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Dytiscidae and Noteridae of Wisconsin (Coleoptera). VI. Distribution, Habitat, Life Cycle, and Identification of Species of *Hydroporus* Clairville Sensu Lato (Hydroporinae)

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*University of Wisconsin*

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ABSTRACT

Thirty-four species of *Hydroporus* s.l. were collected in Wisconsin over the past 32 years, including 20 of *Hydroporus* s.s., 7 of *Neoporus*, 4 of *Hydroporus oblitus*-group, 2 of *Heterosternuta*, and 1 of *Sanfilippodytes*. Species keys and notes on identification are provided for adults of species that occur or may occur in Wisconsin. Information on distribution and abundance in Wisconsin, habitat, and life cycle is provided for each species based on a study of 27,310 adults. Life cycles were predominantly univoltine, with adults overwintering and larvae completing development from late spring to late summer, depending on the species. Most adults apparently overwinter in aquatic habitats, but several species of *Hydroporus* s.s. probably overwinter in terrestrial or riparian habitats.

Fall (1923) revised *Hydroporus* and *Agaporus* (now *Laccornis*) in North America, dividing *Hydroporus* into three subgenera, *Hydroporus*, *Deronectes*, *Oreodytes*, which presently are recognized as genera (Nilsson et al. 1989). He divided *Hydroporus* into four species groups, the *undulatus*-group, the *niger-tenebrosus*-group, the *vilis*-group, and the *oblitus*-group. Wolfe and Matta (1981) reviewed these groups and the status of subgeneric names. They further divided Fall’s *undulatus*-group into the *undulatus*-group, the *pulcher*-group, and the *pilatei-triangularis*-group, giving generic status to the latter by naming it *Falloporus* (now *Lioporeus*). Alarie’s (1991) study of a limited number of larvae supports above subdivisions of *Hydroporus* sensu lato. *Laccornis*, *Oreodytes*, *Deronectes* (now *Nebrioporus* and *Stictotarsus* in North America), and *Lioporeus* were included with seven other genera of *Hydroporinae* in part V (Hilsenhoff 1994). Because generic status will likely be given to the above groups as a result of ongoing revisions by R.E. Roughley, University of Manitoba, David J. Larson, Memorial University, Newfoundland, and G. William Wolfe, Reinhardt College, Georgia, I will treat them as genera, using accepted subgeneric and generic names (Nilsson et al. 1989). Fall’s *niger-tenebrosa*-group will be *Hydroporus*, and his *vilis*-group *Sanfilippodytes*. Wolfe and Matta’s *undulatus*-group will be *Neoporus*, and their *pulcher*-group *Heterosternuta*. Roughley and Larson have not yet published a generic name for the *oblitus*-group, so I will continue to use *Hydroporus*.

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1Research supported by the College of Agricultural and Life Sciences and the Graduate School at the University of Wisconsin-Madison.
2Department of Entomology, University of Wisconsin, Madison, WI 53706.
A generic key to adults and information on collecting efforts, measurement of specimens, and general life cycles of Dytiscidae appear in part I of this study (Hilsenhoff 1992). Part I also contains a map of Wisconsin with numbered counties; county records listed below refer to this map.

A collection of 27,310 adults of 34 species of Hydroporus s.l. from Wisconsin over the last 32 years is the basis for this study (Tables 1 and 2). Listed separately in these tables are records of beetles from McKenna Pond (Hilsenhoff 1992) and from ponds at the Leopold Memorial Reserve in Sauk County (Hilsenhoff 1993). Below under each genus is a key to adults of species that occur or may occur in Wisconsin; a size-range for adults from Wisconsin is included if four or more were collected. Following each key, information on distribution and abundance in Wisconsin, general range in North America, habitat, life cycle, and identification is reported for each species.

Adults of many species became active later in the spring than most dytiscids in the other subfamilies, which delayed oviposition and larval development. Apparently all species are predominantly univoltine, with adults overwintering; partial second generations and occasional overwintering larvae are rare. Adults of Heterosternuta, Sanfilippodytes, most Neoporus, and many Hydroporus oblitus-group species overwinter in streams; adults of some oblitus-group species also overwinter in deeper ponds. Adults of about half of the species of Hydroporus overwinter in bogs or deep lentic habitats; the remainder apparently overwinter in terrestrial sites, especially those adjacent to vernal ponds and marshes.

