THE WATER BEETLES OF MAINE: INCLUDING THE FAMILIES *GYRINIDAE, HALIPLIDAE, DYTISCIDAE, NOTERIDAE, AND HYDROPHILIDAE*

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To my wife, Joann, whose patience and hard work have contributed so much, I dedicate this work.

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THE WATER BEETLES OF MAINE: INCLUDING THE FAMILIES *GYRINIDAE, HALIPLIDAE, DYTISCIDAE, NOTERIDAE, AND HYDROPHILIDAE*

INTRODUCTION

Relatively little is known about Maine's water beetle fauna. Winters (1927) recorded five species of Hydrophilidae from Orono. Randall (1838) named *Laccobius agilis* from Hallowell. In 1922, Fall named *Gyrinus bifarius* from Paris and *Gyrinus frosti* from Monmouth, Maine. In the same paper, Fall records ten other species of *Gyrinus* from various localities within the State. In the Leng catalog (1920), two species of Dytiscidae are noted as occurring in Maine as is one species of Haliplidae. There are only two examples of extensive collecting of Maine water beetles. First, there was the work of Frost early in this century. His material was that used by Fall in making his determinations. Second, there was the Mount Desert region survey by Proctor (1946). This latter work, while very thorough, is outdated in its treatment of some genera. Further, it only lists the species collected; no keys or descriptions are included. Finally, it certainly is not a complete species list for the State. Although some information can be gained by examining the records of species found in the other New England states, total coverage of the area is spotty at best.

Recently published works elaborate the water beetle faunas of California, Florida, and the Pacific Northwest. No revision has been attempted, however, of any Northeastern fauna. The nomenclature for that area is therefore highly burdened with synonomy and scattered through a number of publications. While this work is not meant as a revision, it is hoped that it will form a basis for the efforts of other workers wishing to study the water beetles of this region. This work is also intended to lessen the taxonomic chores of fresh-water biologists in Maine.

METHODS

Material for study was obtained from existing collections and from personal collecting by the author. First, I am indebted to the University of Maine for the use of its collection. I also wish to thank Dr. A. E. Brower and Mr. Richard Dearborn, both of the Maine Forest Service, and Mr. Donald Wilson, of the University of Maine, for the loan of specimens.

Field collections were made throughout the State. Two basic methods were used. For most dytiscids, gyrinids, and haliplids and some hydrophilids a standard dip net was used. With this, one may sample a few feet from shore among submerged and emergent vegetation where these beetles are most often found. For the smaller, crawling hydrophilids, which live within about six inches of shore, a small diameter household strainer was used. Using the strainer, one must first stir around in the water in the area to be sampled and then scoop up the beetles which have been dislodged. Stirring loosens the beetles' grip on the substrate. Once dislodged, the bubble of air carried on the venter causes them to pop to the surface. It is an easy matter to pick up the beetles in this state as most do not actively swim. Until they reach an object on which they can crawl below the surface, they are quite helpless. Once collected, the beetles were immediately placed in 70% ethyl alcohol where they remained until pinned.

In most genera, sex can be determined by close observation of the protarsi. In males the protarsi are often expanded and possess either glandular hairs or suction discs or both. Genitalic extraction in genera without this distinction must be done in order to separate males. The male genitalia are an important key character in many genera and it is best to extract the genitalia routinely when pinning water beetles stored in alcohol. A fine needle is passed into the abdomen between the sclerites of the last segment. The genitalia are then pried out. If care is used, this operation does not sever the connections of the aedeagus to the body. Should the connection be broken, however, the genitalia can be attached to a paper point and mounted just below the insect. The genitalia of dried specimens can be extracted if the specimen is allowed to soak in boiling water until soft. This may take from a few seconds to several minutes depending on the age of the specimen.

Most determinations of species were made using a Bausch and Lomb Stereozoom microscope with a doublet lens. This combination gave a maximum magnification of 60 power. Unless indicated, all illustrations are original.

The expression "expected in Maine" is used in many places in this work. It is defined to include all species collected in Maine in this work or recorded by other authors from Maine or other Northeastern states and Southern Canada. Where a species is expected because it is known to be present in the Northeast, data are given on the nearest localities to Maine recorded in the literature.

All keys presented in this work are to adults. In most cases larval descriptions and keys are unavailable.

FAMILY GYRINIDAE

The gyrinids are the only surface inhabiting family of the aquatic Coleoptera. Except when greatly alarmed, they will not dive. In many ways their biology is adapted to life at the surface. The eyes of gyrinids are completely divided, one half below the surface, the other above. The long front legs, which are often held extended forward, act as a funnel to bring objects in the path of the beetle towards its mouth. The adult is a surface film scavenger, feeding primarily on insects which have fallen into the water. The middle and hind legs are modified into paddle-like appendages used in swimming. The antennae rest on the surface film and are thought to have an echolocation capability (Tucker, 1969). Eggs are laid on submerged vegetation. The larvae are predacious on other aquatic insects. They breathe by means of tracheal gills and are independent of the surface film. Like the dytiscids, the larvae possess hollow mandibles through which digestive enzymes may be injected into their prey (Leech and Chandler, 1956). The pupa is the only non-aquatic stage. A pupal cell is constructed above the water either on the stems of emergent vegetation or on the shore.

Important taxonomic references to this family include LeConte (1868) and Young (1954). Roberts (1895) revised the genus *Dineutus* and Fall (1922a) revised *Gyrinus*. Hatch (1925) gave an outline of the ecology of the family. A second paper in 1927 by Hatch dealt with the biology of the genus *Dineutus*. The latter paper includes a key to the larvae of four species found in this area. Smith (1926) provides notes on the behavior of *D. americanus* (syn. D. *assimilis*). His paper is a good supplement to Hatch (1925) and includes data on seasonal population cycles.

Of the three genera in the United States, *Dineutus* and *Gyrinus* occur in Maine. They are separated as follows, according to Arnett (1968).

1a: Scutellum concealed; elytra smooth or with nine vague or moderately impressed striae; average size large, 9-15 mm. in length . . . . . *Dineutus*

1b: Scutellum exposed; elytra each with eleven striae of punctures, discal striae rarely obsolete; average size smaller, 4-7 mm. in length . . *Gyrinus*

Genus *Dineutus*

Key to the species of *Dineutus* expected in Maine (modified from Roberts, 1895)

1a: Sutural angles produced in one or both sexes 2

1b: Sutural angles rounded in both sexes 5

2a: Sutural angles of the female produced and strongly dehiscent, rounded in the male; aedeagus as in figure 1 . . . . . *D. horni*

2b: Sutural angles produced in both sexes 3

3a: Under surface brown or testaceous; femora of male toothed; aedeagus as in figure 1 . . . . . *D. discolor*

3b: Under surface black, shining, usually bronzed; femora of male not toothed 4

4a: Elytral apices not strongly depressed, dehiscent at suture; aedeagus as in figure 1; anterior tibia regularly broadened from base to apex, exterior angle rectangular . . . . . *D. assimilis*

4b: Elytral apices strongly depressed, not dehiscent at suture, aedeagus as in figure 1.; anterior tibia regularly broadened from base to apex, exterior angle acute *D. nigrior*

5a: Femora of male not toothed; aedeagus as in figure 1.; size large, average 13.8 mm. in length; surface very shining; elytra with a bronze vitta . . . . *D. vittatus*

5b: Femora of male toothed; aedeagus as in figure 1.; size small to medium, average 10.5 mm. in length; surface black, frequently bronzed . . . . . *D. emarginatus*

Comments on Maine species of *Dineutus*

D. horni Roberts: A character not mentioned in the literature, but constant in all collected specimens of *D. horni,* is the color of the epipleurae. In both sexes they are testaceous. The females of *D. horni* resemble those of *D. nigrior* and *D. assimilis* but may be separated by the above character. Likewise, the males of *D. horni* may be separated from those of *D. emarginatus* by the color of the epipleurae. *D. nigrior, D. assimilis,* and *D. emarginatus* all have dark epipleurae. *D. horni* is very common in Maine.

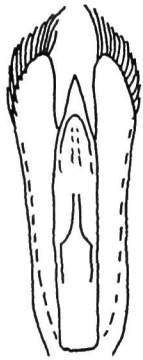
D. discolor Aubé: This species cannot be confused with any other. It is the only member of our fauna with the entire underside pale. In addition, the male genitalia are quite distinctive. The presence of a tooth on the front femora of the male separates *D. horni* from the other species with sulcate elytra.

D. nigrior Roberts: The male genitalia are the best character for separating this species from *D. assimilis,* which it closely resembles. For separating the females, the key characters are recommended. The number of setigerous punctures of the front femora may be used, according to Roberts (1895), but this character may be variable. Roberts gives ten

punctures for the female of *D. nigrior*, eight for the female of *D. assimilis*, nine for the male of *D. nigrior*, and seven for the male of *D. assimilis*. *D. nigrior* is a very common species.

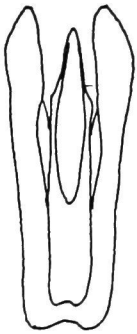
D. assimilis Aubé: Only female specimens of what is apparently *D. assimilis* have been collected in Maine. This may be an accident of collection or it may represent a variability in the characteristics, partic-

D. horni

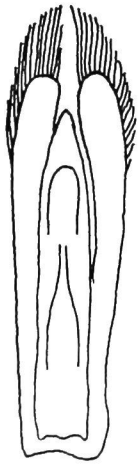


D. nigrior

D. discolor



D. assimilis
redrawn from
Roberts, 1895



D. vittatus

D. emarginatus

Figure 1
Male Genitalia of *Dineutus*

ularly the number of femoral punctures, of *D. nigrior* females. The figure given for the male genitalia of *D. assimilis* is from Roberts (1895). He does not include the apical hairs on the parameres on any of his illustrations.

D. vittatus Aubé: One specimen was taken in New Hampshire by Donald Wilson. Undoubtly the species is present, at least in western Maine. The large size and rounded elytral apices should separate it very easily.

D. emarginatus Say: Smaller than most others, this species can be recognized by the rounded elytral margins and toothed male femora.

The reader should consult both the genitalic illustrations given here and those given by Roberts before making determinations. In addition, Roberts figures the femora and elytral apices of all species.

Genus *Gyrinus*

Fall (1922b) revised this genus. The first sentence of his paper is: "It would be difficult to find in collections of American Coeloptera, a group or genus in which the species are so consistently muddled as they are in the genus here considered." Arnett (1968) says of the entire family, of which *Gyrinus* represents the greatest part, "Most of the species have been separated, but they are as yet rather poorly defined." On the basis of this and other information, determinations in this genus have not been attempted. The reader is referred to Fall's paper and to Young's "Water Beetles of Florida" if he wishes more information. The records of *Gyrinus* in Maine given by Fall are: *G. minutus*: Monmouth; *G. lecontei*: Monmouth, Paris; *G. ventralis*: Monmouth; *G. affinis*: Monmouth, Paris; *G. fraternus*: Monmouth, Paris; *G. pugionis*: Bar Harbor; *G. aeneolus*: Paris; *G. pernitidus*: Paris; *G. dichrous*: Monmouth; *G. lugens*: Monmouth, Paris, Wales, East Machias, Mt. Desert; *G. latilimbus*: Paris; *G. bifarius*: Paris; *G. frosti*: Monmouth.

