mesosternum has a medial, longitudinal crest; meso- and metatarsi tetramerous; *each elytron with a sutural row of coarse, deeply impressed punctures, disjunct in basal fifth, some darkened punctures in longitudinal series, with intervals wide;* color yellowish brown to black, some with lateral margins lighter.

Habitat: Primarily lentic, though also in slow lotic waters. Found on surfaces of submerged vegetation, especially woody debris. *Helobata* is also associated with the emergent aquatic macrophyte *Pontederia* (pickerelweed).

Distribution and Occurrence: Mostly Coastal Plain. Rarely collected.

Species in NC: TAKE TO SPECIES – *larvalis*

Notes: *Helobata larvalis* (formerly *H. striata*) is the only species north of Mexico. These beetles are often well affixed to surfaces much like limpets and can be difficult to remove.

Taxonomic references:

larvae and adults:

- Archangelsky, M. 1997. Studies on the biology, ecology & systematic of the immature stages of the New World Hydrophiloidea (Coleoptera: Staphyliniforma). Ohio Biological Survey Bulletin XII(1). New Series. 207 pp. *Larvae only*
- Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*
- Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Helochares

Genus Diagnosis: Larvae – *labroclypeus asymmetrical, nasale with 5-7 small teeth, two teeth on right larger; mandibles symmetrical to slightly asymmetrical, two inner teeth distal tooth noticeably larger on left mandible, serrate distally*; *ligula long and slender, slightly shorter than segment 2 of the labial palpi*; abdominal segments 1-7 divided by 3-4 transverse folds and bearing small tubercles, segment 8 with a large suboval dorsal plate with four small lobes on caudal margin.

Adults – small, 5.0-6.0 mm; body oblong oval; finely punctate dorsally; *maxillary palpi elongate and slender, longer than antennae, segment 2 (pseudobasal segment) with anterior face (or inside face when extended) concave*, and last segment shorter than preceding segment; clypeus large extended over insertion of antennae but labrum exposed, mesosternum with a small median tubercle; meso- and metasternum not fused into a common keel; *tarsi tetramerous*; *elytron with ten punctate striae*; dorsally brown to piceous (pronotum may have a dark spot), ventrally piceous, except tibiae and tarsi pale.

Habitat: Lentic and lotic. In emergent vegetation at edges.

Distribution and Occurrence: Widespread. Rarely collected.

Species in NC: TAKE TO SPECIES – *maculicollis*

Notes: *Helochares maculicollis* is the only species in North Carolina. *Helochares* larvae can be confused with *Cymbiodyta* larvae but the longer ligula of *Helochares* should separate these two taxa.

Taxonomic references:

larvae and adults:

- Archangelsky, M. 1997. Studies on the biology, ecology & systematic of the immature stages of the New World Hydrophiloidea (Coleoptera: Staphyliniforma). Ohio Biological Survey Bulletin XII(1). New Series. 207 pp. *Larvae only*
- Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*
- Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Helocombus

Genus Diagnosis: Larvae (instar I) – *labroclypeus slightly asymmetrical, nasale with several small, uneven teeth in between two strong teeth on each side*; *mandibles symmetrical, two inner teeth at midlength with distal tooth larger, inner margin serrated*; *ligula subequal to segment one of the labial palpi*; *sulci U-shaped*; segment 8 with a large suboval dorsal plate with emargination caudally.

Adults – moderately small, 5.8-7.6 mm; body sub-oval, convex; moderately punctate dorsally; *maxillary palpi elongate and slender, longer than antennae and width of head, segment 2 (pseudobasal segment) with anterior face (or inside face when extended) concave*, and last segment shorter then preceding segment; *prosternum carinate between coxae*; mesosternum with short conical medial tubercle; meso- and metasternum not fused into a common keel; *protarsi pentamerous, meso- and meta tarsi tetramerous*; tarsal claws with basal tooth; *elytra with ten distinct striae, striae 1-3 not extended to base;* color dark brown to black, with lateral margins lighter.

Habitat: In ponds, pools, and slow waters on vegetation or detritus.

Distribution and Occurrence: Widespread. Rarely collected.

Species in NC: MONOTYPIC – *bifidus*

Notes: Adult *Helocombus bifidus* can be confused with *Hydrobius fuscipes*. Also, *Helocombus* larvae can be mistaken for *Cymbiodyta* larvae unless care is taken. Reference specimen (adult) in poor condition.

Taxonomic references:

larvae and adults:

- Archangelsky, M. 1997. Studies on the biology, ecology & systematic of the immature stages of the New World Hydrophiloidea (Coleoptera: Staphyliniforma). Ohio Biological Survey Bulletin XII(1). New Series. 207 pp. *Larvae only*
- Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*
- Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Hydrobiomorpha

Genus Diagnosis: Larvae – *labroclypeus slightly asymmetrical, nasale obliquely truncate with left side shorter than right side, with five inconspicuous teeth*, lateral lobes of epistome rounded projecting further than nasale; mandibles mostly symmetrical, long sharply pointed, with three inner teeth on basal half, distal tooth larger; *ligula approximately twice as long as first palpal segment and with apex shallowly bifid*; *antennae uniramal*; sulci V-shaped; segment 8 with small suboval plate divided into 4 lobes caudally, with a pair of long procerci on either side of tergal plate; *segment 9 bears two long ventrolateral gills and two long, subterminal paracerci*.

Adults – moderately large, 13-17 mm; body oval, narrowed anteriorly; finely punctate dorsally, elytra with four rows of larger punctures; *clypeus medially emarginate exposing articulation of the labrum*; *antennomeres 6 and 7 asymmetrical, with 7 deeply cleft into two lobes and bearing long, yellow setae*; *prosternum carinate with a moderately long posteriorly directed spine*; mesosternal keel with posteriorly directed spine not exceeding first abdominal sternite; *meso- and metatarsi pentamerous*; *dorsal color shiny black, with elytra lateral margins narrowly rufous, ventral surface rufous.*

Habitat: Lentic, in ponds and swamps, occurs on vegetation.

Distribution and Occurrence: Coastal Plain. Rarely collected.

Species in NC: TAKE TO SPECIES – *casta*

Notes: *Hydorbiomorpha casta* is the only species in the United States. Photos of *Hydrobiomorpha casta* on the BAU server are actually *Hydrochara*.

Taxonomic references:

larvae and adults:

- Archangelsky, M. 1997. Studies on the biology, ecology & systematic of the immature stages of the New World Hydrophiloidea (Coleoptera: Staphyliniforma). Ohio Biological Survey Bulletin XII(1). New Series. 207 pp. *Larvae only*
- Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*
- Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Hydrobius

Genus Diagnosis: Larvae – *labroclypeus asymmetrical, nasale with five subequal teeth, those on right protruding further; mandibles symmetrical, three inner teeth with two distal teeth subequal, and much larger than basal tooth;* ligula long and slender, approximately twice the length of segment 1 of the labial palpi; *antennae apparently uniramal, sensorium reduced*; sulci irregularly V-shaped; *prosternum with a mesal fracture*; segments 1-7 divided into transverse folds and bearing small sclerotized round patches and 2-4 small tubercles, segment 8 with a larger dorsal plate with a basal emargination.

Adults – small to moderate, 5.4-8.2 mm; body oval, convex; finely and densly punctate dorsally; maxillary palpi short, last segment longer than the preceding segment; meso- and metasternum not fused into a common keel; tarsi pentamerous; a dorsomedial fringe of natatory setae on mid and hind tarsal segments; *elytra with ten deeply impressed striae or ten longitudinal rows of moderately coarse punctures, with intervals wide;* color dark brown to black, some with metallic reflections.

Habitat: Lentic on emergent vegetation, though also in streams under rocks or logs at margins.

Distribution and Occurrence: Mostly Coastal Plain. Uncommon.

Species in NC: TAKE TO SPECIES – *(fuscipes), melaenus, (tumidus)*

(H. fuscipes) – adult 5.4-8.0 mm; antennomere 4 darkened apically; elytra with ten distinctly impressed punctate striae; elytra may be paler laterally; dorsal color blackish with faint metallic reflections. Recorded from GSMNP.

H. melaenus – adult 6.8-8.2 mm; antennal club darker than rest of antennomeres; mesosternum with prominent diamond-shaped tubercle; metafemora densely punctate and setose along base and upper margin; elytra with 10 rows of punctures, not impressed; dorsal color blackish with faint metallic (greenish) reflections.

(H. tumidus) – adult 6.0-8.0 mm; prosternum faintly carinate and with an acute elevation at anterior margin; mesosternum with prominent slender and acute crest; metafemora densely punctate along base; elytra with ten rows of punctures, not impressed; dorsal color blackish with bronze reflections.

Notes: Outwardly, the larva of *Hydrobius* is very similar to *Sperchopsis tessalata*, but the median tooth on the labroclypeus is subequal to the other teeth in *Hydrobius* and reduced in *Sperchopsis.*

Taxonomic references:

larvae and adults:

- Archangelsky, M. 1997. Studies on the biology, ecology & systematic of the immature stages of the New World Hydrophiloidea (Coleoptera: Staphyliniforma). Ohio Biological Survey Bulletin XII(1). New Series. 207 pp. *Larvae only*
- Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*
- Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Hydrochara

Genus Diagnosis: Larvae – head wider at anterior end; *labroclypeus mostly symmetrical, nasale slightly projected with a few small inconspicuous teeth*; mandibles mostly symmetrical, long and sharply pointed, with two inner teeth, distal tooth larger and basal tooth sometime truncate or shallowly bifid; *ligula more than twice as long as first palpal*; *submentum wider at base with 2-3 denticles laterally (appearing serrate) and pointed anterolaterally; antennae uniramal*; sulci irregularly V-shaped; *segments 1-7 each bearing a pair of pubescent lateral gills*; segment 8 with small subquadrate plate divided into four lobes caudally; *segment nine bears two long ventrolateral gills*; urogomphi 2-segmented (difficult to see).

HYDROPHILIDAE

Adults – moderate to large, 12-20 mm; body oval, narrowed anteriorly; finely punctate dorsally; *clypeus truncate not exposing labral articulation*; *antennomeres 6 and 7 slightly asymmetrical without long setae*; *prosternum carinate with a small posterior tooth*; mesosternal keel with posteriorly directed spine not or barely exceeding metacoxae; *meso- and metatarsi pentamerous, laterally compressed and fringed with natatory setae*; pronotum irregularly punctate, elytra with several longitudinal series of punctures, 4 rows of larger punctures, some double; rows often obsolete; *dorsal color dark with greenish reflections (black out of ethanol)*, ventral surface rufopiceous to black.

Habitat: Prefer standing waters and swamps but may be in streams at margins or in backwater pools.

Distribution and Occurrence: Coastal Plain. Rarely collected.

Species in NC: TAKE TO SPECIES – *(brevipalpus), (occulta), soror, (spangleri)*

(H. brevipalpus) – adult 16-20 mm; maxillary palpi distinctly shorter than width of clypeus at anterior margin of eyes, palpomere 4 apically darkened; sternal keel robust, metasternal keel slightly widened.

(H. occulta) – adult 12-17 mm; metasternal keel distinctly dilated, twice the width of mesosternal keel at widest point.

H. soror – adult 14-19 mm; maxillary palpomere 3 no more than 1.3 times the length of palpomere 4; palpomere 4 apically darkened (sometimes barely); metasternal keel not or barely dilated, no more than 1.5 times the width of mesosternal keel at widest point, with a shallow medial groove; ventral surface rufopiceous to piceous. Recorded from GSMNP.

(H. spangleri) – adult 12-18 mm; maxillary palpomere 3 at least 1.5 times the length of palpomere 4; palpomere 4 pale throughout; metasternal keel not or barely dilated, no more than 1.5 times the width of mesosternal keel at widest point; ventral surface pale.