**Heterosternuta Strand, 1935**

Heterosternuta has generally been considered a subgenus of Hydroporus Clairville (Nilsson et. al. 1989); the name replaced Heterosternutus Zimmermann, which was preoccupied. Matta and Wolfe (1981) revised the Nearctic fauna, reporting 13 species from the eastern United States and Canada. Most have a southern distribution; only four occur in eastern Canada (Larson and Roughley 1991). All species are predominantly lotic, occurring mostly along gravelly margins of small streams, some of which may be temporary; occasionally they occur in larger streams and in lentic habitats. Studies of larvae by Alarie (1991) indicate Heterosternuta and Neoporus are closely related. Third instar larvae in both genera lack lateral spiracles, which is unique among known dytiscid larvae. This suggests they pupate in aquatic or very wet habitats instead of in cells on land. The elongate-oval shape of adults differs from most Neoporus, and the apically bifid penis is distinctive. Only two species were collected in Wisconsin; both apparently are rare (Table 1). Fifteen Heterosternuta larvae were collected 12 May to 12 June from streams in Brown and Outagamie counties in addition to adults reported below. Distribution records in Wolfe (1979), and Matta and Wolfe (1981), suggest no other species occurs in Wisconsin.
Table 1. Numbers of *Heterosternuta, Hydroporus oblitus*-group, *Neoporus*, and *Sanfilippodytes* adults collected from 1962–1994 in nine areas of Wisconsin (Hilsenhoff 1992), McKenna Pond (McK), and Leopold Memorial Reserve (LMR).

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Key to Species of Adult *Heterosternuta* in Wisconsin

1. Metasternum black or deeply infuscate; dense tuft of setae anterior to procoxa: 3.6–4.0 mm long ......................... *wickhami*

   Metasternum testaceous to rufotestaceous; no dense tuft of setae anterior to procoxa; 3.1–3.6 mm long (Matta and Wolfe 1981) ............... *pulcher*

*Heterosternuta pulcher* (LeConte, 1855)

*Distribution and Abundance:* Very rare in east-central area (Table 1). County record: 43. Range: WI-NF-NC-OK.

*Habitat:* The only specimens were collected from the Red River, a small stream in Kewaunee County that flows into Lake Michigan’s Green Bay.

*Life Cycle:* Adults were collected 2 July and 1 October.

*Identification:* Adults are readily separated from those of *H. wickhami* by the key. The penis is unlike that in any other Nearctic *Heterosternuta*. It is flat apically and ends in two elongate, narrow lobes that curve inward to almost meet at the apex.

*Heterosternuta wickhami* (Zaitzev, 1907)

*Distribution and Abundance:* Rare in southern third and in east-central area (Table 1). County records: 42–44, 56, 62, 71–72. Range: MN-NB-VA-AR-KS.

*Habitat:* Most adults were collected from small to large streams; three were collected in August from ponds that were not adjacent to streams.

*Life Cycle:* A teneral adult was found along the bank of a large river on 26 June. All other adults were collected 27 March–26 April and 2 August–1 November. This suggests a univoltine life cycle with adults overwintering in streams, mating and ovipositing in early spring, and then dying. Larvae probably complete development in late spring or early summer, with those in colder streams emerging later.

*Hydroporus* Clairville, 1806

Currently David J. Larson and Robert E. Roughley are revising the genus. This is Fall’s (1923) *niger-tenebrosa*-group, which contains most North American species of *Hydroporus* s.l. Gordon (1969) revised the genus in North America, but published only descriptions of new species (1981). Twenty species were collected in Wisconsin (Table 2); all occurred almost exclusively in lentic habitats. Females of *H. despectus* and *H. tenebrosus*, which cannot be reliably separated in Wisconsin, were included in Table 2 if they were associated with males or were collected from a site where males of only one of these species occurred; 124 unassociated females were not included in Table 2.
Table 2. Numbers of *Hydroporus* adults collected from 1962–1994 in nine areas of Wisconsin (Hilsenhoff 1992), McKenna Pond (McK), and Leopold Memorial Reserve (LMR).