In addition to these, the following species have been recorded in the vicinity of Maine, according to Fall: *G. rockinghamensis, G. analis, G. woodruffi, G. confinis, G. aquiris, G. borealis.*

FAMILY HALIPLIDAE

The haliplids are commonly referred to as the crawling water beetles. Although they are most commonly found crawling among aquatic plants, they are quite capable of swimming from plant to plant. They are equipped with long swimming hairs on the mid and hind legs, equal to those found in other aquatic Coleoptera.

The most thorough treatment of the biology of the family was by

Hickman (1931). He includes much new information, and tests many older hypotheses. The diet of the adult beetles is entirely herbivorous. When starved, the beetles will take animal food. Hickman proved, however, that animal food alone will not sustain the beetles over long periods. Unlike most water beetles, the haliplids are able to remain active through the winter. They congregate in deep water plant growth where bubbles of air collect under the ice. Hickman also experimented with freezing specimens. After twelve days of alternate freezing and thawing on a daily cycle, the beetles were still alive.

Eggs are generally cemented to the surface of the food plants. *Haliplus immaculicollis,* according to Hickman, first cuts holes in the stem before depositing the eggs. The larvae feed on algae. The pupa is non-aquatic, a pupal cell being constructed in the mud of the bank.

In 1912, Matheson revised the entire family for North America. During the following year Roberts published notes on his study of the taxonomy of the family. In addition to correcting many errors in Matheson's work, Roberts described 15 new species. He included a key to the species of *Peltodytes*. He did not, however, feel qualified to construct a key to the species of *Haliplus*. Wallis (1933) revised the genus *Haliplus* and included a key. In working with *Haliplus,* the reader should use Wallis, supplementing this with the descriptions of Matheson and Roberts.

Four genera of Haliplidae are recognized in the United States. *Haliplus* and *Peltodytes* occur in Maine. They are separated as follows, according to Young (1954).

1a: Hind coxal plates margined and reaching to the base of the last abdominal sternite; last segment of both the labial and maxillary palpi larger than the penultimate . . . . . *Peltodytes*

1b: Hind coxal plates not margined and reaching only to the apex of the third abdominal sternite; last segment of both palpi smaller than the penultimate . . . . . *Haliplus*

Genus *Peltodytes*

Key to the species of *Peltodytes* expected in Maine (modified from Roberts, 1913)

1a: Posterior femora entirely black or brown 2

1b: Posterior femora multicolored 5

2a: Elytra without subhumeral spot or dash of black . . 3

2b: Elytra with subhumeral spot or dash of black 4

3a: Median spots coalescent on suture, forming a black blotch . . . . . *P. muticus*

3b: Median spots free, not coalescent on suture . . . *P. sexmaculatus*
4a: Last abdominal segment shining, polished . . . *P. pedunculatus*
4b: Last abdominal segment dull, rugose . . . . . *P. shermani*
5a: Posterior femora black, ringed with yellow before the apex; apices of coxal plates angulate 6
5b: Posterior femora pale, apices only darker; apices of coxal plates rounded to subangulate . . . . *P. tortulosus*
6a: Elytra without subhumeral spot or dash of black 7
6b: Elytra with a more or less distinct spot or dash of black . . . . . *P. duodecimpunctatus*
7a: Base of head with black collar; apices of posterior coxal plates angulate . . . . . *P. edentulus*
7b: Base of head without black collar; apices of posterior coxal plates rounded . . . . . *P. lengi*

Comments on species of *Peltodytes*

P. muticus LeConte: The key characters are sufficient for recognition of this species. The University of Maine Collection contains only a single specimen, determined by Matheson, from Ithaca, New York. The presence of this species is unconfirmed.

P. sexmaculatus Roberts: Roberts records this species from Massachusetts in his description. It should be easily separated from *P. muticus* by the degree of development of the median elytral macula. None was collected in Maine.

P. pedunculatus Blatchley: A single specimen is in the University Collection, labeled as taken in Orono. The key character is definitive.

P. shermani Roberts: The rugose surface of the last abdominal sternite is quite evident. The University Collection contains one specimen from Amherst, Massachusetts.

P. tortulosus Roberts: This is the most common of the species of *Peltodytes* found in Maine; however, no species of this genus is truly common in the state. Proctor records *P. tortulosus* from Mt. Desert Island. The University Collection contains specimens from several localities in Maine. The key characters separate this species quite easily.

The University Collection contains one specimen each of *P. duodecimpunctatus* Say and *P. edentulus* LeConte. Both are from Ithaca, New York and both bear Matheson's determination labels. *P. lengi* Roberts has been recorded from New York State. None of these has been collected in Maine, but their presence is not ruled out.

Roberts (1913) is the best taxonomic reference to this genus. His descriptions, many original, should be consulted in conjunction with the comments given here. Young (1961) figures the male genitalia of several species.

Genus *Haliplus*

Key to the species of *Haliplus* expected in Maine (modified from Wallis, 1933)

1a: Pronotum folded or pleated basally (fig. 2) 2
1b: Pronotum not folded or pleated basally 4
2a: Apices of elytra strongly sinuate; 3.0 mm. in length . . . . . *H. blanchardi*
2b: Apices of elytra not strongly sinuate, rounded or almost subtruncate and feebly sinuate 3
3a: Basal pronotal plicae short, less than one quarter the length measured from base of plica along the plica to the anterior margin of the pronotum; prosternal process rather deeply channeled longitudinally, especially over declivity; elytral maculation usually distinct, consisting of six black spots in a half elipse, enclosing a common sutural blotch, in extreme cases the maculation may almost entirely disappear; 2.5-3.0 mm. in length . . . . . *H. immaculicollis*
3b: Basal pronotal plicae longer, more than one quarter the length measured from base of plica along plica to anterior margin of pronotum; prosternal process not or very feebly channeled; elytra with more or less definite spots; 2.7-3.0 mm. in length . . *H. longulus*
4a: Prosternal ridge plainly margined at sides . 5
4b: Prosternal ridge not at all margined at sides or at most only feebly so at apex 10

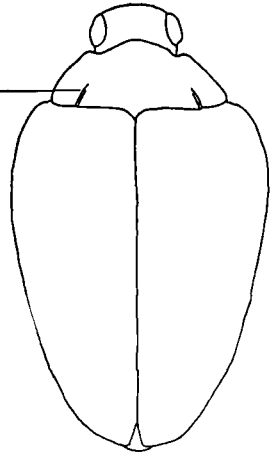


Figure 2
Haliplus immaculicollis
Dorsal View

5a: Apices of elytra strongly sinuate; penultimate joint of labial palpi dilated inwardly into a prominent angle; 2.5-3.0 mm. in length ..... *H. borealis*

5b: Apices of elytra at most only feebly sinuate; penultimate joint of labial palpi not dilated 6

6a: Anterior margin of pronotum not beaded at sides, frequently with a median dark spot 7

6b: Anterior margin of pronotum beaded at sides, without median dark spot 9

7a: Trochanters of the middle legs with coarse deep punctures; length 4.0-4.25 mm. ..... *H. leopardus*

7b: Trochanters of the middle legs without or with few punctures 8

8a: Tarsal claws short; aedeagus abruptly bent downward in apical fifth; 3.0-4.0 mm. in length ..... *H. triopsis*

8b: Tarsal claws long; aedeagus almost evenly curved from base to apex; 3.5-4.0 mm. in length ..... *H. pantherinus*

9a: Apices of elytra distinctly denticulate; sutural stripe narrow, not extending to the sutural striae ..... *H. connexus*

9b: Apices of elytra little if at all denticulate; sutural stripe broad, extending to the sutural striae; 4.0-4.5 mm. in length ..... *H. fasciatus*

10a: Mid-metasternum deeply depressed behind the middle coxae; color reddish-yellow; elytral spots distinct 11

10b: Mid-metasternum about on the same level behind as between the middle coxae, with a circular or subtriangular fovea at middle; elytral punctures distinctly brownish or blackish; basal row of coarse pronotal punctures blackened; aedeagus at tip a little less than two-thirds the width at middle, 3.75-4.25 mm. in length ..... *H. subguttatus*

11a: Average size about 4.75 mm.; punctulation of elytral striae coarse ..... *H. cribrarius*

11b: Average size about 3.75 mm.; punctulation of elytral striae finer ..... *H. canadensis*

Comments on species of *Haliplus*

H. blanchardi Roberts: No specimens of this species have been collected in Maine. Wallis (1933) gives the range of this species as: "from Connecticut and New York west to Minnesota and south to Louisiana." Roberts (1913) named the species from Connecticut but had specimens from Massachusetts as well. Wallis figures the male genitalia for all species.

H. immaculicollis Harris: This is by far the most common species of Haliplidae found in Maine. It separates quite well from *H. longulus* using the key characters. For some time the name *H. ruficollis* had been applied to this species; however, *H. ruficollis* is a European species. According to Wallis (1933), Zimmerman split the two species and restored the name *H. immaculicollis* for North American specimens. Wallis gives a number of differences between the two species.

H. longulus LeConte: Similar in size to *H. immaculicollis*, this species lacks most of the dorsal maculation. The two species are much smaller than any of the others so far collected in Maine.

H. borealis LeConte: This species has not been collected in Maine. It is a small species, less than three millimeters in length. Wallis gives the localities as: "The northern United States, south of the Great Lakes, west to Minnesota, north to Manitoba." He does not, however, give detailed locality data for this area. The presence of this species in Maine remains questionable.

H. leopardus Roberts: Wallis records this species from Massachusetts. Identification, based on the punctation of the middle trochanter, should be very easy.

H. triopsis Say: The range of this species covers most of the United States. It is, however, more common in the west (Wallis 1933). Only one specimen is in the University Collection, from Orono.

H. pantherinus Aubé: The shape of the aedeagus is very important in separating this species from *H. triopsis*. If specimens of both are available for comparison, the relative lengths of the tarsal claws can be used.

H. connexus Matheson: This species is quite common in Maine. The denticulate elytral margin is quite obvious and sets this species apart from all others.

H. fasciatus Aubé: The key characters separate this species very well. The University Collection contains several specimens from the Orono area.

H. subguttattus Roberts: Roberts (1913) reports this species from Tyngsboro, Massachusetts. It may be present in Maine but it has not been collected. The male genitalia may be helpful in separating this species from the following two.

H. cribrarius LeConte: This species is very common. The University Collection contains nearly as many specimens as for *H. connexus*. The male genitalia are helpful in making a positive identification.

H. canadensis Wallis: Vermont is the closest locality listed by Wallis in his description of the species. It is probably present at least in southern Maine but has not been collected as yet.

FAMILY DYTISCIDAE

The Dytiscidae are known as the predacious diving beetles. The larvae, which earn the title "water tigers," are fierce predators on other aquatic insects and even small fish. Their mandibles are hollow and sickle-shaped. Digestive fluids are pumped out through the mandibles into the prey. The process is then reversed and the partially digested prey is sucked back into the larva. The larvae are strong swimmers whose normal habit is to hang suspended from the surface film with the body arched. When something passes within reach, the body is suddenly flexed, propelling the larva rapidly forward towards its prey. The larval legs are equipped with swimming hairs which are quite effective in non-attacking situations.