Notes: Adults of this genus are easily confused with *Hydrobiomorpha*. The labral emargination present in both taxa can be confused for the clypeal emargination which is present only in *Hydrobiomorpha* thereby resulting in misidentifications. Epler (2010) has a good comparison of the antennal characters between these two similar taxa within his key. Additionally, *Hydrochara obtusata* previously referred to a complex of species which were split by Smetana (1980) who described the true *H. obtusata* as being a northern genus. Therefore, BAU records of *Hydrochara obtusa* (a misspelling of *H. obtusata*) are likely misidentifications of other *Hydrochara* species.

Taxonomic references:

larvae and adults:

⇨Archangelsky, M. 1997. Studies on the biology, ecology & systematic of the immature stages of the New World Hydrophiloidea (Coleoptera: Staphyliniforma). Ohio Biological Survey Bulletin XII(1). New Series. 207 pp. *Larvae only*

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Matta, J. F. 1982. The bionomics of two species of *Hydrochara* (Coleoptera: Hydrophilidae) with descriptions of their larvae. Preceedings of the Entomological Society of Washington 84(3): 461-467.

Smetana, A. 1980. Revision of the genus *Hydrochara* berth (Coleoptera: Hydrophilidae). Memoirs of the Entomological Society of Canada 111: 1-100.

Hydrophilus

Genus Diagnosis: Larvae – *labroclypeus slightly asymmetrical, nasale undeveloped, without teeth though may have medial rounded protuberances*; lateral lobes of epistome rounded to pointed, usually projecting further than nasale; *mandibles asymmetrical, right mandible longer and more slender with bifid inner tooth on basal half (with deep notch in H. ovatus), left mandible shorter with one small inner tooth or concavity on basal half*; *ligula short slightly shorter than first palpal segment*; *antennae uniramal, with 4 segments*; sulci U-shaped; segments 1-7 with small lateral and sublateral tubercles (setiferous in *H. ovatus*); segment 8 elongate and with either a subquadrate plate or 2 small subtriangular plates dorsally; *segment nine bears two long ventromedial gills (except in H. ovatus).*

Adults – *large, 30-40 mm*; body ovate, moderately convex to convex; impunctate dorsally; *prosternum at least cleft posteromedially to receive apex of mesosternum, may be completely bifurcated*; sternal keel with posteriorly directed spine exceeding metacoxae; dorsal color dark greenish black, ventrally black, appendages paler.

Habitat: Primarily lentic, in deeply submerged vegetation.

Distribution and Occurrence: Coastal Plain and Piedmont. Rarely collected.

Species in NC: TAKE TO SPECIES – *(ovatus), triangularis*

(H. ovatus) – larvae with left mandible with concavity instead of tooth; pronotum mostly sclerotized with plates meeting along their entire length; with small, lateral setiferous tubercles on abdominal segments 1-7. Adult 30-35 mm; elytra with microsculpture of tiny cracks (alutaceous); prosternum completely cleft medially so anterior apex of mesosternal keel contacts base of head; elytra with three rows of indistinct punctures. The larvae of this species are specialized in feeding on snails (evidenced by the notched right mandible).

H. triangularis – larvae with left mandible with small tooth; pronotum only partially sclerotized with plates meeting medially; small lateral and sublateral tubercles on abdominal segments 1-7. Adult 32-40 mm; prosternum cleft posteriorly only, mesosternal keel contacts anterior hood of prosternum and not the head; each abdominal sterna with a triangular, densely setose area laterally; elytra with three rows of distinct punctures.

Notes: These are the largest hydrophilids and may even be largest water beetles in North Carolina. Speciation is relatively easy with both larvae and adults. There is some controversy with *Hydrophilus ovatus* as it was previously known as *Dibolocelus ovatus* but was downgraded to subgeneric status by Hanson (1991). However, many hydrophilid experts still recognize *Dibolocelus* as a valid genus (e.g. Archangelsky 1997; White and Roughley, 2008). It appears that the subgeneric status is slowly gaining acceptance as ITIS and other institutions around the US have been classifying *Dibolocelus ovatus* as *Hydrophilus (Dibolocelus) ovatus*, including Epler (2010). The NC BAU is currently following Hanson's classification until a resolution is reached.

Taxonomic references:

larvae and adults:

⇨Archangelsky, M. 1997. Studies on the biology, ecology & systematic of the immature stages of the New World Hydrophiloidea (Coleoptera: Staphyliniforma). Ohio Biological Survey Bulletin XII(1). New Series. 207 pp. *Larvae only*

⇨Ciegler, J. C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

White, D. S. and R. E. Roughley. 2008. Aquatic Coleoptera, Chapter 20 (100 pp). In Merritt, R. W., Cummins K. W., and M. B. Berg (editors). *An Introduction to Aquatic Insects of North America*. 4th Edition Kendall Hunt, Dubuque.

Laccobius

Genus Diagnosis: Larvae – labroclypeus asymmetrical with left side of epistome large and covering basal third of left mandible; *mandibles strongly asymmetrical*, left with 2-3 inner teeth, right with two inner teeth which are larger than teeth on left mandible, distal margins slightly serrated; antennae biramal; *ligula absent*; *frontal sutures subparallel to parallel (lyriform) with epicranial suture absent*; tergites 1-7 with 3-4 intersegmental folds, with a pairs of small, round sclerotized plates on anterior fold and four tubercles on median fold; segment 8 with a large subcircular dorsal plate.

Adults – very small to small, 2.3-3.8 mm; body oval, convex; densely punctate dorsally; antenna short with eight antennomeres; scutellum slightly longer than wide; pronotum mostly continuous in outline with elytra; *meso- and meta tibiae without long natatory hairs (tarsi WITH hairs)*; pentamerous tarsi with basal tarsomere shorter than the second; males with front tarsi 2 and 3 dilated; *six visible abdominal sterna; elytra with many rows (>20) of dark punctures in longitudinal series*, lacking sutural striae; color yellowish brown to brown with metallic reflections, pronotum with disc dark with irregular outline and lateral margins pale, ventral surface piceous with yellow to brown legs and epipleuron.

Habitat: Lentic and lotic. In small streams and pond margins, often in sand.

Distribution and Occurrence: Widespread and relatively commen.

Species in NC: TAKE TO SPECIES – *agilis, (minutoides), reflexipenis*

L. agilis – adult 2.4-3.8 mm; most punctures of elytra in irregular rows, of different sizes and not spaced equally, with additional small punctures between rows (especially near scutellum); pale margin of pronotum narrow; head piceous; dorsal surface yellow to gray with dark punctures and dark spots, legs brownish.

(L. minutoides) – adult 2.3-3.2 mm; body short and broad; most punctures of elytra regular, of same size and equally spaced; pale margin of pronotum wide; head piceous with metallic reflections, with small pale spot anterior to but not reaching eye; dorsal surface yellow with larger dark punctures and indistinct dark spots, venter brownish with yellowish legs.

L. reflexipenis – adult 2.3-3.4 mm; most punctures of elytra in moderately regular rows, of different sizes and not spaced equally, with additional small punctures between rows (especially near scutellum); pale margin of pronotum narrow; head piceous to bronzy green with small pale spot anterior to eye; dorsal surface yellow with smaller dark punctures and area around punctures infuscate, ventral surface piceous with yellow epipleuron and legs, coxae darker.

Notes: The key to *Laccobius* in Ciegler (2003) is straightforward. Larvae are not separable to species.

Taxonomic references:

larvae and adults:

- Archangelsky, M. 1997. Studies on the biology, ecology & systematic of the immature stages of the New World Hydrophiloidea (Coleoptera: Staphyliniforma). Ohio Biological Survey Bulletin XII(1). New Series. 207 pp. *Larvae only*
- Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Malcolm, S.E. 1979. Two new species of *Laccobius* from eastern North America (Coleoptera: Hydrophilidae). New York Entomo. Society 87(1): 59-65.

Paracymus

Genus Diagnosis: Larvae – 1-segmented ligula longer than basal segment of labial palpi; *labroclypeus slightly asymmetrical, with four strong median teeth*; *mandibles symmetrical, with three inner teeth, distal two larger*; basal segment of labium with only a few large medial spines; *front sulci reaching occipital foramen wide apart (lyriform).*

Adults – very small, 1.5-2.1 mm; body oval, convex; tarsi pentamerous with first tarsi of middle and hind legs shorter than the second segment; *fine punctures on dorsal surface not in distinct rows*; apical segment of maxillary palpi much longer than penultimate segment; elytra with sutural stria present on apical half; *prosternum longitudinally carinate*; *mesosternal with transverse pyramidal protuberance with longitudinal ridge posterior*; hind femur sparsely pubescent; *color dark overall typically with greenish or olive metallic reflectance.*

Habitat: Prefer sand-bottomed ponds but may be in slow flowing sandy streams. Associated with emergent vegetation.

Distribution and Occurrence: Widespread but rarely collected.

Species in NC: LEAVE AT GENUS – *(confusus), (dispersus), (nanus), (subcupreus)*

Notes: Separation of *Paracymus* species is difficult due to its small size and relies heavily on the shape of the male aedeagus. *Paracymus* can easily be confused with *Anacaena*. However, *Anacaena* does not have metallic reflections and the sternal carination is different. The description in Epler (1996) concerning the larval mandible having only two inner teeth is erroneous but has been corrected in Epler, 2010. The apparent rarity of this taxon may be associated to the difficulty in collecting this genus due to its very small size.

Taxonomic references:

larvae and adults:

- Archangelsky, M. 1997. Studies on the biology, ecology & systematic of the immature stages of the New World Hydrophiloidea (Coleoptera: Staphyliniforma). Ohio Biological Survey Bulletin XII(1). New Series. 207 pp. *larvae only*
- Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *adults only*
- Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Sperchopsis

Genus Diagnosis: Larvae – *labroclypeus symmetrical, nasale with five teeth medial tooth reduced; mandibles symmetrical, three inner teeth with two distal teeth subequal, and much larger than basal tooth;* ligula very long and slender, subequal to segment 2 of the labial palpi; *antennae apparently uniramal, sensorium reduced*; sulci irregularly V-shaped; prosternal plate entire; segments 1-7 divided into transverse folds, conical laterally, and bearing transverse rows of small setose tubercles; segment 8 with a larger dorsal plate with an apical emargination.

Adults – moderate, 6.0-7.5 mm; body broadly oval, *strongly convex; clypeus deeply emarginate*; last segment of maxillary palpi longer than the preceding segment; anterior margin of pronotum sinuate with anterolateral margins almost lobate; outline strongly discontinuous; *lateral margins of pronotum and elytra serrate;* tarsi tetramerous; legs lacking natatory setae; punctation of pronotum coarse, confused; elytra with ten seriate rows of punctures, *intervals raised with interval 2 keeled at apex, intervals 3- 4 keeled basomedially*; color reddish brown, elytra darker with a vaguely triangular pale area in basal quarter with apex terminating medially, venter and legs reddish brown.

Habitat: Lotic. In swift, sandy, gravelly streams, among leafpacks and detritus in undercut banks.

Distribution and Occurrence: Widespread. A very common hydrophilid in NC.

Species in NC: MONOTYPIC – *tesselata*

Notes: The adult of this species is unique in appearance among the hydrophilids in North Carolina making identification easy. However, the larva of *Sperchopsis tesselata* is outwardly very similar to *Hydrobius*. The median tooth on the labroclypeus is reduced in *Sperchopsis* larvae but similar in size to the other teeth in *Hydrobius*.

Taxonomic references:

larvae and adults:

- ⇨Archangelsky, M. 1997. Studies on the biology, ecology & systematic of the immature stages of the New World Hydrophiloidea (Coleoptera: Staphyliniforma). Ohio Biological Survey Bulletin XII(1). New Series. 207 pp. *Larvae only*
- ⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*
- ⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Tropisternus

Genus Diagnosis: Larvae – *labroclypeus symmetrical to slightly asymmetrical, nasale not prominant, with 5-7 short teeth*; lateral lobes of epistome rounded, subequal to nasale; *mandibles slightly asymmetrical and sharply pointed, right mandible with three teeth on basal half, two small teeth on side of groove and one large distal tooth which is truncate or bifid apically, left mandible similar but without groove;* ligula long, slightly shorter than second palpal segment; antennae long, uniramal; sulci V-shaped; pronotum entirely sclerotized; posterior fold of *segments 1-7 with a transverse row of short, apically setose tubercles (some may be longer);* legs long; body typically pigmented.