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Key to Adult *Hydroporus* in Wisconsin

1. Anterior half or pronotum rufous, lighter than or same color as elytra; abdominal sterna mostly rufous, except in female *dichrous* .... 2
   Pronotum piceous to black on disc, as dark or darker than elytra; abdominal sterna mostly black .................. 4

2(1). Larger, > 3.8 mm long ........................................... 2
   Smaller, ≤ 3.7 mm long ........................................... 3

3(2). Anterior protarsal claw of male with large subapical tooth; sides of protarsomere 3 of female evenly convex (Fig. 1); elongate, elytra widest past middle; 3.8–4.6 mm long .................... *dentellus*
   Anterior protarsal claw of male not toothed; sides of protarsomere 3 of female straight or slightly concave in basal two-thirds (Fig. 2); ovate, elytra widest before middle; 3.9–4.4 mm long .......... *dichrous*

4(2). Setae on elytra much longer than distance between punctures; anterior of pronotum paler than elytra; often with pale spot at tip of each elytron; larger, ovate, 3.2–3.7 mm long .......... *melsheimeri*
   Setae on elytra short, not longer than distance between punctures; pronotum and elytra a similar rufous to rufopiceous color; smaller, elongate, 2.9–3.3 mm long ..................... *obscurus*

5(1). Very large, 5.3–6.4 mm long; male protarsal claws short, evenly curved; protarsomere 3 of female almost U-shaped, rounded basally (Fig. 3) ........................................... *columbianus*
   Mostly smaller; if > 5.0 mm long, male protarsal claws modified as described in couplet 7 and protarsomere 3 of female V-shaped, narrowly rounded at base (Fig. 4) .................... 6

6(5). Larger, > 4.0 mm long; elytral punctures small, shallow, and dense, slightly larger than larger meshes in males and so shallow in females they are difficult to see; pronotum and elytra similarly colored, usually piceous on disc ........................................... 7
   Mostly < 4.0 mm long; if > 4.0 mm long, elytra with punctures about as large as 4 meshes; pronotum usually black on disc and darker than elytra ........................................... 8

7(6). Male protarsal claws subequal, elongate and sinuate; pronotal bead of female in lateral view rufopiceous and usually elevated apically, in dorsal view widened apically; 4.7–5.8 mm long .......... *notabilis*
   Male anterior protarsal claw shorter than posterior claw and widened at middle; pronotal bead of female in lateral view black basally, same rufous color as epipleuron and not elevated apically, in dorsal view of uniform width; 4.1–5.2 mm long .......... *niger*

8(6). Large, 4.4–4.9 mm long; labial palp testaceous; genae rufous, similar to color of gula .......................... *rectus*
   Smaller; if near 4.4 mm long, labial palp infuscate and genae black or piceous, much darker than gula, except in teneral specimens .... 9

9(8). Margin of elytra in lateral view nearly straight in basal fourth (Fig. 5); elytra with pale marks at humeral angle and sometimes posterior to humeral angle; beetle widest at basal fourth of elytra; 3.5–4.0 mm long ..................... *signatus*
   Margin of elytra distinctly ascending in basal fourth (Figs. 6–7) or beetle < 3.0 mm long; elytra usually not pale at humeral angle; beetle widest near or past middle of elytra ............................. 10

10(9). Elytral disc and most of venter without distinct reticulate microsculpture ..................................... 11
   Elytral disc and venter with distinct reticulate microsculpture .......... 12

11(10). Venter of head entirely rufous; anterior face of protibia with a single row of fine punctures mesally; 2.8–3.4 mm long .......... *larsoni*
Venter of head black or piceous with gula rufous; anterior face of protibia with irregular coarse punctures mesally; 3.2–3.6 mm long

12(10). Margin of elytra in lateral view strongly ascending at base (Fig. 6).............. 13
13(12). Lateral margins of pronotum nearly straight posteriorly to form an acute angle at base (Fig. 8); pronotum widest at base .............. 14
Lateral margins of pronotum rounded posteriorly to form an obtuse angle at base (Fig. 9); pronotum widest anterior to base .......... 15

14(13). Proepipleuron piceous or black; pronotum black, darker than rufopiceous elytra, which are often infuscate posteromedially; anterior protarsal claw of male similar to posterior claw 2.7–3.3 mm long...........................
Proepipleuron rufous; pronotum and elytra rather uniformly rufopiceous with pronotum often slightly darker basally; anterior protarsal claw of male distinctly thicker and wider than posterior claw; 2.9–3.4 mm long ....................................