There are several egg-laying habits according to Leech and Chandler (1956). Some are laid externally on plants or submerged objects; others are inserted into plant tissue either directly, or indirectly after chewing a hole with the mandibles; and still others are inserted in mud or in crevices either in or near the water. Three basic types of ovipositors correspond generally to the three oviposition habits. Pupae are formed on the shore in a mud cell either at or below the surface. The adults are predacious similar to the larvae. Adult dytiscid beetles are the best swimmers of the aquatic Coleoptera; they have swimming hairs on the hind legs. In addition, they move their legs in a parallel motion, like oars. Other water beetles move the legs alternately as in walking. Parallel motion increases efficiency and aids directional stability.

Taxonomic references will be covered under the generic headings. It is on this level that most recent works have been done.

Key to the northeastern genera of Dytiscidae (modified from Arnett, 1968)

1a: Middle of prosternum and its postcoxal process in same plane (fig. 3a); front and middle tarsi distinctly 5-segmented, segment 4 approximately as long as 3; scutellum exposed or concealed 9

1b: Middle of prosternum not in same plane as its process (fig. 3b); front and middle tarsi 4-segmented or 5-segmented with 4th very small and almost concealed between lobes of 3rd; scutellum usually concealed 2

2a: Scutellum not covered . . . . . *Celina*

2b: Scutellum covered 3

3a: Broad apex of hind coxal processes conjointly divided into three parts, two widely separated narrow lateral lobes and broad depressed middle region (fig. 4) *Hydrovatus*

3b: Hind coxal processes not divided into three parts, but

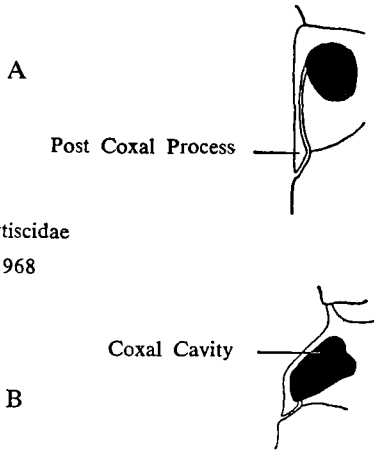


Figure 3
Prosternum of Dytiscidae
from Arnett, 1968

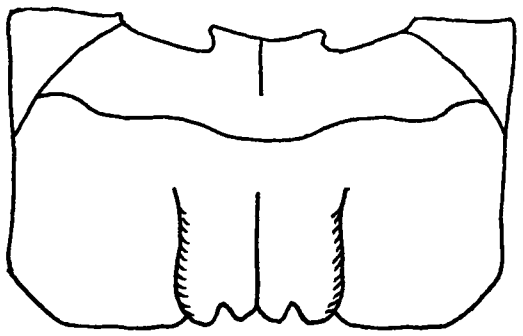


Figure 4
Sternal plate of *Hydrovatus*
from Arnett, 1968

either without lateral lobes or with these lobes covering bases of trochanters 4

4a: Hind coxal processes without lateral lobes, bases of hind trochanters entirely free 5

4b: Sides of hind coxal processes divergent, more or less produced into lobes which cover bases of hind trochanters (fig. 5) 7

5a: Hind tibia straight, of almost uniform width from near base to apex; hind tarsal claws unequal; prosternal process short and broad, or rhomboid; epipleural fold with diagonal carina crossing near base; glabrous *Desmopachria*

5b: Hind tibia slightly arcuate, narrow at base, gradually widening to apex; hind tarsal claws equal; prosternal process oblong; epipleural fold usually without diagonal carina near base 6

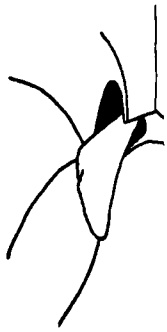


Figure 5
Coxal Process of *Hygrotus* sp.
from Arnett, 1968

6a: Hind coxal lines strongly sulcate-impressed, parallel posteriorly, converging as they continue forward across mid-metasternum to meet at middle coxae (fig. 6); front and middle tarsi clearly 5-segmented . . . *Bidessonotus*

6b: Hind coxal lines not continued anteriorly across metasternum; front and middle tarsi apparently four segmented . . . . . *Bidessus*

7a: Bases of hind femora contacting hind coxal lobes . *Laccornis*

7b: Hind femora separated from hind coxal lobes by basal part of trochanters 8

8a: Diagonal carina crossing epipleural fold near base (fig. 7); front and middle tarsi 4-segmented . . *Hygrotus*

8b: No carina crossing epipleural fold; front and middle tarsi 5-segmented, fourth usually very small and hidden between lobes of third . . . . . *Hydroporus*

9a: Scutellum covered, or rarely small tip visible; hind tarsi with a single straight claw . . . . *Laccophilus*

9b: Scutellum visible 10

10a: Eyes emarginate above bases of antennae; first three

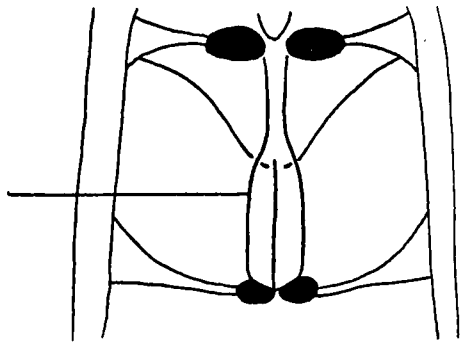


Figure 6
Sternum of *Bidessonotus* sp.
from Arnett, 1968

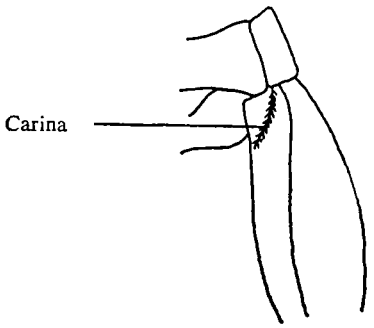


Figure 7
Epipleural Fold of *Hygrotus* sp.
from Arnett, 1968

segments of front tarsi of male widened and with adhesion discs or discs absent, but never together forming nearly round plate 11

10b: Eyes not emarginate above bases of antennae; first three segments of front tarsi of male greatly broadened, forming a nearly round or oval plate with adhesion discs . . 19

11a: Hind femora with linear group of cilia near posterior apical angle 12

11b: Hind femora without such a group of cilia . 13

12a: Hind tarsal claws of equal length; if slightly unequal, then both are very short, only ⅓ length of fifth tarsal segment . . . . . *Agabus*

12b: Hind tarsal claws obviously unequal, outer one of each pair ⅔ or less length of inner claw . . . . . *Ilybius*

13a: Prosternum with median longitudinal furrow, from near front margin to apex of prosternal process; first four hind tarsal segments distinctly produced at upper (inner) posterior corners . . . . . *Matus*

13b: Prosternum without median longitudinal furrow; hind tarsal segments not lobate at upper hind corners . . 14

14a: Hind coxal lines divergent anteriorly, coming so close together posteriorly as almost to touch median line, thence turning outward almost at right angles onto hind coxal processes (fig. 8); hind tarsal claws equal; pronotum clearly but narrowly margined laterally . *Copelatus*

14b: Hind coxal lines never almost touching median line; hind tarsal claws equal or not; pronotum margined or not 15

15a: Hind tarsal claws of equal length or virtually so 16

15b: Hind tarsal claws obviously unequal, outer ones only from ⅓ to ⅔ length of inner ones 17

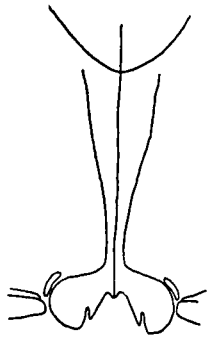


Figure 8
Coxal Lines of *Copelatus* sp.
from Arnett, 1968

16a: Apical segment of palpi notched or emarginate at apex; pronotum clearly though narrowly margined laterally . . . . . *Coptotomus*

16b: Apical segment of palpi not emarginate at apex; pronotum with exceedingly fine line along lateral edges, but not margined . . . . . *Agabetes*

17a: Anterior point of metasternum, between mesocoxae, clearly triangularly split to receive apex of prosternal process, triangular channel usually deep with its apex about on line with hind margins of middle coxae; pronotum usually margined laterally . . . . . *Rhantus*

17b: Anterior apex of metasternum depressed, with shallow pit or broad notch to receive apex of prosternal process, never with sharply defined triangular excavation; pronotum not margined 18

18a: Elytral sculpture consisting of numerous parallel transverse grooves . . . . . *Colymbetes*

18b: Elytra coarsely reticulate, without transverse grooves . . . . . *Neoscutopterus*

19a: Inferior spur at apex of hind tibia dilated, much broader than other spur; first three segments of front tarsi of male forming oval plate . . . . . *Cybister*

19b: Inferior spur not or but little broader than other spur; first three segments of tarsi of male forming nearly round plate 20

20a: Posterior margins of first four hind tarsal segments beset with fringe of flat golden cilia 21

20b: Posterior margins of first four hind tarsal segments bare . . . . . *Dytiscus*

21a: Outer margin of metasternal side wings arcuate; outer

(shorter) spur at apex of hind tibia blunt, more or less emarginate 22

21b: Outer margin of metasternal wings straight; outer spur at apex of hind tibia acute . . . . . *Hydaticus*

22a: Elytra densely punctate, and in addition usually fluted and hairy in female . . . . . *Acilius*

22b: Elytral punctation extremely fine or absent; some females with superimposed sexual sculpture of elongate grooves, or granulate . . . . . *Graphoderus*

Genus *Celina*

A single species, *Celina angustata* Aubé, has been recorded in the northeast. Wickham (1895) gives a questionable record for this species from Canada. Leng (1920) lists New York, as does Young (1954). None has been collected in Maine. The three other known species are all from the southeast. For a complete treatment of the genus see Young (1954).

Genus *Hydrovatus*

Key to the species of *Hydrovatus* expected in Maine (modified from Young, 1956)

1a: Size large, slightly over 3.0 mm. in length; punctation of dorsum coarse; last visible abdominal sternite with a small, vaguely flattened median ridge . . *H. indianensis*

1b: Size smaller, 2.3-2.75 mm. in length; punctation of dorsum finer; last visible abdominal sternite without a flattened median ridge *H. pustulatus pustulatus*

Comments on species of *Hydrovatus*

H. indianensis Blatchley: Young (1956) records this species from Massachusetts. It has not been found in Maine.

H. pustulatus pustulatus Melscheimer: There has been considerable confusion over the identity of this species which Young (1963b) attempts to clarify. As now defined, this species is found throughout the eastern United States. In the present study it was collected in Norway, Maine.

Genus *Desmopachria*

Desmopachria convexa LeConte is the only species known to occur in the northeast. Young (1951) gives the range as "Canada and New York to Indiana." Of the six other described species, none is

known from closer than Georgia. Young indicates that the group of species to which *D. convexa* belongs is in great need of revision. Such a revision might affect the limits of this species and the reader should check current literature before attempting determinations. *D. convexa*, as now defined, was collected in Mariaville and Milford, Maine.