Adults – medium, 7-12 mm; body ovate, moderately convex; finely punctate dorsally; maxillary palpomere 4 subequal to or longer than palpomere 3; *prosternum deeply cleft posteromedially either partially or completely to receive apex of mesosternum; sternal keel with posteriorly directed spine extending at least to second abdominal segment;* tarsi pentamerous; elytra with seriate punctures; dorsal color dark greenish black with metallic reflections, ventrally brown to piceous, appendages sometimes paler.

Habitat: Lentic and lotic, in dense vegetation.

Distribution and Occurrence: Widespread. This is the most commonly encountered hydrophilid in NC.

Species in NC: TAKE TO SPECIES – *blatchleyi, collaris, glaber*, (lateralis), mixtus*, natator, (quadristriatus)*

T. blatchleyi – adult 7.0-10.5 mm; prosternum only partially cleft and closed anteriorly; densely pubescent area of metafemur sub-triangular to trapezoidal, larger and extending past the apex of the trochanters to cover about a third of the femur, distal margin curved; elytra finely and finely punctate with some larger seriate punctures near suture; pronotum and elytra completely dark, metallic greenish, unpatterned; legs mostly brownish to piceous with basal half of femora piceous and apex lighter and tibae with a pale median band. *Tropisternus b. blatchleyi* is the only southern subspecies.

T. collaris – adult 7-11 mm; prosternum completely cleft into 2 lobes; pronotum and elytra with a pale yellow margin and with darker, narrow vittae giving the appearance of longitudinal dark greenish stripes; venter brown to piceous, legs lighter yellow to reddish brown with apical two thirds of femora paler than rest of legs.

*T. glaber** – adult 8.5-10.5 mm; densely pubescent area of metafemur sub-triangular, smaller and barely extending past the apex of the trochanters to cover less than a quarter of the femur; prosternum only partially cleft and closed anteriorly; mesosternal keel narrow, barely wider than metasternal keel, finely punctate apically and slightly convex; pronotum and elytra completely dark metallic green, unpatterned; venter brownish to piceous, femora blackish with apex light; legs mostly reddish

(T. lateralis) – adult 8-10 mm; prosternum only partially cleft and closed anteriorly; elytra with seriate punctures fine, intervals 3 and 5 with larger distant punctures bearing 2-5 setae; pronotum and elytra with a narrow pale border; dorsal color dark metallic green; venter brown with pale legs, tarsi darkened. *Tropisternus l. nimbatus* is the only subspecies to occur east of the Rocky Mountains.

*T. mixtus** – adult 8.0-9.5 mm; prosternum only partially cleft and closed anteriorly; densely pubescent area of metafemur sub-triangular to trapezoidal, larger and extending past the apex of the trochanters to cover about a third of the femur; elytra with dual punctation (not including seriate punctures) and appearing somewhat rugose at base; pronotum and elytra completely dark, metallic greenish, unpatterned; legs mostly reddish with femora bicolored with apex lighter.

T. natator – adult 8.5-12.0 mm; densely pubescent area of metafemur triangular, smaller and barely extending past the apex of the trochanters to cover less than a fifth of the femur; prosternum only partially cleft and closed anteriorly; mesosternal keel noticeably wider than metasternal keel, coarsely punctate apically and flat to slightly sulcate; pronotum and elytra completely dark metallic green, unpatterned; venter piceous, femora blackish with apex light; legs mostly piceous

(T. quadristriatus) – adult 8.5-10.5 mm; prosternum only partially cleft and closed anteriorly; densely pubescent area of metafemur trapezoidal, larger and extending past the apex of the trochanters to cover about a third or more of the femur, distal margin mostly straight; elytra finely and finely punctate with some larger seriate punctures near suture; pronotum and elytra completely dark, metallic greenish, unpatterned; legs mostly brownish with pale apex of femora extending to pubescent area, tibiae paler. Primarily a brackish water species, *Tropisternus q. quadristriatus* is the subspecies occurring in NC.

Notes: *Tropisternus* larvae can be confused with *Derallus* larvae (see *Derallus* notes). Commonly encountered North Carolina species, *Tropisternus blatchleyi*, *T. collaris,* and *T. lateralis* are readily separated from each other using dorsal coloration. *Tropisternus glaber* may be confused with *T. natator* (which has been recorded from GSMNP) and *T. mixtus* with *T. blatchleyi*. Occurrences of *Tropisternus glaber* and *T. mixtus* in North Carolina may have been reported in error (Brigham 1982).

Taxonomic references:

larvae and adults:

⇨Archangelsky, M. 1997. Studies on the biology, ecology & systematic of the immature stages of the New World Hydrophiloidea (Coleoptera: Staphyliniforma). Ohio Biological Survey Bulletin XII(1). New Series. 207 pp. *Larvae only*

Brigham, W. U. 1982. Aquatic Coleoptera, Chapter 10 (136 pp.). In A.R. Brigham, W. U. Brigham, and A. Gnilka, editors. *Aquatic Insects and Oligochaetes of North and South Carolina.* Midwest Aquatic Enterprises, Mahomet, Illinois. 837pp

⇨Ciegler, J. C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

P S E P H E N I D A E

Family Diagnosis: Larvae – body oval to circular, dorsoventrally flattened; thoracic and abdominal segments greatly expanded laterally concealing head and legs from the dorsal aspect.

Adults – terrestrial. Small to medium, 3-6 mm; body broad, wedge-shaped, widest near apex of elytra (except *Dicranopselaphus* which is widest at the middle); body dorsoventrally flattened and soft-bodied; mandibles concealed; filiform antennae with eleven segments; procoxae transverse; pentamerous tarsi.

Genera in NC: *Dicranopselaphus, Ectopria, Psephenus*

Notes: Water pennies (*Psephenus*) and false water pennies (*Ectopria*) are ubiquitous in cleaner North Carolina streams and often dominate the benthic biomass in riffle habitats. Larval psepehids exhibit thigmokinesis, the inhibition of movement in response to contact stimuli. Adults are terrestrial and are not typically collected, although they do occur in samples from time to time and therefore are treated below.

(Dicranopselaphus)

Genus Diagnosis: Larvae – see Family diagnosis. *Lateral expansions of thoracic and abdominal segments long, thin and hook-like, not overlapping*; retractile gills ventrally enclosed in an operculate chamber on abdominal segment 9, no gills on exterior of abdomen; *abdominal segment 9 with distinct, deep, apical notch.*

Adults – see Family diagnosis. Body semispherical; *tarsomeres 2-4 slightly dilated apically, feebly emarginate*; fourth tarsomere subequal to the third tarsomere and slightly prolonged beneath the fifth tarsomere; *posterior margin of pronotum crenulate or finely beaded.*

Habitat: Larvae are lotic, adults terrestrial. Scrapers (algae feeders). Larvae are anecdotally found adhered to hard substrates in silty areas of reduced flow, in streams with limestone.

Distribution and Occurrence: Extremely rare and hard to collect. The extent of its range is unknown.

Species in NC: TAKE TO SPECIES (if collected) – *variegatus*

Notes: Recorded from TN, collections of the elusive *Dicranopselaphus variegatus* are typically of solitary individuals. A specimen was collected in NC from Island Creek, Jones County in the Croatan National Forest by an outside agency.

Taxonomic references:

larvae and adults:

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

Malone, S. B. S. B. Cook and C. Huskey. 2004. An extension of the distribution record for *Dicranopselaphus variegatus* (Coleoptera: Psephenidae) from Tennessee. Journal of the Tennessee Academy of Science 79(4): 81-82.

Ectopria

Genus Diagnosis: Larvae – see Family diagnosis. *Lateral expansions of abdominal segments seperated, not overlapping, sickle-shaped; retractile gills ventrally enclosed in an operculate chamber on abdominal segment 9, no gills on rest of abdomen*; abdominal segment 9 truncate at apex.

Adults – see Family diagnosis. Small, 3.0-4.5 mm; male antennae serrate; tibiae sinuate; *protarsal claws bifid*, with basal tooth; fourth tarsomere shorter than the third tarsomere; *posterior margin of pronotum crenulate or finely beaded.*

Habitat: Larvae are lotic, adults are terrestrial and nocturnal. Larvae are found adhered to hard substrate typically in riffles but can be found in pools, adults in bank vegetation.

Distribution and Occurrence: Mountains and Piedmont (with a few scattered Coastal Plain records). Common.

Species in NC: TAKE TO SPECIES – *nervosa*

Notes: Can co-occur with *Psephenus herricki. Ectopria thoracica* had been synonymized with *E. nervosa* since 1880 (Horn) but was apparently resurrected by Brigham (1981). Some workers treat them as separate species (e.g. Epler, Ciegler). This is apparently because adults have differently colored pronotums although there is apparently much variation in that character. If indeed separate species, *E. thoracia* larvae may lack the dark dots (asperites) on the abdominal tergites while *E. nervosa* has them. The *Ectopria thoracica* type (adult) does occur in North Carolina (Brigham 1982, Ciegler 2003), however pending a published revision of the Psephenidae, BAU is currently recognizing *E. nervosa* as the only valid species.

P S E P H E N I D A E

Taxonomic references:

larvae and adults:

Brigham, W.U. 1981. *Ectopria leechi*, a new False Water Penny from the United States (Coleoptera: Eubriidae). Pan-Pacific Entomologist 57: 313-320.

Brigham, W. U. 1982. Aquatic Coleoptera, Chapter 10 (136 pp.). In A.R. Brigham, W. U. Brigham, and A. Gnilka, editors. *Aquatic Insects and Oligochaetes of North and South Carolina.* Midwest Aquatic Enterprises, Mahomet, Illinois. 837pp

Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

Psephenus

Genus Diagnosis: Larvae – see Family diagnosis. *Lateral expansions of abdominal segments overlapping; five pairs of filamentous gills on ventral surface of abdomen not retractile, operculum absent.*

Adults – see Family diagnosis. Small to medium, 4.5-6.0 mm; head visible from above; male antennae sub-serrate; *posterior margin of pronotum smooth.*

Habitat: Larvae are lotic, adults are terrestrial and nocturnal. Larvae are found adhered to hard substrate typically in riffles but can be found in pools, adults in bank vegetation.

Distribution and Occurrence: Mountains and Piedmont. Very common.

Species in NC: TAKE TO SPECIES – *herricki*

Notes: Larvae are gregarious. Larvae are absent in most streams in the Arc of Despair®. *Psephenus herricki* is the only *Psephenus* species in the eastern US. Can co-occur with *Ectopria*.

Taxonomic references:

larvae and adults:

Brown, H.P. & C.M. Murvosh. 1974. A revision of the genus *Psephenus* (Water-penny Beetles) of the United States and Canada (Coleoptera, Dryopoidea, Psephenidae). Transactions of the American Entomological Society 100: 289-340.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.. in key (although not treated)

DRYOPIDAE

Family Diagnosis: Larvae – terrestrial. Body form cylindrical; abdomen with nine segments, last segment with gill-less operculum.

Adults – small to medium, 4.3-6.3 mm; body sub-oval, broad; punctate and setose; head partially retracted into prothorax; antennae with an apical pectinate club formed of at least six antennomeres; procoxae transverse with trochanters exposed; tarsi pentamerous with long claws; color black.

Genera in NC: *Helichus*

Notes: Larvae of all long-toed water beetles (the semi-aquatic larvae of *Pelonomus* excepted) are terrestrial and are therefore rarely encountered in typical aquatic sampling. Larvae of *Helichus* and *Pelonomus* are inseparable at this time.