15(13). Pronotum and elytra similarly piceous; anterior of head rufopiceous; 2.7–3.2 mm long ...................... striolis
Pronotum black, darker than rufopiceous elytra; anterior of head with a triangular, rufotestaceous area; 2.8–3.2 mm long .......... rufinasus

16(12). Very small, 2.5–2.9 mm long ...................... badiellus
Larger, > 3.2 mm long .................................. 17

17(16). Smaller, < 3.8 mm long; elytra with distinct punctures mostly separated by twice diameter of a puncture .............. 18
Larger, mostly > 3.8 mm long; elytra with shallow punctures often separated by less than their diameters ...................... 19

18(17). Beetle black or nearly so; posterolateral angle of pronotum rounded, with pronotum distinctly widest anterior to base; anterior protarsal claw of male toothed at base; 3.3–3.7 mm long ............. morio
Beetle rufopiceous to piceous; posterolateral angle of pronotum angulate, with pronotum widest at base; protarsal claws of male not modified; 3.3–3.8 mm long ...................... tartarius

19(17). Protarsomere 3 of male enlarged, wider than segments 1 or 2 (Fig. 10); penis in dorsal view narrowed in basal half, parallel-sided or slightly concave past middle (Fig. 12); 3.7–4.6 mm long ................. tenebrosus
Protarsomere 3 of male subequal in width to segment 2 (Fig. 11); penis gradually narrowed in basal four-fifths (Fig. 13); 3.8–4.6 mm long ...................... despectus

_Hydroporus badiellus_ Fall, 1923

**Distribution and Abundance:** Common in northern third, rare elsewhere (Table 2); County records: 1–6, 8–9, 11–15, 17–19, 34, 52, 67. Range: AK-NF-MA-WI.

**Habitat:** Almost all adults were collected from swamps, bogs, and other habitats containing _Sphagnum_.

**Life Cycle:** Adults occurred 6 April–27 August; none were teneral. Almost 44% of adults were found in April, most during late April. I suspect adults overwinter in habitats containing _Sphagnum_. Larval development is probably delayed because of the cold habitat, with pupation and emergence in late summer. Inadequate sampling of swamps and bogs after August probably accounts for the absence of teneral adults.

**Identification:** Adults resemble those of _H. tristis_, except they are smaller and the anterior of the head is infuscate dorsally. The elytral margin is very
weakly ascending anteriorly and straight or slightly recurved just before the base; in *H. tristis* it is strongly ascending (Fig. 6). This is the smallest *Hydroporus* in Wisconsin.

**Hydroporus columbianus** Fall, 1923

**Distribution and Abundance:** Uncommon in northern third to rare in southern third (Table 2). County records: 2-4, 6-7, 10, 16-19, 25-27, 29, 31-32, 35-36, 38, 40, 44, 49, 57. Range: YK-NB-NH-ID.

**Habitat:** Most adults occurred in ponds, although several were also collected from sedge (*Carex*) or cattail (*Typha*) marshes.

**Life Cycle:** Six teneral adults were found in five collections made 16-19 June. All adults, except one collected 16 September, occurred 6 April-20 July; 47% were found in April and 49% June-July. A lack of adults in autumn and early spring suggests they overwinter in terrestrial habitats and fly to ponds in spring to mate and oviposit. Larvae complete development in late spring.

**Identification:** Adults are larger than those of any other *Hydroporus*, except some adults of *H. notabilis*, from which they can be readily separated by the key. The head is rufous, and dark marks between the eyes are distinctly separated and do not coalesce as in *H. notabilis*. The pronotal bead in lateral view is very wide and curved downward apically. Elytral punctures in females are distinct, unlike the small, indistinct, extremely shallow punctures in females of *H. notabilis* and *H. niger*.

**Hydroporus denteHus** Fall, 1917

**Distribution and Abundance:** Common in northern two-thirds, fairly common in southern third (Table 2). County records: 1-21, 23-27, 29-40, 43-44, 47-49, 51, 53-57, 59, 61, 64, 67-68, 72. Range: AK-LB-MA-IL.

**Habitat:** Most adults were found in shallow ponds and marshes; they also occurred in a variety of other lentic habitats. One was collected from the margin of a stream in November.

**Life Cycle:** Most adults (62%) were collected March-April; 30% were found June-July. Teneral adults occurred 12 June-5 October, with 72% occurring June-July. Adults apparently overwinter in deeper aquatic habitats and fly to shallower habitats in spring to mate and oviposit. Most larval development is completed in late spring and early summer, except in cold, northern habitats. Two teneral adults on 5 October probably resulted from a partial second generation.

**Identification:** Adults most resemble the more ovate adults of *H. dichrous*. Occasional specimens are a dark rufopiceous throughout and could be confused with *H. tenebrosus* because of their shape, but close examination reveals a rufous cast in the prothorax. The pronotum in darker individuals is most rufous in a band posterior to the anterior fourth; in *H. dichrous* the most lightly pigmented area extends to the anterior margin. In dark females the basal abdominal sternae are medially rufous; in *H. dichrous*, *H. despectus*, and *H. tenebrosus* they are black.