Genus *Bidessonotus*

Young (1954) records *Bidessonotus inconspicuus* LeConte from Massachusetts and more southern localities. It has not been collected in Maine. The two other species in the genus are both southeastern. Young (1954) gives a very complete summary and bibliography for the genus.

Genus *Bidessus*

Key to the species of *Bidessus* expected in Maine (modified from Young, 1954 and Hatch, 1928)

1a: Elytral plicae extremely short or lacking, not extending well onto the disk 2

1b: Elytral plicae evident, may be shorter than pronotal plicae but always reaching disk 3

2a: Elytral plicae lacking, at most represented by a vague impression, or an indefinite series of punctures . . . *B. flavicollis*

2b: Elytral plicae represented by very short, but deep, impressions on the base of the elytra, seldom reaching the disk . . . . . some *B. fuscatus*

3a: Elytral plicae distinct, and distinctly shorter than the pronotal plicae, but extending onto the disk of the elytra 4

3b: Elytral plicae distinct, subequal to or longer than the pronotal plicae 5

4a: Elytra very coarsely punctate; dorsum only moderately shining, sometimes opaque; form narrowly elongate oval, the sides rather subparallel; length about 1.7 mm. . . . . *B. fuscatus*

4b: Elytra finely punctate; dorsum highly polished, very shining; form more regularly ovate; size slightly larger, about 1.75-2.0 mm. . . . . some *B. affinis*

5a: Elytral plicae distinctly longer than pronotal plicae 6

5b: Elytral plicae subequal to or a bit longer than the pronotal plicae 8

6a: Elytra coarsely and distinctly punctate, not blackish

at base; body ovate ..... *B. granarius*

6b: Elytra more finely punctate, blackish at base; body less ovate to elongate oval 7

7a: Body subovate; elytra finely punctate, very finely and feebly pubescent ..... *B. suburbanus*

7b: Body elongate oval; elytra finely and indistinctly punctate; finely pubescent ..... *B. lacustris*

8a: Dorsum coarsely punctate; form elongate oval, sides subparallel ..... *B. fuscatus*

8b: Dorsum finely punctate; form narrowly ovate .. *B. affinis*

Comments on species of *Bidessus*

B. flavicollis (LeConte): Young (1954) records this species from as far north as New York. It has not been collected in Maine. The nearly complete lack of elytral plicae should separate it from those individuals of *B. fuscatus* which come out in this couplet. The plicae of *B. fuscatus* are always quite deeply impressed although sometimes short.

B. fuscatus (Crotch): The complete variability in the length of the elytral plicae means that this species comes out in three places in Young's key. *B. affinis,* as well, comes out in two places based on this character. The reader is urged to beware of such a key, that is, one which has as its basis a character which is known to be variable in several species. Hatch (1928) ignored, or was not aware of, the variability of this character. His use of it in his key is therefore misleading. One specimen of *B. fuscatus* was collected in Maine and it keyed to couplet two. The species appears most like *B. affinis* but lacks the strong vittaform elytral markings of the latter.

B. affinis (Say): This species is the most common of the genus in this area. There are two forms in Maine; first, the typical form and second, a microreticulate form. The latter would appear to be Hatch's var. *microreticulatus* which he described from Michigan and Washington. The typical form is far more common. All the specimens collected had long elytral plicae and so went to couplet eight in the key.

B. granarius (Aubé): This species has been recorded from Massachusetts but has not been collected in Maine. The coarse elytral punctation should separate it from the following two species.

B. lacustris (Say) and *B. suburbanus* Fall: These two species are separated by rather fine distinctions. Without specimens for comparison, positive determinations are impossible. One series of *Bidessus* collected seems to be *B. suburbanus* but this is only speculation. *B. lacustris* has been recorded from Massachusetts; *B. suburbanus from* New York.

Young (1954) gives very good descriptions of all species but *B. suburbanus.* He does, however, relate that species to *B. lacustris.*

Genus *Laccornis*

Key to the species of *Laccornis* expected in Maine (modified from Leech, 1940)

1a: Metacoxal plates often subrugose, distinctly punctate, the punctures a little finer than those of elytra; males with elytra more attenuated posteriorly, with anterior protarsal claws strongly and acutely toothed at middle, with meso and metafemora ciliate posteriorly, and with antennal segments three to seven broadened *L. conoideus*

1b: Metacoxal plates finely strigate, very finely and sparsely punctate, or both; males with elytra more attenuated than in females, or not; anterior protarsal claws of males broadened and contorted, meso- and metafemora not ciliate posteriorly (except *L. difformis*), antennal segment four somewhat broadened and elongated 2

2a: Larger species, about 5.8 mm. in length; pronotum reddish-brown at least discally, little or not at all darker than the head or elytra; metafemora of males ciliate along posterior margin . . . . . *L. difformis*

2b: Smaller species, about 5.4 mm. in length; pronotum piceous, darker than head or elytral base; metafemora of males not ciliate posteriorly. . . . . *L. latens*

Comments on species of *Laccornis*

Of these three species only *L. difformis* (LeConte) has been recorded in Maine, by Proctor (1946). *L. conoideus* (LeConte) and *L. latens* (Fall) have both been collected in Massachusetts according to Leech (1940) who gives excellent figures of the male genitalia. No specimens of *Laccornis* were collected in the present study. The generic character given in the key, that is, "Hind femora reaching the coxal lobes", should be quite apparent. According to Leech, it should look similar to the condition in *Ilybius* and *Agabus*. Care must be used, however, as some *Hydroporous* approach this condition.

Another paper of importance to the study of this genus is Fall's revision of 1923. It contains several new descriptions and a general background of the genus. He treats it under the name *Agaporus* which is now recognized as synonomy for *Laccornis*. Unfortunately, this paper is very difficult to obtain and so Leech alone is more often used.

Genus *Hygrotus*

Anderson is in the process of publishing a revision of this genus, the first section having been published in March, 1971. The last re-

vision was that of Fall in 1919. Due to the unstable state of the taxonomy of the genus, neither a key nor descriptions of species are included.

One species, *H. sayi* Balfour-Browne, from Maine is covered in section one of Anderson's revision. This is the *Coelambus punctatus* of Fall's 1919 paper. The species is very abundant in Maine. Another species, *H. farctus* LeConte, is known from Massachusetts but has not been collected in Maine.

Two other species of *Hygrotus* were collected but determinations await the further publications of Anderson.

Genus *Hydroporus*

The genus *Hydroporus* contains many species. It was last revised by Fall in 1923. Since then, many new species have been described and the genus is in need of revision again. Although many specimens of *Hydroporus* were collected, determinations of species have not been attempted. The reader is urged to consult Fall (1923) and Wickham (1895) for descriptions of most of the known species.

Genus *Laccophilus*

This genus is in very great need of revision.[1] One of the species collected in Maine, *L. proximus*, apparently should be split into several sub-species (Young, 1954). In addition to the two species collected, a third species, *L. fasciatus,* may be present. Considering the state of the genus, neither a key nor a description of this third species has been attempted. Existing keys are generally unsatisfactory unless determined material is available for comparison.

Comments on species of *Laccophilus* known to occur in Maine

L. maculosus (Germ.): Common throughout Maine, it is often very abundant, especially in areas overgrown with aquatic plants. Dorsal coloration is highly variable in hue although consistent in pattern. Under a microscope, the dark areas on the elytra can be seen to be composed of many small granules of color. Average size is 5.8 mm. in length.

L. proximus Say: A single series of this species was collected in Norway, Maine. They were among emergent aquatic plants at the edge of a lake. In *L. proximus* the dark elytral color is uniformly disposed. Average size is 4.5 mm. in length.

Genus *Agabus*

This genus was revised by Fall (1922a). One species, *A. discolor* was recorded from Maine. Eighteen other species were noted as occurring in New England. Those species were: *A. obtusatus, A. planatus, A. seriatus, A. punctatus, A. aeruginosus, A. punctulatus, A. semipunc-*

[1] A new revision (Zimmerman 1970) has appeared since this was written.

tatus, A. taeniolatus, A. disintegratus, A. ambiguus, A. erythropterus, A. congener, A. incriptus, A. subfuscatus, A. anthracinus, A. nigroaeneus, A. gagates, and *A. tristis.*

Leech (1942) erected two subspecies of *A. seriatus. A. seriatus seriatus* occurs in the northeast. No key to the species of *Agabus* is included in this work due to space consideration. The reader is urged to consult Fall (1922a) for both a key and species descriptions.

Comments on species of *Agabus* collected in Maine

A. seriatus seriatus (Say): The sharply acuminate tip of the prosternal process and the inner row of punctures of the hind tibia will separate this species from all others of the genus. Average size is 8.7 mm. in length. The elytra are black.

A. ambiguus Say: The coarse elytral reticulation of both sexes and the brown elytral color are definitive. Average size is about 8.5 mm. in length.

A. erythropterus Say: There can be no confusion of this species with any other if males are collected. The foliate expansion of the male protarsal claws is readily apparent on first examination. Average size is large, 10.0 mm. in length. The elytra are black, often narrowly margined with fuscous basally and marginally.

A. anthracinus Mann: The large circular palettes of the male protarsi separate this species from all other *Agabus.* Average size is about 7.5 mm. in length. The elytra are black.

A. gagates Aubé: There are no definitive characters for this species. It does, however, key out readily. Average size is about 9.0 mm. in length.

A. discolor Harris: This species has brown elytra. The elytral reticulation is minute in both sexes. Average size is 7.5 mm. in length.

Genus *Ilybius*

Proctor (1946) recorded *I. subaenous, I. angustior, I. biguttatus, I. pleuriticus, I. ignarius,* and *I. confusus* from Mount Desert Island, Maine. Mairs (1957) recorded *I. quadrimaculatus* from Monmouth, Maine. Of the three specimens which he collected, however, only one is *I. quadrimaculatus.* The other two are *I. biguttatus.* Wallis revised *Ilybius* in 1939(b). His revision includes keys to both males and females.

In the present study only two species were collected, *I. quadrimaculatus* Aubé and *I. biguttatus* Germ. Both were common. *I. quadrimaculatus* has the male hind tarsal segments margined externally above. In *I. biguttatus* the male hind tarsal segments are not margined. Both species have a median carina on the last abdominal sternum. *I. quad-*

rimaculatus averages 12.0 mm. in length. *I. biguttatus* is about 10.5 mm. in length.

Genus *Matus*

There are only two known species of *Matus* which may be present in Maine. They are *M. bicarinatus* (Say) and *M. ovatus ovatus* Leech. They can be distinguished by the metacoxal plates which are microreticulate in the latter species (Young, 1953b). Young (1953b) figures the male genitalia of both species. This is an excellent character to use if males are collected. Both species vary greatly in size but average size for both is near 8.4 mm. in length.

A single specimen of *M. ovatus ovatus* was loaned by Donald Wilson. It was collected in Durham, New Hampshire. Since the topography and flora of New Hampshire are nearly identical to that of western Maine, it is probable that *M. ovatus ovatus* is present in Maine as well. *M. bicarinatus* has been recorded from Massachusetts (Young, 1953b). It may be present in Maine.