Helichus

Genus Diagnosis: Larvae – terrestrial. See family diagnosis; tergites with longitudinal carinae arising near anterior margins.

Adults – small, 4.3-6.3 mm; *antennal bases far apart and almost contacting the anteromedial portion of the eyes*; *antennae with second segment expanded as a heavily sclerotized shield covering successive antennomeres*; eyes glabrous; color dark overall, punctate; elytra with seriate punctures, setose.

Habitat: Primarily lotic. Collected from riffles and pools, typically on hard substrates.

Distribution and Occurrence: Mostly Mountains and Piedmont. Very common except for *H. striatus*.

Species in NC: TAKE TO SPECIES – *basalis, fastigiatus, lithophilus, striatus*

H. basalis – adult 4.3-5.5 mm; pronotum abruptly depressed behind middle forming a distinctively concave posterior surface; glabrous area of pronotum nearly impunctate; elytral striae of small shallow punctures only to basal fourth with stria 1 indistinct, not extending to scutellum; elytra with bronze tomentum or pubescence laterally; male without tooth-like tubercle on hind coxae.

H. fastigiatus – adult 4.5-5.5 mm; pronotum depressed behind middle forming a slightly concave to slightly convex posterior surface, with shallow median impression; anterolateral corners of pronotum of slightly acuminate, with straight to concave lateral margins apically; glabrous area of pronotum finely punctate; elytral striae of large deep punctures with first stria distinct, extending to scutellum; elytra with bronze tomentum or pubescence laterally; male with tooth-like tubercle on hind coxae.

H. lithophilus – adult 4.3-5.8 mm; male with long silky setae on clypeus; body covered with a fine, dense golden pubescence, some parts may be denuded; pronotum not depressed behind middle; elytral striae of small punctures; elytra with short, coarse setae interspersed among fine pubescence, suture lighter; elytral lateral margins sub-parallel to parallel with slight concavity submedially, apex pointed.

H. striatus – adult 4.5-6.3 mm; pronotum not depressed behind middle, posterior surface convex, with two longitudinal sulci sublaterally to base, pronotum without glabrous area, finely punctate; elytral striae of large deep punctures with first stria distinct; elytra with bronze tomentum throughout.

Notes: Several species of *Helichus* can co-occur within the same stream. The pubescence on the elytra of *Helichus* species varies due to the amount of medial "rubbing" (Brown 1972); therefore the amount and shape of the elytral tomentum are not strictly reliable characters. If using the the dryopid genus key in Epler (1996) note that the key has a portion of the *Helichus/Pelonomus* couplet switched: "…bases of antennae widely separated…" with "…bases of antennae very close together…" This error has been addressed in the Epler's 2010 edition of the Water Beetles of Florida. Also, the transverse medial pronotal ridge on *Helichus basalis* is almost carinate and sharply delineated while that of *H. fastigiatus* is broadly rounded at its apex (cleft by a shallow medial impression). The majority of BAU records are at genus level thereby masking the frequency of occurrence for each species.

Taxonomic references:

larvae and adults:

Barr, C. B. and J. B. Chapin. 1988. The aquatic Dryopoidea of Lousiana (Coleoptera: Psephenidae, Dryopidae, Elmidae). Tulane Studies in Zoology and Botany 26: 89-164.

Brown, H. P. Aquatic dryopid beetles (Coleoptera) of the United States. Biota of Freshwater Ecosystems Identification Manual No. 6 Water Pollution Control Research Series, ESEPA, Cincinatti, 82pp.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

SCIRTIDAE

Family Diagnosis: Larvae – small, body elongate, slightly dorsoventrally flattened; very long multi-segmented antennae; abdomen with nine segments; color brownish.

Adults – terrestrial, not covered here.

Genera in NC: *Cyphon, Scirtes*

Notes: Only the larvae of marsh beetles are aquatic. They are small and often missed in sampling. Additionally, the antennae are fragile and frequently broken off. Luckily, the larvae are relatively distinctive and easy to identify. The larvae of some genera that may occur in North Carolina have not been described (*Ora, Sarabandus robustus*). Therefore, only the genera that are likely to be encountered in North Carolina have been included in the genus analysis below. This family was previously known as Helodidae.

Cyphon

Genus Diagnosis: Larvae – see family diagnosis; cone of hypopharynx with two pairs of pectinate spines; *lateral margin of abdominal segments 3-6 with scattered thin setae similar to those on dorsal surface*; color light brown-to-brown, ventral surface paler.

Habitat: Larvae prefer swampy areas, in detritus.

Distribution and Occurrence: Coastal Plain. Rarely collected.

Species in NC: LEAVE AT GENUS.

Notes: Larvae are not separable to species and, therefore no species are listed here. The identification key in Epler's revised manual (2010) is much improved over his earlier edition (1996). This genus may be more common than records indicate as it may have been misidentified as *Scirtes* in older samples.

Taxonomic references:

larvae and adults:

- Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*
- Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee.

Scirtes

Genus Diagnosis: Larvae – see family diagnosis; cone of hypopharynx with two pairs of pectinate spines; maxillary palpi with 4 segments, last segment less than a quarter of the preceding segment; *lateral margin of abdominal segments 3-6 with series of short, flattened setae different than those on dorsal surface*; color dark brown to piceous, ventral surface paler.

Habitat: Larvae prefer swampy areas, in detritus.

Distribution and Occurrence: A mostly Coastal Plain and Piedmont taxon. Uncommon.

Species in NC: LEAVE AT GENUS.

Notes: Larvae are not separable to species and, therefore no species are listed here. The identification key in Epler's revised manual (2010) is much improved over his earlier edition (1996) and actually seperates *Scirtes* from *Ora*. Easily confused with *Cyphon*.

Taxonomic references:

larvae and adults:

- Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*
- Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

E L M I D A E

Family Diagnosis: Larvae – body form sub-cylindrical to cylindrical; abdomen with nine segments; sternites 1-6 with lateral pleurites; last abdominal segment with apicoventral operculum enclosing retractile gills, with a pair of hooks and terminally bifid or notched.

Adults – very small to small, 1.2-4.5 mm; body sub-oval to elongate elliptical, punctate; antennae typically slender and with eleven antennomeres (except *Macronychus*); procoxae globular, trochanters not exposed; tarsi pentamerous, segment 5 subequal to segments 1-4 combined, or longer; color brownish to black, some bicolored or vittate.

Genera in NC: *Ancyronyx, Dubiraphia, Gonielmis, Maconychus, Microcylloepus, Optioservus, Oulimnus, Promoresia, Stenelmis*

Notes: Riffle beetles are the most common aquatic beetles in NC and are typically sensitive to pollution. Both larvae and adults are aquatic although pupation occurs above the water line. In most cases, larvae of riffle beetles cannot be identified to species. Adult members of this family are usually restricted to areas of faster flows due to the method of respiration which requires high dissolved oxygen concentrations to facilitate the diffusion of oxygen across a plastron. Adults can live up to three years in-stream.

The heads of the adults of many genera are often retracted making length measurements difficult. Therefore, some genera described below include only the pronotum and elytra in the length measurements. These are noted by a "PE" following the measurement.

Ancyronyx

Genus Diagnosis: Larvae – procoxal cavities closed posteriorly; abdomen with pleura on first seven segments; *lateral margins of abdominal segments 1-8 produced into posterolateral projections*; last abdominal segment not spined apically.

Adults – small, 3.0-3.5 mm; hind coxae semiglobular, smaller than other coxae; legs long, spindley, bicolored; *anterior tibiae without fringe of tomentum*; claws with a basal tooth; color blackish, *elytra with a pair of conspicuous yellow to orange C-shaped vittae and elongate subapical spots*.

Habitat: Lotic. Found in sandy to gravelly streams, almost exclusively on wood.

Distribution and Occurrence: Widepread. Very common.

Species in NC: MONOTYPIC – *variegatus*

Notes: A very distinctive elmid that only occurs in the eastern United States. Possibly sensitive to sewage or industrial wastes.

Taxonomic references:

larvae and adults:

Barr, C. B. and J. B. Chapin. 1988. The aquatic Dryopoidea of Lousiana (Coleoptera: Psephenidae, Dryopidae, Elmidae). Tulane Studies in Zoology and Botany 26: 89-164.

Brown, H. P. 1972. Aquatic dryopid beetles (Coleoptera) of the United States. Biota of Freshwater Ecosystems Identification Manual No. 6 Water Pollution Control Research Series, ESEPA, Cincinatti, 82pp.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Dubiraphia

Genus Diagnosis: Larvae – abdomen with pleura on first eight segments; *last abdominal segment very long, at least four times as long as wide, operculum confined to apical third*.

Adults – small, 2-3 mm; body long and slender, somewhat pointed posteriorly; *anterior tibiae with fringe of tomentum;* absence of sublateral carinae on pronotum; prosternal process much narrower than head; *hind coxae large and transverse*; lateral margin of fourth abdominal sternite not produced into an epipleuron clasping tooth; color blackish, *elytra bicolored, with large seriate punctures and vittate.*

Habitat: Lotic and lentic. Found in riffles and pools on roots or vegetation.

Distribution and Occurrence: Widespread. Very common.

Species in NC: LEAVE AT GENUS – *(bivittata), quadrinotata, vittata*

Notes: Overlap and variation of vittate characters with the presence of undescribed species in the Southeast make speciation untenable. Male aedeagal characters are also necessary for species confirmation. *Dubiraphia quadrinotata* may appear to be the easiest to key based on elytral coloration but other species may have interrupted vittae (Epler, 2010) thereby leading to misidentifications.

Taxonomic references:

larvae and adults:

Barr, C. B. and J. B. Chapin. 1988. The aquatic Dryopoidea of Lousiana (Coleoptera: Psephenidae, Dryopidae, Elmidae). Tulane Studies in Zoology and Botany 26: 89-164.

Brown, H. P. Aquatic dryopid beetles (Coleoptera) of the United States. Biota of Freshwater Ecosystems Identification Manual No. 6 Water Pollution Control Research Series, ESEPA, Cincinatti, 82pp.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Gonielmis

Genus Diagnosis: Larvae – procoxal cavities open posteriorly; *mesopleuron composed of two sclerites, anterior sclerite narrow*; abdomen with pleura on first 7 segments; *dorsum with median humps, each bearing conspicuous scale-like hairs and with two longitudinal dark spots on each side*; last abdominal segment more than twice as long as it's height, not apically spined though slightly emarginate at tip.

Adults – small, 2.2-2.6 mm; body elongate, widest at midpoint of elytra, narrows quickly; *anterior tibiae with fringe of tomentum*; pronotum rugose, without sublateral carinae on pronotum; prosternal process much narrower than head; *hind coxae transverse*; femora with apex darkened and tibiae darkened basally; *lateral margin of fourth abdominal sternite with tooth which clasps the epipleuron*; *elytra with two pair of conspicuous yellow to orange obliquely elongate spots, one anteriorly and one posteriorly.*

Habitat: Lotic. Found in acidic sandy/gravelly streams on woody substrate.

Distribution and Occurrence: Sand Hills. Uncommon.

Species in NC: MONOTYPIC – *dietrichi*

Notes: *Gonielmis dietrichi* occurs only in the southeastern United States. A few scattered Piedmont records outside of the Sand Hills may be misidentifications of *Promoresia elegans*.

Taxonomic references:

larvae and adults:

Barr, C. B. and J. B. Chapin. 1988. The aquatic Dryopoidea of Lousiana (Coleoptera: Psephenidae, Dryopidae, Elmidae). Tulane Studies in Zoology and Botany 26: 89-164.