**Hydroporus despectus** Sharp, 1882

**Distribution and Abundance:** Common in northern third and in east-central area, uncommon elsewhere (Table 2). County records: 2-3, 9-14, 16-20, 29-30, 32, 35, 37-39, 42, 46, 48-49, 54, 57, 63-64, 70. Range: YK-NF-NJ-IL-SD-AZ-CA-WA.
**Habitat:** Adults occurred in shallow ponds, marshes, and other shallow lentic habitats.

**Life Cycle:** Adults were collected 27 March – 3 October, with 65% being found before June and only 1% after August. Eleven teneral adults occurred 5 June – 10 August, seven of them after 17 July. Adults apparently overwinter in terrestrial habitats and enter breeding sites mostly in April to mate and oviposit. Larval development is completed from late spring to mid-summer.

**Identification:** Adults of *H. despectus* and *H. tenebrosus* can be readily separated from those of other species of *Hydroporus* in Wisconsin by their medium size (3.7–4.6 mm), rather shallow elytral punctures, their shape (widest at middle of elytra), and the mostly black pronotum. However, adults of these two species are very similar and most females cannot be reliably identified. Males can be identified by using the key. *Hydroporus despectus* adults are usually darker than those of *H. tenebrosus* and have little or no contrast between the pronotum and elytra. The epipleurae are usually infuscate mesally and not rufous as in *H. tenebrosus*.

**Hydroporus dichrous** Melsheimer, 1844

**Distribution and Abundance:** Uncommon in southwest and south-central areas (Table 2). County records: 52, 54–57, 61, 63–64. Range: MN-VT-MD-MO.

**Habitat:** Adults were collected from shallow ponds and marshes, except three found in spring ponds in late September.

**Life Cycle:** One teneral adult was found 8 June. Most adults (77%) occurred 27 March – 29 June; 23% were found in September. Late collections from spring ponds suggest adults overwinter there and fly to shallow habitats in spring to mate and oviposit, with emergence occurring in late spring.

**Identification:** Separation from *H. dentellus* is discussed under that species. The anterior protarsal claw of males is two-thirds the length of the posterior claw. The venter of *H. dichrous* females is normally black, at least basally.

**Hydroporus fuscipennis** Schaum, 1868 = *H. criniticaxis* Larson, 1975

**Distribution and Abundance:** Fairly common in eastern third to rare in western third (Table 2). County records: 2, 15–18, 20–21, 24, 29, 35, 38–41, 43–47, 49, 59, 61, 64–65. Range: AK-NF-CT-CO-WA.

**Habitat:** Most adults were found in small ponds in the spring; they also occurred in marshes and other lentic habitats.

**Life Cycle:** All adults were collected 13 March – 8 July, 48% of them in June. This strongly suggests aestivation and overwintering in terrestrial habitats. The early return of adults to ponds and occurrence of 24 teneral adults 25 May – 22 June indicates early oviposition and completion of larval development by late spring.

**Identification:** The general lack of reticulate microsculpture readily separates adults from those of other small *Hydroporus*, except *H. larsoni*. Adults differ from those of *H. larsoni* by ventral head color, except when teneral. In addition to their somewhat larger size and coarse punctures on the anterior of protibiae, adults of *H. fuscipennis* are more densely setose on the intralineal area of the metacoxae than on the metasternum; in *H. larsoni* setae in both areas are similarly sparse and appressed.

**Hydroporus larsoni** Nilsson, 1984 = *H. fuscipennis* in Larson (1975)

**Distribution and Abundance:** Common in northern third, rare in central third (Table 2). County records: 2–4, 6, 10–14, 16–21, 27, 35. Range: YK-LB-WI-MN.
Habitat: Adults occurred in a variety of ponds and occasionally in marshes or swamps.

Life Cycle: Adults were collected 6 April – 1 October; 64% were found in April and June and 95% occurred before September. Two teneral adults were collected 14 July and 14 August. Larvae apparently develop in late spring and early summer. Adults likely overwinter in terrestrial habitats.

Identification: The small size and lack of reticulate microsculpture on the elytral disc and metacoxae separate adults from those of other Wisconsin species, except *H. fuscipennis*. Separation from the mostly larger adults of *H. fuscipennis* is discussed under that species.