Two papers of great importance for the genus *Matus*, other than the above mentioned Young (1953b), are Leech (1941) and Young (1953a). Leech describes *M. ovatus ovatus* and redescribes *M. bicarinatus*. Young discusses the taxonomic problems associated with *Matus*.

Genus *Copelatus*

According to Young (1963a), only *C. glyphicus* (Say) is present in New England. In his revision of the genus, Young states that he has seen specimens of *C. glyphicus*, "from all of the United States east of the Mississippi River except West Virginia." It was not collected in the present study nor was it represented in the University of Maine collection. Young includes illustrations of the male genitalia of *C. glyphicus* and other species.

Genus *Coptotomus*

One species, *C. interrogatus* Fabr., is present in the northeast. Many specimens were collected in Maine. Wickham (1895) gives a short description of its appearance as does Blatchley (1910). The species is most common in standing water situations such as farm ponds where abundant vegetation is present.

Genus *Agabetes*

The genus is monotypic. *A. acuductus* (Harris) is known from Canada to Florida (Young, 1954). Young (1954) records it from Massachusetts. It was not collected in the present study. Young (1954) gives an excellent characterization of the species.

Genus *Rhantus*

Hatch (1928) published a key to the North American species and records *R. calidus* from Maine. Four other species appear likely to occur in Maine, according to Hatch's records. They are *R. binotatus, R. bistriatus, R. consimilis,* and *R. sinuatus.*

Key to the species of *Rhantus* expected in Maine

1a: Mesotarsal claws of male equal in length . . . . . *R. calidus*

1b: Mesotarsal claws of male unequal in length, the anterior claw longer 2

2a: Posterior angles of pronotum acute, somewhat prolonged (fig. 9); elytra black . . . . . *R. sinuatus*

2b: Posterior angles of pronotum not prolonged; elytra testaceous, marked with many small dots of fuscous 3

3a: Front with a transverse bilobed spot; metasternum black 4

3b: Front entirely black; metasternum black to testaceous . . . . . *R. consimilis*

4a: Disc of pronotum bimaculate . . . . . *R. binotatus*

4b: Disc of pronotum immaculate, anterior and posterior margins medially transversely dark . . . . *R. bistriatus*

Comments on species of *Rhantus* expected in Maine

R. calidus Fabr.: The key character, equal male mesotarsal claws, should easily separate this species from all others occurring in Maine. It was not collected in the present study.

R. sinuatus LeConte: This species is entirely dark dorsally, unlike the other species known from Maine. The doubly sinuate hind margin and consequent prolonged appearance of the hind angles of the prono-

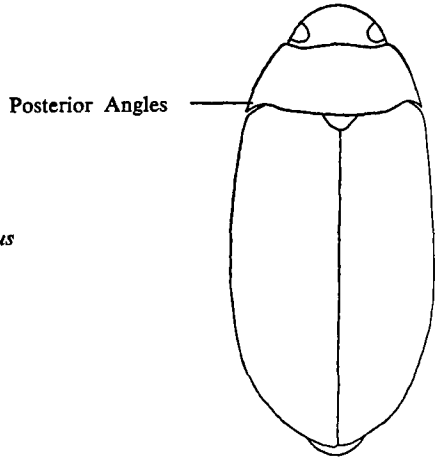


Figure 9
Rhantus sinuatus
Dorsal View

tum, separate this species from all other *Rhantus*. A single specimen, from Orono, Maine is in the University Collection.

R. consimilis Mots.: The key characters are sufficient to distinguish this species. It has not been collected closer than New York. It does, however, occur in Michigan and Canada and so may be present in the Northeast.

R. binotatus Harris: This species is the most common *Rhantus* in Maine. The key characters are definitive.

R. bistriatus Bergst.: The University Collection contains a single female specimen from Orono, Maine. The pronotal markings will separate *R. bistriatus* from all other species of the genus.

Genus *Colymbetes*

Key to the species of *Colymbetes* expected in Maine
(modified from Hatch, 1928)

1a: Protarsi of male without palettes beneath, but with glandular pubescence (fig. 10) 2

1b: Protarsi of male with palettes beneath in four rows (fig. 10); 16 mm. in length *C. sculptilis*

2a: Pronotum with sides and interrupted median fascia pale; elytra with sides pale; 19 mm. in length *C. paykulli*

2b: Pronotum and elytra with pale side margins; 16.5 mm. in length *C. longulus*

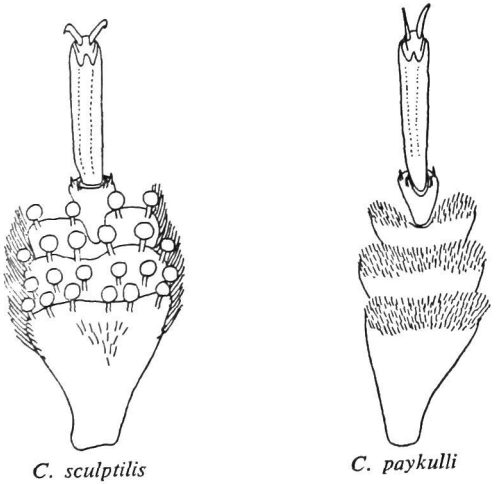


Figure 10
Male Protarsi of *Colymbetes*

Comments on species of *Colymbetes*

C. sculptilis Harris: The pronotum of this species is pale with a transverse black discal spot. The elytra have the sides paler than in *C. paykulli*. *C. sculptilis* is very common in Maine.

C. paykulli Erichson: *C. paykulli* is both larger and darker than *C. sculptilis*. The coloration of the pronotum is opposite to that of *C. sculptilis*. Although the pale markings of the pronotum of *C. paykulli* may be somewhat obscure, the species may be distinguished from *C. longulus* by its larger size. Three specimens, all labeled as from Orono, are in the University Collection.

C. longulus LeConte: Hatch (1928) includes New Hampshire in the range of this species. It is therefore almost certainly present, at least in western Maine. It was not collected in this study.

Genus *Neoscutopterus*

Two species were recorded from Canada by Wickham (1895) under the old generic name, *Scutopterus*. The use of this name has since been found to be in error and *Neoscutopterus* was proposed to replace it (Balfour-Browne, 1943).

A single specimen of *N. angustus* (LeConte) was loaned by Mr. Donald Wilson. It was collected in Moosehead, Maine. According to Wickham (1895), the species is piceous black, reticulate, and with indistinct serial punctures behind. The specimen observed was 16.0 mm. in length.

Genus *Cybister*

Young (1954) records both subspecies of *C. fimbriolatus* from as far north as Pennsylvania. The University Collection contains two specimens of *C. fimbriolatus*, one from Vermont, the other from Orono, Maine. Both appear to be *C. fimbriolatus crotchi* Wilke. Young (1954) provides several characters for separating the subspecies. *C. fimbriolatus crotchi* females lack the sexual sculpture found on the pronotum of *C. fimbriolatus fimbriolatus* (Say) females. In *C. fimbriolatus crotchi* the yellow stripe on the elytra leaves the margin posteriorly. Finally, male *C. fimbriolatus crotchi* possess only three ridges on the stridulatory plate. *C. fimbriolatus fimbriolatus* males have four.

Genus *Dytiscus*

Hatch (1928) constructed a key to the species of *Dytiscus* of North America. Wallis (1950) described a new Western species and constructed a key to the species with rounded hind coxal processes.

Wallis (1950) also includes some general diagnostic characters for the species he treats.

Key to the species of *Dytiscus* expected in Maine
(modified from Hatch, 1928 and Wallis, 1950)

1a: Labrum emarginate at middle 2
1b: Labrum nearly truncate . . . . . *D. harrisi*
2a: Metacoxal processes rounded 3
2b: Metacoxal processes pointed at apex 6
3a: Size larger, length 30 mm. and over 4
3b: Size smaller, length under 30 mm. 5
4a: Black or piceous beneath; pronotum not margined with yellow apically or basally . . . . . *D. verticalis*
4b: Ferruginous beneath; pronotum margined with yellow apically and basally . . . . . *D. cordieri*
5a: Black or piceous beneath; dilated joints of male middle tarsus with a longitudinal smooth space; females always smooth . . . . . *D. hybridus*
5b: Largely ferruginous or brownish piceous beneath; females always sulcate . . . . . *D. fasciventris*
6a: Metacoxal processes obtuse at apex . . . . *D. marginalis*
6b: Metacoxal processes spinose at apex *D. dauricus*

Comments on species of *Dytiscus*

D. harrisi Kirby: In *D. harrisi* both the base and the apex of the pronotum are margined with yellow. The metacoxal processes are rounded. The females are dimorphic, that is, they may have either sulcate or smooth elytra. Average size is 39 mm. in length. This makes *D. harrisi* the largest water beetle in Maine. *D. harrisi* is fairly common in the lentic habitats frequented by members of the genus. It certainly is more common than the other species of *Dytiscus*.

D. verticalis Say: The pronotum of this species is pale only at the sides. Average size is 34 mm. in length. The female elytra are smooth. Several specimens from Maine are in the University Collection.

D. cordieri Aubé: In this species the pronotum is bordered both basally and apically with yellow. Average size is slightly smaller than *D. verticalis*, only 30 mm. in length. The University Collection contains five specimens, all from Orono, Maine.

D. hybridus Aubé: The University Collection contains only a single female specimen of *D. hybridus*. The key characters are sufficient for identification of this species. As in *D. verticalis* and *D. fasciventris*, the pronotum is margined with yellow only at the sides. Average size, according to Hatch (1928), is 26 mm. in length.

D. fasciventris Say: The fact that *D. fasciventris* females are always

sulcate and *D. hybridus* always smooth separates these two species. The pronotum is not, or is very faintly margined with yellow (Wallis, 1950). The University Collection contains specimens from several localities in Maine. Average size is about 27 mm. in length.

D. marginalis Linn.: Both *D. marginalis* and *D. dauricus* have the base and apex of the pronotum yellow (Hatch, 1928). While the meta-coxal processes are pointed in *D. marginalis,* they are not acutely spinose as in the following species. Females of *D. marginalis* are dimorphic. Average size is 34 mm. in length. The University Collection contains specimens from Orono, and Unity, Maine.

D. dauricus Gegl.: This species has not been collected in Maine. Hatch (1928) records it from New Hampshire. Average size is 33 mm. in length (Hatch, 1928). Females are dimorphic, according to Hatch (1928).

Genus *Hydaticus*

Three specimens of *H. piceus* LeConte were collected in East Corinth, Maine. *H. piceus* is rufo-piceus above, slightly paler on the sides of the elytra, the pronotum, and the anterior portion of the head. Average size is 13.1 mm. in length. Wickham (1895) records *H. piceus, H. stagnalis,* and *H. bimarginatus* from Canada. Young (1954) confines the range of *H. bimarginatus* to Virginia, Louisiana, and Florida. These and other conflicting locality reports suggest that the genus is in need of revision and that the determinations of several authors may be in error. No key is presented here for those reasons. Several keys to the species mentioned above may be found in the literature; Wickham (1895) and Blatchley (1910). The latter author also includes short descriptions of each species.