Brown, H. P. 1972. Aquatic dryopid beetles (Coleoptera) of the United States. Biota of Freshwater Ecosystems Identification Manual No. 6 Water Pollution Control Research Series, ESEPA, Cincinatti, 82pp.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Macronychus

Genus Diagnosis: Larvae – procoxal cavities open posteriorly; *mesopleuron composed of two sclerites, anterior sclerite wide*; *abdomen with pleura on first 6 segments*; *dorsal surface of each abdominal segment with faint, wide, often posteriorly interrupted, longitudinal bands composed of tiny tubercles (thus giving the appearance of bluish dashed lines running the length of the body at low magnification)*; *each abdominal tergite with a posterior fringe of widely spaced setae*; last abdominal segment with two narrowly separated spines at tip.

Adults – small, 3-4 mm; body elongate, outline mostly continuous; *antennae with seven segments, apically enlarged*; anterior tibiae with fringe of tomentum; pronotum laterally sinuate, shallowly sulcate with basal sublateral carinae and submedial tubercles; hind coxae globular; legs long and spidery; *elytra coarsely punctate, with sublateral carinae and a conspicuous silvery-gold band of tomentum between carinae and lateral margin*; each elytron with an elongate submediobasal tubercle; color uniform, dark brown to blackish, shiny.

Habitat: Lotic. Found in sandy/gravelly streams, most often found on woody substrate.

Distribution and Occurrence: Widespread. Very common.

Species in NC: TAKE TO SPECIES – *glabratus*

Notes: This is only species in the eastern United States. Encrusted individuals can be easily identified by the unique antennae. BAU photos of *Macronychus* larvae are actually *Stenelmis*. This species may be sensitive to sewage and industrial wastes.

Taxonomic references:

larvae and adults:

Barr, C. B. and J. B. Chapin. 1988. The aquatic Dryopoidea of Lousiana (Coleoptera: Psephenidae, Dryopidae, Elmidae). Tulane Studies in Zoology and Botany 26: 89-164.

Brown, H. P. 1972. Aquatic dryopid beetles (Coleoptera) of the United States. Biota of Freshwater Ecosystems Identification Manual No. 6 Water Pollution Control Research Series, ESEPA, Cincinatti, 82pp.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Microcylloepus

Genus Diagnosis: Larvae – clypeus without tooth at lateral margins; procoxal cavities closed posteriorly; *dorsal tubercles arranged in parallel longitudinal rows*; *white mid-dorsal stripe enlarged into a spot at posterior margins of each sclerite.*

Adults – *very small, 1.7-2.2 mm (PE)*; antennae with eleven segments; anterior tibiae with fringe of tomentum; *pronotum with sublateral carinae running the entire length, a transverse sulcus anterior to the middle, a Y-shape ridge medially posterior to middle with the "stem" contacting the basal margin*; hind coxae transverse; *lateral margin of fifth abdominal sternite with tooth which clasps the epipleuron*; elytra coarsely punctate, with sublateral carinae, margins beaded or serrate; color reddish brown to blackish, shiny, some individuals may be vittate or quadrimaculate.

Habitat: Lotic. Found in sandy/gravelly streams, most often found on woody substrate.

Distribution and Occurrence: Widespread. Common, less so in the Coastal Plain.

Species in NC: TAKE TO SPECIES – *pusillus*

Notes: There is only one species in the eastern US. Subspecies designations (*M. pusillus pusillus, M. p. aptus, M. p. loedingi* – not in NC) can be difficult as the primary character, maculation, tends towards variability. This species may be sensitive to sewage and industrial wastes but tolerant of sediments.

Taxonomic references:

larvae and adults:

Barr, C. B. and J. B. Chapin. 1988. The aquatic Dryopoidea of Lousiana (Coleoptera: Psephenidae, Dryopidae, Elmidae). Tulane Studies in Zoology and Botany 26: 89-164.

Brown, H. P. 1972. Aquatic dryopid beetles (Coleoptera) of the United States. Biota of Freshwater Ecosystems Identification Manual No. 6 Water Pollution Control Research Series, ESEPA, Cincinatti, 82pp.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Optioservus

Genus Diagnosis: Larvae – body sub-triangular in cross section, particularly evident in the last few abdominal segments; pro-, meso- and metanotal lateral margins lined with flattened scale-like setae; procoxal cavities open posteriorly; *mesopleuron composed of one sclerite; abdomen with pleura on first seven segments*; *tubercles on dorsal surface of abdomen not arranged in longitudinal rows*; abdominal segments 7-9 progressively more dorsomedially carinate; last abdominal segment edentate apically.

Adults – very small, 1.7-2.6 mm (PE); body sub-oval, punctate and sparsely pubescent; antennae with eleven segments; hind coxae transverse; *anterior tibiae with fringe of tomentum; pronotum with very short basal sublateral carinae; pronotal and elytral margins slightly serrate*; elytra coarsely punctate, with intervals 3 and 5 converging apically; color uniform, dark brown to blackish, shiny.

Habitat: Lotic. Found in sandy/gravelly streams in riffles.

Distribution and Occurrence: Widespread. Very common.

Species in NC: TAKE TO SPECIES – *immunis, ovalis, trivittatus*

O. immunis – adult 1.7-2.4 mm (PE); sublateral carinae markedly developed, about one third the length of the pronotum; scutellum quadrate, shield-shaped; elytra immaculate, with no markings; color blackish with legs lighter, apical half of femora darker. Mountains only.

O. ovalis – adult 2.2-2.6 mm (PE); sublateral carinae moderately developed, about one fourth the length of the pronotum; scutellum quadrate, diamond-shaped; elytra quadrimaculate, with two lighter oval humeral spots and two vittae in apical half; color blackish with legs dark, tarsi lighter.

O. trivittatus – adult 1.7-2.2 mm (PE); sublateral carinae moderately developed, about one fourth the length of the pronotum; scutellum smaller, oval; elytra vittate, with a sutural vitta extending about halfway; color blackish with legs dark, tarsi lighter. Primarily a mountain species.

Notes: The "hood-like pronotum" larval character included in the Epler key (1996) is not very useful as the generalized body form of both *Macronychus* and *Oulimnius* larvae are similar to that of *Optioservus*. However, the lateral margins of the pronotum of *Optioservus* converges anteriorly more so than those of *Macronychus* which are sub-parallel to parallel and *Optioservus* is much larger than *Oulimnius*. A fourth species included in Ciegler (2003) is a more northerly species with a southern limit of Maryland (Ciegler, 2003) and most likely does not occur in North Carolina. *Optioservus ovalis* can be confused with *Promoresia tardella*.

Taxonomic references:

larvae and adults:

Barr, C. B. and J. B. Chapin. 1988. The aquatic Dryopoidea of Lousiana (Coleoptera: Psephenidae, Dryopidae, Elmidae). Tulane Studies in Zoology and Botany 26: 89-164.

Brown, H. P. 1972. Aquatic dryopid beetles (Coleoptera) of the United States. Biota of Freshwater Ecosystems Identification Manual No. 6 Water Pollution Control Research Series, ESEPA, Cincinatti, 82pp.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

White, D. S. 1978. A revision of the Nearctic *Optioservus* (Coleoptera: Elmidae) with descriptions of new species. Systematic Entomology 3: 59-74.

Oulimnius

Genus Diagnosis: Larvae – mature larvae no longer than 3 mm; procoxal cavities open posteriorly; *mesopleuron composed of two sclerites, anterior sclerite wide*; *abdomen with pleura on first seven segments*; *dorsal surface of each abdominal segment sparsely covered with large tubercles separated by their own widths except along mid-dorsal line.*

Adults – *very small, 1.25-1.60 mm (PE)*; body sub-oval to oval; antennae with eleven segments; anterior tibiae with fringe of tomentum; hind coxae transverse, wide; *pronotum with sublateral carinae extending the entire length of segment*; pronotum punctate with secondary sculpturing of micro-dimples, with lateral margins slightly serrate; *each elytron punctate, with three sublateral carinae*; color uniform, dark brown to blackish, shiny.

Habitat: Lotic. Found in sandy/gravelly streams in riffles.

Distribution and Occurrence: Primarily Mountain and Piedmont. Common.

Species in NC: TAKE TO SPECIES – *latiusculus, nitidulus*

O. latiusculus – adult 1.5-1.6 mm (PE); pronotal margins converging in apical half making sides appear moderately rounded; elytra with punctures typically appear smaller, of similar size; elytral sublateral carinae conspicuous.

O. nitidulus – adult 1.25-1.30 mm (PE); pronotal margins less rounded; elytra with punctures of various sizes, appear large to very large; elytral sublateral carinae less conspicuous.

Notes: The only two species found in the US are eastern only and both are found in NC. These two species can best be separated by size. The size of the elytral punctures can also be used but BAU has specimens corresponding to the sizes of *O. latiusculus* (1.5+ mm) that have larger pits apically, some almost subequal to those found on *O. nitidulus*. *Oulimnius nitidulus* has been misidentified as *O. latiusculus* over the past 30 years as *O. latiusculus* was previously thought to be the only species in NC.

Taxonomic references:

larvae and adults:

Barr, C. B. and J. B. Chapin. 1988. The aquatic Dryopoidea of Lousiana (Coleoptera: Psephenidae, Dryopidae, Elmidae). Tulane Studies in Zoology and Botany 26: 89-164.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

E L M I D A E

Promoresia

Genus Diagnosis: Larvae – procoxal cavities open posteriorly; *mesopleuron composed of one sclerite*; *abdomen with pleura on first seven segments*; *dorsum with median and sublateral humps*; last abdominal segment about twice as long as its height, slightly emarginate.

Adults – small, 1.7-2.8 mm; body elongate; antennae with eleven segments; hind coxae transverse; *anterior tibiae with fringe of tomentum;* tarsi long and prominent with large, thick claws; *pronotum with short basal sublateral carinae*, and with two very short, basal, obsolete grooves on either side of scutellar area; *pronotal and elytral margins smooth*; *ventral surface and femora densely pubescent*; elytra coarsely punctate, bimaculate; color uniform, black.

Habitat: Lotic. Found in riffles of sandy/gravelly streams.

Distribution and Occurrence: A mostly Mountain taxon (with a few scattered Piedmont records). Common.

Species in NC: TAKE TO SPECIES – *elegans, tardella*

P. elegans – larva with dorsal humps less pronounced, with humps of last three segments less than one fourth the diameter (not including hump) of the respective segment; lateral humps almost obsolete; each abdominal segment with 2 pair of dark spots, one pair lateral and the other sublateral. Adult 2.1-2.8 mm; tarsi dark, same color as tibiae and femora; elytra slightly wider than pronotum at base; elytral maculations elongate and oblique, humeral spot tapered to middle.

P. tardella – larva with dorsal humps pronounced, those of last three segments approximately half or more the diameter (not including hump) of the respective segment; lateral humps small but conspicuous; abcomen without pairs of dark spots. Adult 1.7-2.7 mm; tarsi same color as tibiae and femora, or barely lighter; elytra distinctly wider than pronotum at base; humeral spots of elytra roundish to oval, subapical spots oblique.

Notes: *Promoresia elegans* prefers headwater streams, while *P. tardella* prefers the lower reaches of streams, although they often co-occur in mid-order streams. *Promoresia elegans* can be confused with *Gonielmis dietrichi* while *P. tardella* can be confused with *Optioservus ovalis.*

Taxonomic references:

larvae and adults:

Brown, H. P. 1972. Aquatic dryopid beetles (Coleoptera) of the United States. Biota of Freshwater Ecosystems Identification Manual No. 6 Water Pollution Control Research Series, ESEPA, Cincinatti, 82pp.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

⇨ Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Stenelmis

Genus Diagnosis: Larvae – *clypeus with prominent tooth at lateral margins*; mesopleuron composed of two sclerites; *procoxal cavities closed posteriorly; last abdominal segment with a pair of posterolateral spines.*

Adults – small, 2.2-4.0 mm (PE); body elongate, punctate; antennae with eleven segments; prosternal process narrower posteriorly than width of head; hind coxae transverse; *anterior tibiae without fringe of tomentum*; males of some species with swelling or ridge on inner surface of middle tibiae; *pronotum sulcate and costate, with tubercles; elytra carinate from humerus nearly to apex, with basal discal costa confluent with interval 3*; color reddish brown to blackish; immaculate, bimaculate or vittate.