**Hydroporus melsheimeri** Fall, 1917

Distribution and Abundance: Common in southwest and west-central areas to rare in eastern third (Table 2). County records: 6–7, 14, 16, 25–26, 29–33, 36–37, 46, 49–58, 60–61, 63–64, 68. Range: MN-NH-NJ-IN.

Habitat: Most adults were collected from ponds; some were found in marshes, ditches, and river sloughs.

Life Cycle: Most adults (77%) occurred 19 March – 30 June, 30% of them in June. About equal numbers were collected in July, August, September, and October. Teneral adults (20) occurred 31 May – 16 June. Adults probably overwinter in deeper ponds and fly to breeding sites in early spring to mate and oviposit. Larval development, pupation, and emergence is completed by late spring.

Identification: Adults resemble those of the larger *H. dichrous*, but there is no overlap in size. Males lack the shortened anterior protarsal claw found in *H. dichrous* and females do not have black venters. Occasional dark individuals resemble adults of the somewhat larger *H. signatus*, which are similarly widest at the basal fourth of the elytra, but in *H. signatus* the venter is black mesally instead of rufous.

**Hydroporus morio** Aubé, 1836

Distribution and Abundance: Uncommon in northern third (Table 2). County records: 1, 13. Range: AK-NF-NH-ND

Habitat: All adults were collected from spruce-tamarack (*Picea mariana-Larix laricina*) swamps.

Life Cycle: Adults occurred 16 June – 14 August; none were teneral.

Identification: Because of rounded basolateral angles on the pronotum and a black or nearly black dorsal color, adults resemble those of the distinctly smaller *H. puberulus*. Elytra are widest at about the apical two-thirds; the genae are rufous or rufopiceous, never black.

**Hydroporus niger** Say, 1823

Distribution and Abundance: Common statewide, except uncommon in northwest area (Table 2). County records: 2, 6, 8–10, 12–16, 18–72. Range: ON-NF-NC-TX.

Habitat: Most adults were collected from ponds; several also were found in marshes and other lentic habitats.

Life Cycle: Teneral adults (45) occurred 20 May – 6 July; 11% were collected in May and 84% by 22 June, which indicates eggs are probably laid very early in spring, allowing most larvae to complete development before summer. Adults, which apparently overwinter in ponds, occurred 29 February – 17 November, 32% occurring September – November and 21% February – April. Another 32% were found in June, when most adults emerged. Many adults
apparently aestivate after emergence in dry summers and become active in autumn when ponds are replenished by rain.

**Identification:** Although usually smaller, adults closely resemble those of *H. notabilis*. Males can be readily identified by their shorter anterior protarsal claw, which is broadened at the middle. Most females are less than 5.0 mm long, while those of *H. notabilis* are longer than 5.0 mm. The anterior portion of the pronotal bead is rufous, the same color as the epipleuron, and difficult to see in lateral view; in *H. notabilis* it is piceous and readily visible above the epipleuron. The anterior of the head is rufous, except for two dark spots between the eyes. In *H. notabilis* these spots tend to coalesce and the infuscation usually extends forward over much of the frontoclypeus. The pronotum of most adults is quite broadly rufous laterally.

**Hydroporus notabilis** LeConte, 1850  
**Distribution and Abundance:** Common in southern two-thirds, uncommon in northern third (Table 2). County records: 6, 8, 14-16, 18-20, 23-24, 26-27, 29-36, 39-59, 61-63, 66-68, 71-72. Range: AK-NF-MA-UT.  
**Habitat:** Adults were collected mostly from shallow ponds and marshes in spring and summer and from permanent ponds in autumn.  
**Life Cycle:** Most adults (62%) occurred 19 May – 30 June; teneral adults (44%) were evenly distributed over the 19 May – 22 June period. Overwintering adults that were collected 3 March – 12 May (19%) and 15 September – 23 November (16%). Adults overwinter in permanent ponds, fly to breeding sites in early spring to mate and oviposit, and then die. Larval development is completed by late spring and emerging adults, after feeding for a short period, apparently aestivate in terrestrial sites until the advent of autumn rains. Larson (1975) suggested possible overwintering of eggs or larvae in Alberta.  
**Identification:** Separation of adults from those of *H. columbianus* and *H. niger* is discussed under those species.