Genus *Acilius*

Three species appear likely to be found in Maine. They include *A. semisulcatus, A. fraternus,* and *A. mediatas. A. fraternus* is listed from Massachusetts and *A. mediatas* from New Hampshire by Leng (1920). *A. semisulcatus* was collected in Maine by Proctor (1946). Blatchley (1910) provides a key and short descriptions of these three species.

Comments on the species of *Acilius* expected in Maine

A. semisulcatus Aubé: This species can be distinguished by the reddish brown hind femora and larger size from *A. mediatus,* which it otherwise resembles. In both species the elytral sulci of the female are unequal in length. Both species have an M-shaped black mark on the

vertex (Blatchley, 1910). Average size of Maine specimens of *A. semisulcatus* is 14.1 mm. in length. This species is common in Maine.

A. mediatus Say: In *A. mediatus* the hind femora are black. Average size is 12.0 mm. in length (Blatchley, 1910). The species has not been collected in Maine.

A. fraternus Harris: The vertex of *A. fraternus* is unmarked. The female elytral sulci are shorter and unequal in length (Blatchley, 1910). The species has not yet been recorded in Maine. Leng's 1920 record from New Hampshire indicates that the species is probably present, at least in western Maine.

Genus *Graphoderus*

Key to the species of *Graphoderus* expected in Maine (modified from Wallis, 1939a)

1a: Head and pronotum without any distinct black markings; size smaller, about 11.2 mm. in length *G. liberus*

1b: Head and pronotum with distinct black markings; size larger, about 14.5 mm. in length . . *G. fasciatocollis*

Comments on species of *Graphoderus*

G. liberus Say: There can be no confusion between this and the following species. The key characters are definitive. The University Collection contains several specimens from Monmouth, Maine and several others without locality data.

G. fasciatocollis Harris: Some confusion exists over the status of the name *G. fasciatocollis*. Several authors claim that this species is conspecific with *G. cinereus*. Wallis (1939a) refutes this claim and gives several characters separating the two species. *G. cinereus,* as now defined, is a strictly European species. If the reader wishes further information he should see Wallis (1939a). *G. fasciatocollis* is apparently more common than *G. liberus* in Maine. Neither is abundant.

FAMILY NOTERIDAE

In biology and morphology of the adult, the Noteridae are most similar to the Dytiscidae. Indeed, until 1931 they were considered a part of that family (Young, 1954). The Noteridae differ, however, in the habits of the larvae and pupae. Noterid larvae burrow around the roots of aquatic plants. Some have fossorial front legs (Young, 1954). To respire they insert the tip of the abdomen into the plant tissue. The tip of the abdomen contains the larva's only pair of functional spiracles, as in the Dytiscidae. The pupal case is formed underwater, over a hole

bitten in the root of a plant. Air seeping out of this hole fills the pupal cell and allows the pupa to respire (Leech and Chandler, 1956).

Young (1954) provides the best taxonomic treatment of the family for the United States. For the genus *Hydrocanthus,* Zimmermann (1928) must also be consulted.

Key to the genera of Noteridae possibly present in Maine (modified from Young, 1954)

1a: Protibial spurs strong, curved, and conspicuous; hind femora with angular cilia; prosternal process truncate behind 2

1b: Protibial spurs weak and inconspicuous; hind femora usually without angular cilia; prosternal process rounded behind . . . . . *Pronoterus*

2a: Apex of prosternal process at least twice its breadth between the anterior coxae, not broader than long; last segment of maxillary palpus emarginate at apex; pronotum with lateral marginal lines originating at the hind angle, but disappearing about the middle; length usually less than 3.0 mm. . . . . *Suphisellus*

2b: Apex of prosternal process very broad, at least two and one-half to three times its breadth between the coxae, broader than long; last segment of maxillary palpus truncate at apex; pronotum with lateral marginal lines originating at base and extending the entire length of the pronotum to join the front margin; length usually over 4.0 mm. . . . . *Hydrocanthus*

Genus *Pronoterus*

Species of *Pronoterus* have been recorded from Florida and Michigan only, according to Young (1954). Little is known about the distribution of species in this genus. It is included in this work on the chance that it may be discovered in this area. Young (1954) treats both described species of this genus.

Genus *Hydrocanthus*

The taxonomy of this genus is in doubt (Young, 1954). Current work may make the following data obsolete. Two species of this genus have been recorded from Massachusetts, according to Zimmermann (1928). These are *H. iricolor* Say and *H. similator* Zimm. The middle of the prosternum is distinctly punctate in *H. iricolor* and smooth or only slightly punctate in *H. similator* (Zimmermann, 1928). Both

species are about 5 mm. in length. Both are reddish-brown in color with the elytra somewhat darker.

H. iricolor was collected in Norway, Maine. Several long series were taken in a weedy area bordering a lake. No others were collected in the State.

Genus *Suphisellus*

Young (1954) records *S. puncticollis* Crotch from Massachusetts. It is 2.7-3.0 mm. in length. The elytra bear a transverse yellow bar and the pronotum a fuscous spot (Young, 1954). It has not been collected in Maine.

FAMILY HYDROPHILIDAE

The family Hydrophilidae, or water scavenger beetles, includes a terrestrial, dung inhabiting subfamily, the Sphaeridiinae. As these are not aquatic, they have been omitted from this work.

In most hydrophilid genera, a silken chamber is made for the eggs and it is attached under water. A "mast", or hollow trail of silk, connects the air pocket around the eggs to the atmosphere above the surface. The mast is flexible and water-proof. The tip floats on the surface allowing for small variations in water height. When the larvae hatch, they must come to the surface along this pathway to fill their trachea with air before they can take up their submerged existence (Miller, 1963).

Larvae of the genus *Berosus* have abdominal gills and are independent of the surface. All other hydrophilid larvae possess only a posterior pair of spiracles and enlarged internal tracheal storage areas. Most larvae are therefore dependent on the surface for their air supply. The larvae are predacious (Leech and Chandler, 1956).

All but the genus *Enochrus* make a pupal cell in damp soil near the shore. Some *Enochrus* form a pupal cell of strands of algae and pupate in the water. The pupae lack hydrofuge hairs but possess spines which keep them away from the sides of the cell where they might become wetted (Leech and Chandler, 1956).

Swimming adult Hydrophilidae may possess swimming hairs on the tarsal segments or on the tibia. Most swimming forms also possess a well-developed mid-ventral spine which acts as a keel. Air is carried under the elytra and on the ventral surface. This supply is connected by a channel to the hydrofuge hairs of the antennae. When the beetle surfaces for air, it is the antennae which break the surface and allow the exchange of gases (Miller, 1963). Most adults are herbivorous although

Leech and Chandler (1956) report that they will eat dead animal material.

Taxonomic references will be covered under the generic headings. Key to the Northeastern genera of Hydrophilidae (modified from Arnett, 1968)

1a: Pronotum with five longitudinal grooves . . . . . *Helophorus*
1b: Pronotum without such grooves 2
2a: Pronotum at base definitely narrower than elytra at widest part of basal one-fourth; scutellum very small; eyes protuberant; antennae with no more than three segments basad of cupule . . . . . *Hydrochus*
2b: Pronotum usually nearly as wide at base as basal one-fourth of elytra, but if narrower, scutellum is elongate triangular; eyes prominent or not; antennae usually with five well-developed segments basad of cupule 3
3a: Meso- and metasternum with a median keel produced into a posterior spine extending between hind coxae 6
3b: Sternal region without such a keel 4
4a: Abdomen with normal sternites 5
4b: First two visible abdominal sternites on each side with common excavation covered by a fringe of golden hairs . . . . . *Chaetarthria*
5a: Head strongly deflexed; antennae usually seven-segmented; scutellum a long triangle; middle and hind tibia fringed with long swimming hairs . . . . . *Berosus*
5b: Head not strongly deflexed; antennae usually nine-segmented; scutellum not or not much longer than its basal width, tibiae without swimming hairs 8
6a: Prosternum sulcate to receive anterior part of mesosternal keel; metasternal keel projecting beyond hind trochanters as a spine 7
6b: Prosternum carinate, not sulcate; metasternal keel not or hardly reaching beyond bases of hind trochanters . . . . . *Hydrochara*
7a: Large species, 30-45 mm. in length; last segment of maxillary palpus shorter than preceding segment . . *Hydrophilus*
7b: Smaller species, 6-15 mm. in length; last segment of maxillary palpus equal to or longer than preceding segment . . . . . *Tropisternus*
8a: Maxillary palpi robust and short, shorter or not much longer than antennae; ultimate segment as long as or longer than penultimate segment 9
8b: Maxillary palpi more slender, longer than antennae, with

ultimate segment usually shorter than penultimate segment 13

9a: Elytra with sutural striae in at least apical half; usually only five visible abdominal sternites; hind tibia not arcuate; hind trochanters normal, closely applied to femora 10

9b: Elytra with rows of punctures but no sutural striae; fifth visible abdominal sternite truncate or emarginate, usually exposing sixth; hind tibia arcuate; hind trochanters large, about one-third as large as femora, their apices distinct from femora . . . . . *Laccobius*

10a: Species 4.5 mm. or more in length; elytra striate or with rows of punctures . . . . . *Hydrobius*

10b: Species 3.0 mm. or less in length; elytra impunctate or confusedly punctate, never striate, at most with punctures subserially arranged . . 11

11a: Prosternum longitudinally carinate at middle . *Paracymus*

11b: Prosternum not carinate 12

12a: Mesosternum simple, not carinate, or with a small transverse protuberance anterior to middle coxae . *Crenitis*

12b: Mesosternum with a prominent angularly elevated or dentiform protuberance anterior to middle coxae *Anacaena*

13a: Tarsi 5-5-5, basal segment may be minute *Enochrus*

13b: Tarsi 5-4-4 14

14a: Maxillary palpi long and slender; tarsal claws with broad basal tooth in male, less prominently toothed in female . . . . . *Helocombus*

14b: Maxillary palpi shorter, stouter; tarsal claws simple in both sexes . . . . . *Cymbiodyta*

Genus *Helophorus*

No published revision of this genus for the United States exists. One, that of McCorkle (1968), has been written as a dissertation but has not yet been published. Much valuable information is contained in that revision, including the description of four new species from the East. Since these descriptions have not been published, the taxonomic status of those species is uncertain. Two of the four species were recorded from Maine by McCorkle (1968). Should they be published as they appear in his thesis, they would be *H. frosti* and *H. knischi.* Species identification in this genus is very difficult, even with McCorkle's thesis as a guide. Most identifications require determined material in order to make comparisons of characters. As such, determinations of

most species were impossible. It is possible to say that *H. aquaticus, H. lacustris, H. lineatus* and *H. jacutus* do occur in Maine.

H. aquaticus (Linn.): This species is easily recognizable. It is the largest *Helophorus* in the United States. Average size for Maine specimens is 6.5 mm. in length. *H. aquaticus* is very common and often abundant in seasonal dispersal flights.

H. lacustris (LeConte): McCorkle has split this species into five, including the four new ones mentioned above. He records the restricted *H. lacustris* from Kittery Point, Maine.