Habitat: Lentic and lotic. Found in riffles and on wood.

Distribution and Occurrence: Widespread. Common. See species accounts.

Species in NC: TAKE TO SPECIES (provisional- see notes and following verification table) – *antennalis, (bicarinata), concinna, convexula, crenata, decorata*, fuscata, gammoni, (grossa), harleyi, (humerosa), lignicola, mera, mirabilis, morsei, (musgravi),* n. sp., *(quadrimaculata), sandersoni, sinuata, (williami), xylonastis*

Notes: Speciation of *Stenelmis* is difficult especially considering that there are at least 22 species in North Carolina. Given that specimens are often encrusted with dirt, that elytral patterns tend to be somewhat variable, and that the examination of male genitalia is usually needed for confirmation of some species, it is best to leave this group at genus. In addition, use of different keys will yield different designations for some specimens. However, some species are readily identifiable based on some easily seen characters such as palpi coloration or tarsal length. Additionally, *Stenelmis* are known to be good water quality indicators and therefore there is some justification for taking this group to species. The following verification/identification table may help separate out the species. According to Schmude (personal communication), the Sand Hills are the epicenter of *Stenelmis* diversity in North Carolina.

Stenelmis vittipennis was synonymized with *S. bicarinata* while *S. markeli* (a mispelling of *S. maerkelii*) was synonymized with *S. lignicola* (Schmude and Hilsenhoff 1991). *Stenelmis* sp. B in Ciegler is *S. williami* and *S.* sp C is *S. harleyi*. The entire BAU reference series for *Stenelmis* is missing.

larvae and adults:

Brown, H. P. 1972. Aquatic dryopid beetles (Coleoptera) of the United States. Biota of Freshwater Ecosystems Identification Manual No. 6 Water Pollution Control Research Series, ESEPA, Cincinatti, 82pp.

⇨Ciegler, J.C. 2003. Water Beetles of South Carolina. Clemson University Public Service Publishing. *Adults only*

Epler, J. H. 2010. The Water Beetles of Florida: An Identification Manual for the Families Chrysomelidae, Curculionidae, s Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrochidae, Hydrophilidae, Noteridae, Psephenidae, Ptilodactylidae, Scirtidae. Florida Department of Environmental Protection, Tallahassee..

Schmude, K. L. 1992. Revision of the riffle beetle genus *Stenelmis* (Coleoptera: Elmidae) in North America, with notes on bionomics. Doctoral Dissertation, University of Wisconsin-Madison. 287 pps. ----------**partial copy only**

Schmude, K. L. and W. L. Hilsenhoff. 1991. *Stenelmis maerkelii* Motschulsky and *S. vittipennis* LeConte as synonyms of *S. bicarinata* LeConte (Coleoptera: Elmidae). Proceedings of the Entomological Society of Washington 93: 756-759.

Schmude, K. L, C. B. Barr and H. P. Brown. 1992. *Stenelmis lignicoli* and *Stenelmis xylonastis*, two new North American species of wood-inhabiting riffle beetles (Coleoptera: Elmidae). Proceedings of the Entomological Society of Washington 94(4): 580-594.

White, D. S. 1982. *Stenelmis morsei*, a new species of riffle beetle (Coleoptera: Dryopoidea: Elmidae) from South Carolina. The Coleopterists Bulletin 36(2): 170-174.

White, D. S. and H. P. Brown. 1976. A new species of *Stenelmis* from North Carolina (Coleoptera: Dryopoidea: Elmidae). The Coleopterists Bulletin 30: 189-191.

Stenelmis Verification Table

Species	Antennae (antennmeres affected)	Palpi	maculate/vittate	Vittae overlap umbones	Pronotal sculpturing	Median Sulcus	Costae	Basomesal triangles
S. antennalis	bicolored, (5-11 piceous)	yellow-brown	narrowly vittate to bimaculate	no	feeble	dark, shallow, obsolete anteriorly and posteriorly	obsolete anteriorly and posteriorly	light/tomentose
S. bicarinata	yellow-brown	yellow-brown	narrowly vittate	no	feeble-moderate	dark, shallow, obsolete anteriorly	not prominent, broad	dark
S. concinna	yellow-brown	yellow-brown	bimaculate	yes	heavy	very deep	prominent	grey, not apparent
S. convexula	yellow-brown	yellow-brown	faintly bimaculate	no	smooth-feeble	shallow, extended to anterior 1/3	not prominent	dark (some spec.)
S. crenata	yellow-brown	yellow-brown	narrowly vittate to bimaculate	no	heavy	deep, very wide, wider medially	prominent	
S. decorata*	yellow-brown	yellow-brown	moderately vittae to immaculate	no	moderate	dark, deep	narrowed posteriorly	light (females)
S. fuscata	yellow-brown	yellow-brown	narrowly vittae to immaculate	no	moderate	moderatley deep, wide	moderate	
S. gammoni	bicolored, (3-11 piceous)	brown-black basally	bimaculate	yes	moderate	dark, moderately deep		dark
(S. grossa)	yellow-brown	yellow-brown	faintly vittae to immaculate	no	moderate-heavy	deep from anterior 1/4	narrowed posteriorly	grey, not apparent
S. harleyi	yellow-brown	yellow-brown	broadly vittate, bright	yes	feeble	dark, shallow, narrowed posteriorly, obsolete on ant. 1/3	not prominent, broad	dark, large, conspicuous
(S. humerosa)	yellow-brown	yellow-brown	narrow to moderately vittate	yes	feeble	shallow	inconspicuous	dark
S. lignicola	yellow-brown	yellow-brown	bimaculate	no	feeble	short, shallow, narrowed posteriorly, obsolete in ant. 1/4	not prominent, obsolete in ant. 1/4, convergent posteriorly	dark
S. mera	yellow-brown	brown-black basally/ yellow-brown	moderately vittate to bimaculate	yes	moderate	dark, long, deep, wide anterioroly	prominent, broad	dark
S. mirabilis	piceous (3-11)	brown-black basally	bimaculate	yes	feeble-moderate	dark, moderately deep and wide, narrowed basally	moderate, convergent, obsolete apically	dark (see other)
S. morsei	yellow-brown	yellow-brown	broadly vittate, bright	yes	feeble	deep, obsolete on ant. 1/3	not prominent, obsolete	grey, not apparent
(S. musgravei)	bicolored, (5, 8-11 dusky)	brown-black basally	moderately vittae to immaculate	yes/no	moderate	deep, wide anteriorly, shallow and narrow posteriorly	moderate, convergent basally	dark
(S. quadrimaculata)	bicolored, (8-11 rufous)	brown-black basally	moderately vittae	no	moderate	deepest and widest anteriorly	obsolete in ant. 1/4, not reaching base	
S. n. sp.	yellow-brown	yellow-brown	moderately vittae, bright	no?	moderate		obsolete in ant. ¼, convergent basally	dark
S. sandersoni	yellow-brown	yellow-brown	bimaculate to immaculate	yes/no	heavy	deep, uniformly wide	very prominent, slightly convergent basally	brownish
S. sinuata	yellow-brown	yellow-brown	vittae to bimaculate	no	moderate-heavy	deep, wide, elongate	prominent	grey, not apparent
(S. williami)	yellow-brown	yellow-brown	faintly vittae	no	moderate-heavy	moderately deep, widest in middle	prominent in basal half	dark (females)
S. xylonastis	yellow-brown	yellow-brown	faintly bimaculate	no	feeble	deepest and widest anteriorly, obsolete in anterior 1/4	low, obsolete in anterior 1/4, convergent posteriorly	grey, not apparent

Stenelmis Verification Table Continued

Species	Pronotal granules	Tibial Ridge?	Tarsomere 5 Type 1 - widens gradually Type 2 - widens abruptly	Tarsomere 5 5≥1-4 5<1-4	Aedeagus with flange? tip shape	Size (mm)	Other
S. antennalis	small, relatively dense	yes	Type 2	5>1-4	yes	2.4-3.3	tarsomere 5 darker basally, NC specimens small in size (2.5-2.8); on wood, roots in large rivers
S. bicarinata	large, sparse		Type 2	5>1-4	yes	2.9-3.7	gravelly rocks, streams
S. concinna	moderately large, relatively dense	yes (small)	Type 1	5<1-4, with process	no	3.2-3.9	pronotum longer than wide; on rocks on medium to large rivers; Mountains
S. convexula	very small, sparse	yes	Type 2	5≥1-4	yes	2.7-3.5	shiny and convex between umbones
S. crenata	small, relatively dense	yes	Type 1/ Type 2	5=1-4, small process	yes	2.7-3.8	bicolored femora with apices lighter, stout.; deep elytral punctures; most common and tolerant sp.
S. decorata*	basal cluster (females)	yes	Type 2	5≥1-4	no	2.6-3.5	large rivers
S. fuscata	small	yes	Type 2	5≥1-4	yes	3.2-4.0	small, sandy streams
S. gammoni		yes	Type 2	5>1-4	yes	2.3-2.6	tarsomere 5 bicolored; rocks in swift, clean rivers
(S. grossa)	none (microgranulate), tomentose	yes	Type 2	5≥1-4	yes	2.7-4.1	large, deep elytral punctations, femora punctate, not granulate; unique aedeagus; coastal?
S. harleyi	moderately large, evenly scattered		Type 2	5=1-4	yes	2.1-2.5	medial elytral carina darkly contrasting with bright, wide vittae,
(S. humerosa)	moderately large, evenly scattered		Type 2	5>1-4	yes		
S. lignicola	large, relatively dense	no	Type 2	5>1-4	yes	2.6-3.3	on wood
S. mera	large, relatively dense	yes	Type 1	5<1-4	no	2.3-3.1	NC specimens are small and bimaculate, vittae often indistinct medially; on rock in swift rivers
S. mirabilis	large, relatively dense	yes (large, tooth-like)	Type 2	5>1-4	yes	2.5-3.2	tibia light with dark apices; male basomesal triangles with a grey, transverse bar near base
S. morsei	large (on disc), dense	?	Type 1	5<1-4	no	2.2-2.7	large, deep elytral punctures; in gravel of small streams, Lumber R., medial elyrlal carina dark and conspicuous
(S. musgravei)	moderately large, scattered	yes	Type 2	5>1-4	yes	2.3-3.0	
(S. quadrimaculata)				5>1-4	yes	2.7-3.3	in shallow lakes
S. n. sp.	small to moderate, moderately sparse		Type 2	5>1-4	?	2.4-2.7	Little R. in Lumber R. basin
S. sandersoni	moderately large, dense	no (?)	Type 1	5<1-4, large process	no	3.1-3.8	pronotum wider than long; rocky areas of swift medium to large rivers
S. sinuata	moderately large, dense	no	Type 2	5≥1-4	yes	3.0-3.7	anterolateral angles divergent; punctures deep on elytral disc; in small, sandy and acidic streams
(S. williami)	very small, sparse	yes	Type 2	5>1-4	yes	2.6-3.2	
S. xylonastis	small (NC pop.), sparse	no	Type 2	5≥1-4	yes/ pointed	2.7-3.6	on wood

PTILODACTYLIDAE

Family Diagnosis: Larvae – body form cylindrical; legs 5-segmented, adapted for walking; abdomen with nine segments, without operculum.

Adults – terrestrial. Small, 3.2-6.0 mm; body wedge-shaped to oblong-oval, typically widest past middle of elytra; soft-bodied, unicolorous; antennae inserted below eyes; pronotum partly conceals head, constricted anteriorly; tarsi pentamerous; abdomen with five visible sterna.

Genera in NC: *Anchytarsus*

Notes: Adults of the toe-winged beetles are terrestrial and are rarely encountered during typical aquatic sampling. Of the two aquatic ptilodactylids taxa that occur in the eastern US (*Anchytarsus bicolor* and *Paralichas trivittis*) only *Anchytarsus* occurs in North Carolina.