**Hydroporus obscurus** Sturm, 1835 = *H. hockingi* Larson, 1975  
**Distribution and Abundance:** Uncommon in north-central and northeast areas (Table 2). County records: 11, 13, 17-18. Range: AK-NF-MA-WI.  
**Habitat:** Almost all adults occurred in bogs or swamps containing *Sphagnum*; two were from a shallow pond, which likely also contained *Sphagnum*.  
**Life Cycle:** Seventeen adults occurred 23 April – 16 June; two others were found 27 August and 16 September. Teneral adults occurred 6 June and 27 August. Adults obviously overwinter, perhaps in *Sphagnum*; the teneral adult 6 June in a cold bog habitat suggests larvae may also overwinter, which would indicate at least a partially semivoltine life cycle.  
**Identification:** The small size, rufopiceous color, with the head and pronotum usually less piceous, and the elongate shape with elytra nearly parallel-sided in the basal two-thirds, will identify this species. Some individuals were nearly black, with only the head and anterior and lateral margins of the pronotum being dark rufopiceous.

**Hydroporus puberulus** LeConte, 1850 = *H. glabriusculus* Aubé, 1836  
**Distribution and Abundance:** Fairly common in northern third (Table 2). County records: 1–3, 9-13, 18-19. Range: AK-NF-NH-WI.  
**Habitat:** Adults occurred in shallow ponds, sedge marshes, margins of swamps, and a variety of other habitats.  
**Life Cycle:** Adults were collected 23 April – 9 September, 85% in April; teneral adults (11) occurred 12 August – 9 September. The absence of adults in
autumn and early spring suggests they overwinter in terrestrial habitats. Adults probably do not mate until late April or May, after which most die. This accounts for delayed larval development and scarcity of adults in late spring and summer.

Identification: Adults resemble very dark specimens of *H. striata*, except that posterolateral margins of the pronotum are rounded. Microsculpture on the metacoxae is lightly impressed; in *H. striata* this microsculpture is coarse.

*Hydroporus rectus* Fall, 1923

Distribution and Abundance: Fairly common in northwest third, very rare in west-central area (Table 2). County records: 2-5, 8-12, 14-15, 17-20, 31.

Habitat: Adults were found only in swamps and other boggy areas containing *Sphagnum*, except two in ponds 23 April and 30 September.

Life Cycle: All adults, except one, occurred 19 April–23 August. The only teneral adult was found 13 August. Adults probably overwinter in *Sphagnum* or in deeper ponds, as suggested by the 23 April and 30 September collections. Larvae probably develop slowly in spring and early summer due to their cold *Sphagnum* habitat.

Identification: Their rather large size (4.4–4.9 mm long), almost black dorsal color, elongate shape with elytra widest past the middle, rufous genae, coarse elytral punctation, and testaceous labial palpi readily separate adults from those of all other *Hydroporus*.

*Hydroporus rufinasus* Mannerheim, 1852

Distribution and Abundance: Fairly common in northern third, rare elsewhere (Table 2). County records: 1–6, 8–10, 12–19, 27, 29, 34, 64, 70. Range: AK-NF-MI-WI.

Habitat: Although adults were collected from a variety of shallow lentic habitats, there was a strong relationship to *Sphagnum*.

Life Cycle: Adults occurred 6 April–20 August, 81% of them in April. One teneral adult was collected 19 August and three others were found in late April. The latter specimens were distinctly, but not extremely teneral, which suggests they may have emerged the previous fall. The life cycle is probably similar to that of *H. puberulus*, with adults overwintering in terrestrial habitats, mating and ovipositing in late April or May, and then mostly dying. This would account for the rarity of adults after June (5%).

Identification: Because of head color and a black pronotum, adults resemble those of *H. tristis*. The proepipleuron in *H. rufinasus*, however, is rufous instead of black, and the pronotum is rounded at the basolateral angles.

*Hydroporus signatus* Mannerheim, 1853


Habitat: Almost all adults, including all teneral adults, were found in ponds. Occasionally adults occurred in other lentic habitats.

Life Cycle: Teneral adults (82) occurred 31 May–12 July, all except two by 22 June. Adults were collected 20 February–6 November, 38% February–April and 44% 1 June–15 July. Adults overwinter in ponds and enter breeding sites in early spring to mate and oviposit. Almost all larvae complete development by late spring, and emerging adults apparently aestivate in dry summers after briefly feeding in ponds.