H. lineatus (Say): McCorkle (1968) records this species from Paris, Maine. It appears common in the Northeast.

H. jacutus (Poppius): Recorded from Bar Harbor, Maine by McCorkle (1968).

Hopefully, McCorkle's revision will eventually be published. The work is a fine one and should not be denied to present and future workers.

Genus *Hydrochus*

This genus is currently under revision by Mr. Lee Hellman of the University of Maryland. All specimens of *Hydrochus* collected in this study have been sent to Mr. Hellman for identification. As the process of revision is always slow, and since Mr. Hellman has only recently begun his task, no conclusion can be presented here.

Genus *Chaetarthria*

Dr. David C. Miller is currently revising this genus for North America. He has examined specimens of *C. atra* (LeConte) from South Paris, Maine collected by Frost in 1912. In addition Miller reports that *C. pallida* (LeConte) may be present. So far it has not been collected closer than Fair Haven, New York (Miller, pers. comm.) The two species are easily separated. The head of *C. atra* is black while the pronotum and elytra are brownish-black. In *C. palida* the head is black; the pronotum and elytra are brownish-yellow. The protibiae of male *C. atra* are expanded from base to apex and have a series of parallel plates along the entire ventral surface. In *C. palida* males the plates on the protibiae are less noticeable and are restricted to the expanded apical portion of the protibiae.

These beetles are not found directly in the water but frequent moist sand just above the water line. They can be collected by pushing some of the sand into the water and scooping up the beetles which float to the surface (Miller, pers. comm.). No specimens of *Chaetarthria* were collected in the present study.

Genus *Berosus*

This genus was revised by Van Tassell as her doctoral thesis. The revision has not been published. Published descriptions of the species expected in Maine can be found in Leech and Chandler (1956), Young (1954), and Miller (1965). The male genitalia of three species are figured in Miller, 1965.

Key to the species of *Berosus* expected in Maine (modified from Van Tassell, 1966)

1a: Apical emargination of fifth visible abdominal sternum with two small teeth at center 2

1b: Apical emargination with one tooth or projection, or truncate, without teeth 5

2a: Setigerous punctures of intervals 3, 5, and 7 larger than punctures of striae; female elytra usually strongly alutaceous 3

2b: Intervals 3, 5, and 7 with setigerous punctures as large as or smaller than strial punctures; female elytra shining or only lightly alutaceous 4

3a: First visible abdominal sternum with median longitudinal carina on basal half which is sharply declivous posteriorly; apices of elytra of female with short, sharp, pre-apical tooth; male genitalia with apices of parameres dehiscent, bluntly rounded . . . . . *B. hatchi*

3b: Carina of first visible abdominal sternum sloping gradually into sternum; apices of female elytra emarginate, pointed or rounded, but not with pre-apical tooth; pronotal punctures small, even, and close; female elytra usually alutaceous, apices rounded, with teeth or emarginations; male genitalia with parameres projecting posteriorly, apices attenuate . . . . . *B. fraternus*

4a: Punctures of pronotum and elytra with anterior margins moderately to strongly scabrous; setigerous punctures of odd numbered intervals of same size as adjacent punctures; parameres of male genitalia pointed in dorsal view, but not attenuate . . . . . *B. ordinatus*

4b: Pronotum and elytra with smooth margined punctures, slightly scabrous only at sides; setigerous punctures of intervals 3, 5, and 7 larger than adjacent punctures, as large as those of discal striae; parameres of male genitalia slightly widened at apex, extreme apices rounded in dorsal view, evenly deflexed in lateral view *B. striatus*

5a: Emargination of fifth visible abdominal sternum with a slightly rounded projection; head testaceous or brown;

parameres slightly curved at apex, partly covering apex of median lobe; median lobe of male genitalia with tuft of dorsal setae at middle; striae very deeply impressed to base, scutellar striole usually with 8 to 10 punctures ..... *B. exiguus*

5b: Emargination of fifth visible abdominal sternum with sharply angled or slightly emarginate median projection; head testaceous to metallic black; parameres slightly curving outwardly, exposing apex of median lobe 6

6a: Apices of elytra produced or prolonged in both sexes, but especially in females; usually with small tubercle or bump before apices, near suture; pronotum usually coarsely, irregularly punctate; parameres with apices extremely slender, slightly curved toward middle. *B. aculeatus*

6b: Apices of elytra rounded in male, rounded or pointed in female, but never greatly prolonged; elytra without pre-apical tubercles near suture; pronotum usually more uniformly and finely punctate; parameres wider at apex, more strongly curved toward middle .... *B. peregrinu*

Comments on species of *Berosus* expected in Maine

B. hatchi (Miller): This species was named from the Pacifi Northwest, (Miller, 1965). It has since been found in Quebec an New York (Van Tassell, 1966). It has not been collected in Maine

B. fraternus (LeConte): *B. fraternus* is distributed generall across the United States and Canada. It has not been collected in Ne England, however.

B. ordinatus (LeConte): Massachusetts is the closest known loca ity for *B. ordinatus*. It was not collected in Maine.

B. striatus (Say): This species is the most common *Berosus* Maine. The two small teeth of the fifth visible abdominal sternum this species are overlapped by a larger, median carina near the dist edge of the sternum. Care must be used in couplet one to avoid mi interpreting this character.

B. exiguus (Say): *B. exiguus* has not been recorded north of Ne York. As its range is generally southeastern, it probably is not prese in Maine.

B. aculeatus (LeConte): One specimen, a female, was collect in Deblois, Maine. Several others from New Hampshire were loan by Dr. A. E. Brower. The key characters, especially the produc elytral apices and the slender parameres, should separate this spec from all others in this area

B. perigrinus (Herbst.): Several specimens labeled Monmouth, Maine are in the University of Maine Collection. They separate well from *B. aculeatus* using the key characters.

Genus *Hydrochara*

H. obtusatus (Say) is often common in farm ponds and similar lentic habitats. Average size is 17 mm. in length. *H. obtusatus* is the only species of the genus known to occur in the Northeast. *Hydrochara* is more convex dorsally than either *Hydrophilus* or *Tropisternus.*

Genus *Hydrophilus*

Young (1954) records *H. triangularis* (Say) from New York. A single specimen, from Hampden, New Hampshire, was loaned by Dr. A. E. Brower. The species is probably present, at least in southwestern Maine. *H. triangularis,* if present in Maine, would be by far our largest species of hydrophilid. Average is about 35 mm. in length. Dorsally, it is not nearly as convex in form as *Hydrochara obtusatus.* Ventrally, however, it is much more convex in form.

Genus *Tropisternus*

In 1960, this genus was revised as the doctoral dissertation of P. J. Spangler. That revision has not been published. Based on the literature and personal communication with Dr. Spangler, five species are known to occur in Maine. They may be separated as follows.

Key to the species of *Tropisternus* known to occur in Maine

1a: Elytra with testaceous margins ..... *T. lateralis nimbatus*
1b: Elytra uniformly black 2
2a: Metathoracic legs testaceous, except basal pubescent areas of femora dark ..... *T. quadristiatus*
2b: Metathoracic legs mostly dark, testaceous coloration limited to apical halves of femora 3
3a: Pubescent areas of hind femora 1.5 times as long as the trochanter, as measured along the posterior edge of the leg; apical halves of hind femora testaceous, the rest of leg piceous ..... *T. mixtus*
3b: Pubescent areas of hind femora 1.0 to 1.2 times as long as trochanter; hind femora mostly black, only extreme apices testaceous 4
4a: Mesosternal keel wide, often depressed medially; metasternal spine reaching to near hind margin of third sternum ..... *T. natator*

4b: Mesosternal keel narrow, flat; metasternal spine extending only slightly beyond hind margin of second sternum ..... *T. glaber*

Comments on species of *Tropisternus* known to occur in Maine

T. lateralis nimbatus (Say): Spangler (1960) records this species from Lincoln County, Maine. It was not collected in this study. The coloration of the elytra separates this species from all others found in Maine.

T. quadristriatus (Horn): This species is known from both the East and West Coasts of North America. Dr. Spangler has recorded it from Moody, Old Orchard, and Mount Desert Island, Maine. It is most often found in brackish water. The pubescent area of the metafemora is much larger than in the following three species. *T. quadristriatus* was not collected in the present study.

T. mixtus (LeConte): *T. mixtus* is by far the most common *Tropisternus* in Maine. It is easily identifiable using the key characters. The long golden cilia on the male mesosternal keel contrast dramatically with the short setae of *T. natator* and *T. glaber*. Female *T. mixtus* lack these long cilia, however.

T. natator D'Orchymont: *T. natator* can be recognized by the wide mesosternal keel and long metasternal spine. The species was collected in several localities but was never common.

T. glaber (Herbst.): Several specimens from New Hampshire were loaned by Mr. Donald Wilson. The University of Maine Collection contains a single specimen labeled Orono, Maine. The mesosternal keel is much narrower and more finely punctate than in *T. natator*.

Genus *Laccobius*

Mr. S. Cheary, of the University of California at Riverside, is currently revising this genus. His assistance in working with *Laccobius* has been invaluable. Mr. Cheary's revision should be in press within a few months.

Previously, two species had been known from the Northeast; *L. agilis*, described by Randall from Hallowell, Maine, and *L. minutoides*, described by D'Orchymont from New York. In collections made for this study, two new species were recognized. One proved to be a species recently described from Michigan, *L. spangleri* Willson (Cheary, pers. comm.). The other has not yet been described. Mr. Cheary who will be the author plans to call it *L. reflexipenis* because of the unusual form of the tips of the male parameres. It was thought that another species

L. arenarius, might be present in Maine (Cheary, pers. comm.). It appears, however, that it is not.

Species of *Laccobius* are separated by characters of the male genitalia. Although the species do vary slightly in size, they are virtually indistinguishable in body form and coloration. Mr. Cheary, working on a geographically larger scale, will hopefully, be able to supply characters based on external morphology. The key constructed for this work does not include such characters. Females can be determined only by association with identified males.

Key to the species of *Laccobius* known to occur in Maine

1a: Parameres of male genitalia with a strongly recurved lobe on the ventral inner surface (fig. 11) . . *L. reflexipenis*

1b: Parameres not so formed, without strongly projecting, recurved lobes 2

2a: Parameres each with a ventral membranous flap, the two overlapping the midline when in a natural position, enclosing the median lobe ventrally; tips of the parameres curved towards the midline (fig. 11) . *L. spangleri*

2b: Parameres without membranous areas, the median lobe exposed dorsally when in a natural position 3

3a: Parameres spatulate at their tips, broadening slightly towards the tip . . . . . *L. agilis*

3b: Parameres not spatulate, narrow throughout their length . . . . . *L. minutoides*

Comments on species of *Laccobius* known to occur in Maine

L. reflexipenis: This species was collected at many localities in Maine. The elaborate form of the parameres is completely unlike that of any other species in the East. They most resemble those of *L. carri* which occurs further West.

L. spangleri Willson: The structure of the parameres is definitive. The overall shape and bulk of the parameres is similar to that of *L. reflexipenis*. In contrast, the parameres of *L. agilis* and *L. minutoides* are much more slender and elongate. *L. spangleri* is also common in Maine.