Anchytarsus

Genus Diagnosis: Larvae – see Family diagnosis. *Antennal long, dark*; dorsum with each segment bearing two transverse rows of widely spaced punctures, one anterior and one posterior, each puncture bearing a very long seta; *last abdominal segment with numerous finger-like gills, with two curved lobes covered with long dark spines, dorsum slightly carinate laterally*; color yellowish-brown to brown with pronotum, head, and last tergite darker.

Adults – terrestrial. See Family diagnosis. Small, 5-6 mm;; antennae slender, filiform; pronotum obtusely margined laterally; middle coxae separated the same distance as the forecoxae; elytral striae impressed with feeble punctures, intervals finely punctate; color black, legs paler.

Habitat: Lotic. Small clear streams on submerged decaying wood.

Distribution and Occurrence: A mostly Mountain and Piedmont taxon. Common but in low numbers.

Species in NC: TAKE TO SPECIES – *bicolor*

Notes: *Anchytarsus bicolor* is the only species of *Anchytarsus* in North America. Adults superficially resemble psephenid adults thus a diagnosis is provided.

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Credit: jasondecairestaylor.com

Confirmed beetle genera and species occuring in North Carolina with distributional and tolerance data. M = Mountains, P = Piedmont, CP = Coastal Plain, SB = Slate Belt, SH = Sand Hills. x = found at 2-25 waterbodies, **X** = 26-50 waterbodies, Ⓧ = more than 50 waterbodies (predominate ecoregion). The number "1 " indicates that the taxon has been collected from only 1 waterbody. Taxa without tolerance values have less than 50 records with an associated final bioclassification. A = Adult, L = Larva. Lentic taxa may be underrepresented on this table.

Taxonomic Hierarchy			Ecoregion *					NCBI Tol. Value	Total No. BAU Records **	Ref. Spec. Avail.	Notes
			Level III			Selected Level IV					
Family	Genus	Species	M	P	CP	SB	SH				
Dryopidae											
	Helichus		Ⓧ	Ⓧ	x	Ⓧ	x	4.1	1999		
		basalis LeConte, 1852	**X**	**X**		x	x	0.5	121	A	
		fastigiatus (Say, 1824)	**X**	**X**	x	x	1	---	109	A	
		lithophilus (Germar, 1824)	x	x	x	x		3.0	77	A	
		striatus LeConte, 1852			1			---	1		
Dytiscidae											
	Acilius			x	x	x		---	14	A	
		confusus Bergston & Miller, 2005									
		fraternus (Harris, 1828)									
		mediatus (Say, 1823)								A	
	Agabetes							---	6		
		acuductus (Harris, 1828)	x	x	x						
	Agabus		x	x	**X**	x		---	55	A	
		ambiguus Say, 1823									
		astrictovittatus (Larson & Wolfe, 1998)									transfer to *Platambus* not recognized
		bifarius (Kirby, 1837)									
		disintegratus (Crotch, 1873)									
		erythropterus (Say, 1823)									
		flavovittatus (Larson & Wolfe, 1998)									transfer to *Platambus* not recognized
		gagates Aubé, 1838								A	
		johannis (Fall, 1922)									transfer to *Platambus* not recognized
		obtusatus (Say, 1823)									transfer to *Platambus* not recognized
		punctatus Melsheimer, 1844									
		seriatus (Say, 1823)									transfer to *Ilybiosoma* not recognized
		stagninus (Say, 1823)									transfer to *Platambus* not recognized
		xyztrus Larson, Alarie & Roughly, 2000									
	Anodocheilus										
		exiguus (Aubé, 1838)			x			---	2	A	
	Bidessonotus				x	1		---	21	A	
		inconspicuus (LeConte, 1855)									
		longovalis (Blatchley, 1919)									
		pulicarius (Aubé, 1838)									

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Taxonomic Hierarchy			Ecoregion *					NCBI Tol. Value	Total No. BAU Records **	Ref. Spec. Avail.	Notes
			Level III			Selected Level IV					
Family	Genus	Species	M	P	CP	SB	SH				
Dytiscidae (cont.)											
	Celina		x	1	x	x		---	21	A	
		angustata Aubé, 1838									
		contiger Guignot, 1947									
		grossula LeConte, 1863									
		hubbelli Young, 1979									
		imatatrix Young, 1979									
		pulustris Young, 1979									
		slossoni Mutchler, 1918									
	Copelatus		x	x	X	x	1	---	54		
		caelatipennis Aubé, 1838								A	NC subspecies - *C. c. princeps*
		chevrolati Aubé, 1838								A	NC subspecies - *C. c. chevrolati*
		glyphicus (Say, 1823)									
		punctulatus Aubé, 1838									jr. synonym of *C. glyphicus* not accepted
	Coptotomus		1	x	Ⓧ	1	1	8.5	131		
		interrogatus (Fabricius, 1801)									
		longulus LeConte, 1852									NC subspecies - *C. l. lenticus*
		loticus Hilsenhoff, 1980								L, A	
		venustus (Say, 1823)									
	Cybister							---	10		
		fimbriolatus (Say,1825)		x	x					L, A	2 NC subspecies - *C. f. crotchi, C. f. fimbriolatus*
	Desmopachria		x	x	x	1		---	5		
		convexa (Aubé, 1838)								A	
		grana (LeConte, 1855)									
		leechi Young, 1981									
	Dytiscus		x	x	x	1		---	32		
		carolinus Aubé, 1838									
		hybridus Aubé, 1838									
	Graphoderus										
		liberius (Say, 1825)									
	Heterosternuta										
		alleghenianus (Matta & Wolfe, 1979)									
		pulcher (LeConte), 1855)									
		wickhami (Zaitzev, 1908)									
	Hoperius										
		planatus Fall, 1927			1			---	1		Conoho Creek, Martin County, 2004

Taxonomic Hierarchy			Ecoregion *					NCBI Tol. Value	Total No. BAU Records **	Ref. Spec. Avail.	Notes
			Level III			Selected Level IV					
Family	Genus	Species	M	P	CP	SB	SH				
Dytiscidae (cont.)											
	Hydaticus			x	1			---	4	A	
		aruspex Clarke, 1864									
		cinctipennis Aubé, 1838									
	Hydrocolus		1						1	A	*Hydroporus oblitus* group in some literature
		filiolus (Fall, 1923)									
		oblitus (Aubé, 1838)									
		persimilis (Crotch, 1873)									
		stagnalis (Gemminger & Harold, 1868)									
	Hydroporus		x	X	X	x	x	7.0	154	A	does not include records before *Neoporus et al*. were elevated to generic status
		americanus Aubé, 1838									
		brevicornis Fall, 1917									
		niger Say, 1823									
		ruficeps Aubé, 1838									
		rufilabris Sharp, 1882									
		signatus Mannerheim, 1853								A	NC subspecies - *H. s. youngi*
	Hydrovatus							---	30		
		pustulatus (Melsheimer, 1844)	x	x	x	x	x			A	2 NC subspecies - *H. p. compressus, H. p. pustulatus*
	Hygrotus										
		farctus (LeConte, 1855)		x	x			---	5		
		nubilus (LeConte, 1855)									
	Ilybius		x	x	x			---	12		
		biguttulus (Germar, 1824)								A	
		incarinatus Zimmermann, 1928									
		oblitus Sharp, 1882									
	Laccophilus		x	x	x	x	x	9.8	128		
		fasciatus Aubé, 1838								A	NC subspecies - *L. f. rufus*
		gentilis LeConte, 1863									NC subspecies - *L. g. gentilis*
		maculosus Say, 1823								A	NC subspecies - *L. m. maculosus*
		proximus Say, 1823									
		schwarzi Fall, 1917									
	Laccornis		x	x	x	x		---	14		
		difformis (LeConte, 1855)									

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Taxonomic Hierarchy			Ecoregion *					NCBI Tol. Value	Total No. BAU Records **	Ref. Spec. Avail.	Notes
			Level III			Selected Level IV					
Family	Genus	Species	M	P	CP	SB	SH				
Dytiscidae (cont.)											
	Liodessus				x	x		---	3		
		affinis (Say, 1823)									
		crotchi Nilsson 2001									
		noviaffinis Miller, 1998									
	Lioporeus		x	x	X	x	x	4.0	86		
		pilatei (Fall, 1917)		x	x	x	x	---	35	A	
		triangularis (Fall, 1917)	x	1			1	---	6	A	
	Matus										
		bicarinatus (Say, 1823)									
		ovatus Leech, 1941			x			---	3	A	2 NC subspecies - *M. o. ovatus, M. o. blatchleyi*
	Neoporus		X	Ⓧ	Ⓧ	Ⓧ	x	5.0	491		
		aulicus (Aubé, 1838)									
		blanchardi (Sherman, 1913)									
		carolinus (Fall, 1917)									
		cimicoides (Sharp, 1882)									
		clypealis (Sharp, 1882)								A	
		dilatatus (Fall, 1917)								A	
		dixianus (Fall, 1917)								A	
		gaudens (Fall, 1923)									
		hybridus (LeConte, 1855)									
		lobatus (Sharp, 1882)									
		lynceus (Sharp, 1882)									
		mellitus (LeConte, 1855)	x	X	X	X	x	3.9	211	A	
		shermani (Fall, 1917)									
		striatopunctatus (Melsheimer, 1844)									
		undulatus (Say, 1823)									
		venustus (LeConte, 1855)								A	
		vittatipennis (Gemminger and Harold, 1868)									
	Prodaticus			x	1			---	4		
		bimarginatus (Say, 1834)		x	x			---	22	A	previously *Hydaticus bimarginatus*
	Rhantus							---	17		
		calidus (Fabricius, 1792)	1	x	x	x					
	Stictotarsus										
		griseostriatus (De Geer, 1774)	x	X	x	x	x	5.0	98		previously *Deronectes griseostriatus*

Taxonomic Hierarchy			Ecoregion *					NCBI Tol. Value	Total No. BAU Records **	Ref. Spec. Avail.	Notes
			Level III			Selected Level IV					
Family	Genus	Species	M	P	CP	SB	SH				
Dytiscidae (cont.)											
	Thermonectus			1	x			---	6		
		basillaris (Harris, 1829)			1			---	1	A	
		nigrofasciatus (Aubé, 1838)									NC subspecies - *T. n. ornaticollis*
	Uvarus										
		falli (Young, 1940)									
		granarius (Aubé, 1838)									
		inflatus (Young, 1950)									
		lacustris (Say, 1823)			1			---	1	A	White Oak R., Jones/Onslow Co. , 2010
		rogersi (Young, 1941)									
Elmidae											
	Ancyronyx										
		variegatus (Germar, 1824)	Ⓧ	Ⓧ	Ⓧ	Ⓧ	Ⓧ	6.8	2039	L, A	
	Dubiraphia		Ⓧ	Ⓧ	Ⓧ	Ⓧ	Ⓧ	5.5	1477	A	
		bivittata (LeConte, 1852)									
		quadrinotata (Say, 1825)	x	x	x	x		---	14	A	
		vittata (Melsheimer, 1844)	x	X	x	x	x	5.0	124	A	
	Gonielmis										
		dietrichi (Musgrave, 1933)		x		x	Ⓧ	---	30	A	
	Macronychus										
		glabratus Say, 1825	Ⓧ	Ⓧ	Ⓧ	Ⓧ	Ⓧ	4.7	2398	A	
	Microcylloepus										
		pusillus (Leconte, 1852)	X	X	x	X	x	3.3	264	A	2 NC subspecies - *M. p. pusillus, M. p. aptus*
	Optioservus		Ⓧ	X	x	X	x	2.1	639		
		immunis (Fall, 1925)	x					---	14	A	
		ovalis (LeConte, 1863)	Ⓧ	X		x	x	2.1	262	A	
		trivittatus (Brown, 1930)	x	x				---	37		
	Oulimnius		Ⓧ	x		x	x	---	80		
		latiusculus LeConte, 1866	Ⓧ	X		x	x	1.9	209	A	
		nitidulus (LeConte, 1866)	x	1				---	17	A	
	Promoresia		Ⓧ	x	1	x	1	3.1	104		
		elegans (LeConte, 1852)	Ⓧ	X	x	x	x	2.1	585	A	
		tardella (Fall, 1925)	Ⓧ	x		x		0.0	256	A	
	Stenelmis		Ⓧ	Ⓧ	Ⓧ	Ⓧ	Ⓧ	5.6	1913		
		antennalis Sanderson, 1938	1	1	x		x	---	14	A	
		bicarinata LeConte, 1852									
		concinna Sanderson, 1938	x					---	9		

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Taxonomic Hierarchy			Ecoregion *					NCBI Tol. Value	Total No. BAU Records **	Ref. Spec. Avail.	Notes
			Level III			Selected Level IV					
Family	Genus	Species	M	P	CP	SB	SH				
Elmidae (cont.)											
	Stenelmis (cont.)										
		convexula Sanderson, 1938		1	x		x	---	15	A	
		crenata (Say, 1824)	x	Ⓧ	x	X	x	7.8	158		
		fuscata Blatchley, 1925	x	1	x	1	1	---	20	A	
		gammoni White & Brown, 1976	x	x				---	13	A	described from NC, Significantly Rare (NC NHP 2008)
		grossa Sanderson, 1938									
		harleyi Schmude, 1992					1	---	1	A	allotype from NC, *Stenelmis* sp. C in Ciegler (2003)
		humerosa Motschulsky, 1859									
		hungerfordi Sanderson, 1938									
		lignicola Schmude & Brown, 1992	1	x	x		x	---	26	A	
		mera Sanderson, 1938	x	1		x	x	---	15		
		mirabilis Sanderson, 1938		x		1		---	8	A	
		morsei White, 1982					x	---	3	A	
		musgravi Sanderson, 1938									
		new species (Little R)								A	records for a n. sp. from Tar R are unverified
		quadrimaculata Horn, 1970									
		sandersoni Musgrave, 1940	x	x		x		---	33		
		sinuata LeConte, 1852			x	x		---	17	A	
		williami Schmude, 1992									*Stenelmis* sp. B in Ciegler (2003)
		xylonastis Schmude & Brown, 1992	x		x	x	x	---	35	A	
Gyrinidae											
	Dineutus		Ⓧ	Ⓧ	Ⓧ	Ⓧ	Ⓧ	5.0	1668		
		americanus Linnaeus, 1788									
		angustus Leconte, 1878									
		assimilis Kirby, 1937									
		carolinus LeConte, 1868									
		ciliatus Forsburg, 1821									
		discolor Aube, 1838									
		emarginatus Say, 1823									
		horni Roberts, 1895									
		nigrior Roberts, 1895									
		robertsi Leng, 1911									
		serrulatus LeConte, 1868		1	x			---	8	A	

Taxonomic Hierarchy			Ecoregion *					NCBI Tol. Value	Total No. BAU Records **	Ref. Spec. Avail.	Notes
			Level III			Selected Level IV					
Family	Genus	Species	M	P	CP	SB	SH				
Gyrinidae (cont.)											
	Gyrinus		Ⓧ	Ⓧ	Ⓧ	X	x	5.8	624	A	
		aeneolus LeConte, 1868									
		analis Say, 1823									
		aquiris LeConte, 1868									
		bifarius Fall, 1922									
		elevatus LeConte, 1868									
		gibber LeConte, 1868									
		marginellus Fall, 1922									
		pachysomus Fall, 1922									
		pectoralis LeConte, 1868									
		pernitidus LeConte, 1868									
		rockinghamensis LeConte, 1868									described from NC
		sayi Aubé, 1838									
		woodruffi Fall, 1922									
Haliplidae											
	Haliplus		x	x	X	x		---	55	A	
		annulatus Roberts, 1913									
		confluentus Roberts, 1913									
		fasciatus Aubé, 1838		1	x			---	10		
		leopardus Roberts, 1913									
		mutchleri Wallis, 1933									
		pantherinus Aubé, 1838									
		pseudofasciatus Wallis, 1933									
		punctatus Aubé, 1838									
		triopsis Say, 1825									
	Peltodytes		x	Ⓧ	Ⓧ	X	x	8.4	757		
		bradleyi Young, 1961									
		dietrichi Young, 1961									
		dunavani Young, 1961		1	x			---	5	A	
		duodecimpunctatus (Say, 1825)		x	x	1		---	18	A	
		floridensis Matheson, 1912									
		lengi Roberts, 1913									
		muticus (LeConte, 1853)			x			---	3		
		oppositus Roberts, 1913									
		sexmaculatus Roberts, 1913	x	x	x	x		---	14	A	
		shermani Roberts, 1913		1	x			---	3		

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Taxonomic Hierarchy			Ecoregion *					NCBI Tol. Value	Total No. BAU Records **	Ref. Spec. Avail.	Notes
			Level III			Selected Level IV					
Family	Genus	Species	M	P	CP	SB	SH				
Helophoridae											
	Helophorus		x	x	x	x		---	53		
		linearis LeConte, 1855									
		lineatus Say, 1823								A	
		marginicollis Smetana, 1985								A	
Hydrochidae											
	Hydrochus		x	x	X	x	x	---	63	A	
		excavatus LeConte, 1855									
		foveatus Haldeman, 1852									
		rufipes Melsheimer, 1844									
		simplex Leconte, 1851									
		subcupreus Randall, 1838									
		sp 2 "H. prolatus"									Hellman 1975 unpublished Dissertation
		sp 4 "H. sandrae"									Hellman 1975 unpublished Dissertation
		sp 5 "H. undulatus"									Hellman 1975 unpublished Dissertation
		sp 6 "H. woodi"									Hellman 1975 unpublished Dissertation
Hydrophilidae											
	Anacaena			x	1	1		---	4		
		limbata (Fabricius, 1792)									
		suturalis (LeConte, 1866)									
	Berosus		x	Ⓧ	Ⓧ	X	x	8.8	642	L, A	
		aculeatus LeConte, 1855									
		corrini Wooldridge 1964									
		exiguus (Say, 1825)									
		fraternus LeConte, 1855									
		infuscatus LeConte, 1855									
		ordinatus LeConte, 1855									
		pantherinus LeConte, 1855									
		peregrinus (Herbst, 1797)									
		pugnax Leconte, 1863									
		sayi Hansen, 1999									
	Cymbiodyta		x	x	x	x	1	---	36	L, A	
		blanchardi Horn, 1890									
		chamberlaini Smetana, 1974									
		eumera Smetana, 1974									
		rotunda (Say, 1825)									
		semistriata (Zimmermann, 1869)									
		vindicata Fall, 1924									

Taxonomic Hierarchy			Ecoregion *					NCBI Tol. Value	Total No. BAU Records **	Ref. Spec. Avail.	Notes
			Level III			Selected Level IV					
Family	Genus	Species	M	P	CP	SB	SH				
Hydrophilidae (cont.)											
	Derallus										
		altus (LeConte, 1855)	1	x	x	x	1	---	16		
	Enochrus		x	Ⓧ	Ⓧ	x	x	8.5	170	L	
		blatchleyi (Fall, 1924)									
		cinctus (Say, 1824)									
		consors (LeConte, 1863)									
		consortus Green, 1946									
		fimbriatus (Melsheimer, 1844)									
		hamiltoni (Horn, 1890)									
		interruptus Gundersen, 1977									
		ochraceus (Melsheimer, 1844)			x			---	4	A	
		pygmaeus (Fabricius, 1792)									
		reflexipennis (Zimmermann, 1869)									
		sayi Gundersen, 1977			1			---	1	A	
		sublongus (Fall, 1926)									
	Helobata										
		larvalis (Horn, 1873)			x	1	1	---	6	A	
	Helochares										
		maculicollis Mulsant, 1844	x	x		x		---	7		
	Helocombus										
		bifidus (LeConte, 1855)	x	x	x	x	1	---	14	A	
	Hydrobiomorpha										
		casta (Say, 1835)		1	x			---	3	L	
	Hydrobius		x	x	x	x		---	41	L	
		fuscipes (Linnaeus, 1758)									
		melaenus (Germar, 1824)	x		x			---	5	A	
		tumidus LeConte, 1855									
	Hydrochara				x			---	3		
		brevipalpus Smetana, 1980									
		occulta (Orchymont, 1933)									
		soror Smetana, 1980			1				1	A	
		spangleri Smetana, 1980									
	Hydrophilus										
		ovatus Gemminger and Harold, 1868									a.k.a. *Dibolocelus ovatus*
		triangularis Say, 1823			1	1		---	2		

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Taxonomic Hierarchy			Ecoregion *					NCBI Tol. Value	Total No. BAU Records **	Ref. Spec. Avail.	Notes
			Level III			Selected Level IV					
Family	Genus	Species	M	P	CP	SB	SH				
Hydrophilidae (cont.)											
	Laccobius		X	X	x	x		6.5	99		
		agilis (Randall, 1838)		1				---	1		
		minutoides Orchymont, 1942								A	
		reflexipenis Cheary, 1971	x						3	A	
	Paracymus		1	x	x			---	8	A (cond.)	
		confusus Wooldridge, 1966									
		dispersus Wooldridge, 1966									
		nanus (Fall, 1910)									
		subcupreus (Say, 1825)									
	Sperchopsis										
		tesselata (Ziegler, 1844)	Ⓧ	Ⓧ	X	X	x	4.4	420	L, A	
	Tropisternus		Ⓧ	Ⓧ	Ⓧ	X	x	9.3	434	L	
		blatchleyi Orchymont, 1922			x			---	5	A	NC subspecies - *T. b. blatchleyi*
		collaris (Fabricius, 1775)		x	x			---	8	A	
		lateralis (Fabricius, 1775)								A	NC subspecies - *T. l. nimbatus*
		natator Orchymont, 1938		1	1			---	2	A	
		quadristriatus (Horn, 1871)									NC subspecies - *T. q. quadristriatus*
Noteridae											
	Hydrocanthus		1	x	X	x	1	---	81	A	
		atripennis Sharp, 1882									
		iricolor Say, 1823									
		oblongus Sharp, 1882									
	Notomicrus										
		nanulus (LeConte, 1863)				1		---	1	A	confirmed by K. Miller
	Suphisellus			x	x	1		---	13	A	
		bicolor (Say, 1830)									NC subspecies - *S. b. punctipennis*
		puncticollis (Crotch, 1873)			x			---	2	A	
Psephenidae											
	Dicranopselaphus										
		variegatus Horn, 1880									collected by outside agency from Coastal Plain
	Ectopria										
		nervosa (Melsheimer, 1845)	Ⓧ	Ⓧ	x	X	X	4.3	475	L	
	Psephenus										
		herricki (Dekay, 1844)	Ⓧ	Ⓧ	x	Ⓧ	Ⓧ	2.3	1437	L	

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			Level III			Selected Level IV					
Family	Genus	Species	M	P	CP	SB	SH				
Ptilodactylidae											
	Anchytarsus										
		bicolor (Melsheimer, 1846)	Ⓧ	Ⓧ	x	x	x	2.4	369	L	
Scirtidae											
	Cyphon				x			---	4	L	
		collaris (Guérin and Méneville, 1843)									
		cooperi Schaeffer, 1931									
		obscurus (Guérin and Méneville, 1843)									
		perplexus Blatchley, 1914									
		ruficollis (Say, 1825)									
Scirtidae (cont.)											
	Cyphon (cont.)										
		variabilis (Thunberg)									
	Scirtes		1	x	X	x	1	---	81		
		orbiculatus Fabricius, 1801									
		ovalis Blatchley, 1924									
		tibialis (Guérin and Méneville, 1843)									

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