L. agilis Randall: *L. agilis* is common throughout the State. It averages slightly larger than the other three species. The character would only be of value in direct comparison of series of specimens. D'Orchymont (1942) figures the male genitalia.

L. minutoides D'Orchymont: The distribution of this species in Maine seems to follow the coastline. As the species is found inland in other parts of the country (D'Orchymont, 1942), such a distribution probably reflects a thermal limitation on its Northern range. In South-

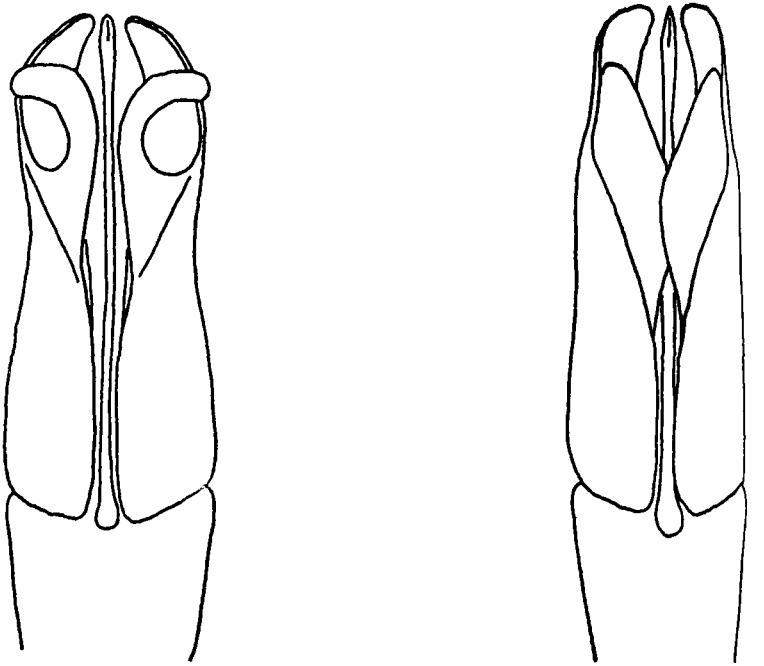


Figure 11
Male Genitalia of *Laccobius*
Ventral View

ern Maine, particularly along the coast, this species is quite common. D'Orchymont (1942) figures the male genitalia.

Genus *Hydrobius*

Three species are known from the northeast. They are separated as follows, according to Winters, 1926.

1a: Elytra with well-marked striae, form oblong . . . . . *H. fuscipes*
1b: Elytra with rows of fine punctures, form short and convex 2
2a: Posterior femora merely closely punctate near base, not opaque and pubescent . . . . . *H. tumidus*
2b: Posterior femora densely punctate and pubescent near base and along the upper border . . . . . *H. melaenus*

Comments on species of *Hydrobius* expected in Maine

H. fuscipes Linn: This species is very common in collections of Maine Hydrophilidae. Its range covers the entire state. Generally, it is found in somewhat lentic environments. The oblong form and deeply impressed striae separate it from the following two species.

H. tumidus LeConte: The key characters should easily separate this species from the other two. It has not been found in Maine. It may not occur this far north. Winters (1926) records it from New York and the Southeast.

H. melaenus Germ: The extremely convex dorsal surface of this beetle makes it look unlike any other water beetle recorded from Maine. It is found in areas of swifter water than *H. fuscipes,* often under rocks near the edges of small streams.

Genus *Paracymus*

Wooldridge published an excellent revision of this genus in 1966. The male genitalia of two species from the Northeast are illustrated. Those species are *P. confluens* and *P. subcupreus.* The reader should note that a printing error exists in Wooldridge's (1966) paper. Figure 3 should be *P. confusus* and figure 4 *P. communis* (Wooldridge, pers. comm.).

Key to the species of *Paracymus* expected in Maine (modified from Wooldridge, 1966)

1a: Mesosternum laminate; antennae always seven-segmented; size about 2.2 mm. in length *P. confluens*

1b: Mesosternum non-laminate; antennae variable 2

2a: Pronotum and elytra both microreticulate; antennae nine-segmented *P. despectus*

2b: Pronotum and elytra not microreticulate; antennae eight-segmented; length 2.4-2.6 mm. *P. subcupreus*

Comments on species of *Paracymus* expected in Maine

P. confluens Wooldridge: Wooldridge (1966) records this species from Massachusetts. Size for the type specimen was 2.2 mm. in length. None has been collected in Maine.

P. despectus (LeConte): The combination of microreticulate dorsal sculpture and nine-segmented antennae will separate this species from all others. Although no specimens were collected in Maine, Wooldridge (1966) records the species from Vermont.

P. subcupreus (Say): This species is very common in Maine. The dorsum is dark metallic green except for the apical margins of the elytra which are testaceous. When Wooldridge (1966) revised the

genus, he split *P. subcupreus* into several species. None of these, other than the new *P. subcupreus,* has been recorded from the Northeast. *P. confusus,* however, occurs across most of the United States and so may eventually be found in Maine as well. Careful examination of the male genitalia and Wooldridge's (1966) descriptions and figures are necessary to distinguish the species from *P. subcupreus.*

Genus *Crenitis*

This genus is very much in need of revision. *C. digestus* was recorded from Massachusetts by Winters (1926). He treated it as a *Paracymus,* however. *C. monticola* is known from New Hampshire (Winters, 1926). The antennae of *C. digestus* are nine-segmented, those of *C. monticola* are eight-segmented.

In the present study only *C. digestus* (LeConte) was collected. Size of the specimens varied widely, from 2.5 to 3.2 mm. in length, with males generally smaller than females.

Genus *Anacaena*

The only species known from the Northeast is *A. limbata* (Fab.). Winters (1926) records it from Orono, Maine. The species is known from coast to coast. In *A. limbata* the head is black, the pronotum is testaceous clouded with black, and the elytra are testaceous. Average size is about 2.5 mm. in length. *A. limbata* can always be distinguished in the field from species of *Paracymus* or *Crenitis* by its paler elytral coloration. *A. limbata* was very common in collections made for this study. It seems most abundant in slowly moving waters, often among floating or emergent vegetation.

Genus *Enochrus*

Enochrus is another genus for which a recent revision exists but has not been published. R. W. Gundersen revised the genus in 1968 as his doctoral thesis. No other work covers all the species from the Northeast. The reader is therefore urged to consult Gundersen's thesis first, and then to work backwards to references in the literature. Another important consideration is the fact that Gundersen's revision includes illustrations of the male genitalia of most species.

Gundersen (1968) lists four species as known from Maine. They are *E. cinctus, E. consortus, E. perplexus,* and *E. ochraceus.* He lists seven other species from various parts of New England. The latter group includes *E. blatchleyi, E. consors, E. pygameus nebulosus, E. sayi, E. reflexipenis, E. horni,* and *E. hamiltoni hamiltoni.* Due to the present uncertain status of the taxonomy of the genus, neither a key to all species

nor descriptions of species not collected are included here. Three species of *Enochrus* were collected in this study. They are *E. cinctus, E. ochraceus,* and *E. horni.*

Comments on the species of *Enochrus* collected in Maine

E. cinctus (Say): *E. cinctus* is by far the largest *Enochrus* known from Maine. It is similar in size and shape to *Hydrobius fuscipes.* Average size is 6.2 mm. in length. In *E. cinctus* the mesosternal crest is undercut posteriorly. In the two following species the crest tapers gradually posteriorly. *E. cinctus* is shining black dorsally, margined with yellow on the corners of the clypeus, the pronotum, and the elytra. Specimens were collected from a number of localities in Maine.

E. ochraceus (Melsch.): *E. ochraceus* is easily separated by the mesosternal crest, which is small and rounded. Average size is 3.3 mm. in length. Color is brownish above with the corners of the clypeus paler. The species is common throughout Maine.

E. horni Leech: *E. horni* is similar in appearance to *E. ochraceus* but is somewhat larger. Average size is 5.1 mm. in length. The last abdominal sternite is not emarginate in *E. horni.* The last sternite of *E. ochraceus* is emarginate. A coastal species similar to *E. horni* is *E. hamiltoni hamiltoni.* They can be separated on the form of the clypeus (Gundersen, 1968). In *E. horni* the clypeus is emarginate so that the preclypeus is visible in the emargination. In *E. hamiltoni hamiltoni* the preclypeus is not visible. *E. horni* is common in Maine.

Genus *Helocombus*

The genus is monotypic. *H. bifidus* (LeConte) occurs from Labrador to Florida. Superficially, *H. bifidus* closely resembles *Hydrobius fuscipes.* The former can always be distinguished by the key characters, that is, long maxillary palpi with the ultimate segment shorter than the penultimate. In *Hydrobius* the opposite is true. Specimens of *Helocombus bifidus* were collected in Orono, and Deblois, Maine.

Genus *Cymbiodyta*

Spangler (pers. comm.) suggests that five species may be present in Maine. Only three, *C. minima, C. fimbriata,* and *C. vindicata,* were collected.

Key to the species of *Cymbiodyta* expected in Maine (modified from Winters, 1927 and Spangler, 1966)

1a: Mesosternal ridge angularly elevated at middle or dentiform 2

1b: Mesosternal ridge straight or gently curved 3

2a: Broadly oval, large species, 6.0-7.0 mm. in length; mesosternal ridge pyramidal . . . . . *C. rotunda*

2b: Oblong oval, smaller species, 2.75-3.5 mm. in length; mesosternal ridge pyramidal . . . . . *C. rotunda*

3a: Clypeus with a brown spot in front of each eye, pale margin of prothorax and elytra pronounced *C. blanchardi*

3b: Clypeus piceous, margin of prothorax and elytra variable . . . 4

4a: Elytra widest at basal third, then conspicuously narrowed toward apex, giving the species an egg-shaped outline when viewed from above; median lobe of male genitalia angulate at apex . . *C. fimbriata*

4b: Form depressed, oblong, elytra widest at middle; median lobe of male genitalia truncate at apex . . . . . *C. vindicata*

Comments on species of *Cymbiodyta* expected in Maine

C. rotunda (Say): Spangler (pers. comm.) suggests that this species may have been overlooked in collecting because it is confined to woodland seepage areas and is somewhat rare. It is larger than any *Cymbiodyta* known to occur in Maine.

C. minima Not: A single specimen of *C. minima* from the University Collection is labeled Orono. The acute mesosternal ridge and small size separate this species from all others in Maine.

C. blanchardi Horn: This species has not been recorded in Maine The coloration which is similar to some species of *Enochrus* should be definitive. Indeed, one determined specimen of *C. blanchardi* examined was in reality *E. ochraceus*. Care must be exercised in counting the tarsal segments, the first of which may be minute in *Enochrus*.

C. fimbriata (Melsch.): This species is very similar in form to *C. vindicata*. The male genitalia is the only character which is definitive (Spangler, 1966). Spangler (1966) figures the male genitalia. Several specimens of *C. fimbriata* were collected in this study. According to Winters (1927) the species is much rarer than *C. vindicata*.

C. vindicata Fall: Both Spangler (1966) and Miller (1964) figure the male genitalia. The species was collected in Orono, Maine during the month of August.

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