Identification: The nearly parallel sided elytra in the basal half, color, size
(3.5-4.0 mm), and straight elytral margins in lateral view readily separate adults from those of other *Hydroporus*. Humeral elytral angles and lateral pronotal margins are broadly pale, with the pronotum at most slightly darker than the elytra. The head is rufous ventrally and piceous dorsally, except for a transverse rufous stripe behind the eyes. Small adults of *H. tenebrosus* and *H. despectus* are most similar, but elytra are widest past the middle, the gula is paler than the genae, and elytral margins ascend basally.

*Hydroporus striola* (Gyllenhal, 1827)

**Distribution and Abundance:** Abundant statewide (Table 2). County records: 1-27, 29-49, 51-55, 57-61, 63-72. Range: AK-NF-NJ-CO-MT.

**Habitat:** Adults were collected from a variety of ponds and marshes, and occasionally from other lentic habitats.

**Life Cycle:** Adults occurred 20 February-27 October, with 72% being collected before June, when 62% of the 271 teneral adults appeared. One teneral adult was found 11 May and another 30 September; all others occurred 5 June-22 August. The life cycle is probably univoltine, with adults overwintering in aquatic habitats, and mating and ovipositing mostly in April.

**Identification:** Anterior head color varies from a rufous triangle, as in most *H. tristis*, to almost completely dark, as in *H. puberulus*; usually it is rufopiceous. Dorsally, adults are a rather uniform rufopiceous color, with the pronotum usually darker basally. The proepipleurae are rufous, while they are black in *H. tristis*. In most specimens the gula is distinctly lighter than the genae, while in *H. tristis* the head is unicolorous ventrally. The thicker and ventrally flanged anterior protarsal claw of males is diagnostic.

*Hydroporus tartaricus* LeConte, 1850

**Distribution and Abundance:** Two color morphs exist in Wisconsin, which may be different species. R.E. Roughley and D.J. Larson, who are revising the genus, are evaluating differences. The dark morph, in which the genae are piceous or black and the gula is rufous or rufotestaceous, is uncommon in the northern half (Table 2). The rufous morph, in which the genae and gula are similarly rufous to rufopiceous, is uncommon statewide (Table 2). County records: 2, 10, 12, 14-18, 25, 29-30, 38, 48, 61, 64. Range: AK-LB-MA-WY+CO.

**Habitat:** All adults were collected from shallow ponds or marshes.

**Life Cycle:** Adults occurred 20 February-20 August, 52% before June. Twelve found 12 August were in a recently flooded sedge marsh. Four teneral adults occurred 13 June and one 9 July, indicating larvae develop in the spring. Absence of adults from collections after 22 August suggests they overwinter in terrestrial sites, perhaps shallow marshes and areas adjacent to ponds that flood in autumn or early spring.

**Identification:** Adults can be readily separated from those of *H. morio* by the key. Very small adults of *H. tenebrosus* and *H. despectus* are similar in shape and color, but have distinctly shallower and denser elytral punctures.

*Hydroporus tenebrosus* LeConte, 1850


**Habitat:** Adults were collected from shallow ponds, marshes, and other
shallow, lentic habitats that were less acidic than those inhabited by *H. despectus* adults.

**Life Cycle:** Adults occurred 20 February – 19 October, with 65% found before May and 29% in June, when 90% of the adults emerged. Teneral adults occurred 9 June to 24 July. Less than 1% of the adults occurred after 16 September or before March. I believe adults overwinter in terrestrial sites adjacent to shallow habitats that flood in late autumn or early spring, and that most larvae complete development before summer begins.

**Identification:** Separation from *H. despectus* is discussed under that species. The third protarsomere is sufficiently enlarged on most males to allow easy separation from *H. despectus*; in some the difference is slight and the shape of the penis, a reliable character in Wisconsin, must be used.

*Hydroporus tristis* (Paykull, 1798)

**Distribution and Abundance:** Very common in northern third to uncommon in southern third (Table 2). County records: 1-23, 27, 29-39, 41, 45, 47-49, 57, 61, 67-68. Range: AK-NF-NJ-IN-CO-WA.

**Habitat:** Adults were collected from a variety of ponds and marshes, but were most abundant in boggy areas and swamps.

**Life Cycle:** Adults occurred 19 March – 14 November; 73% of them in April; 24% were evenly distributed May – August. Teneral adults were found 15 June – 15 September. With only 0.5% of adults occurring after 5 October and 80% of adults being collected from ponds in April and May, it seems likely adults overwinter in terrestrial habitats. I believe the life cycle is univoltine, with the prolonged emergence period being due to delayed breeding and retarded larval development in cold northern habitats.

**Identification:** The black proepipleurae distinguish adults from those of the three other small *Hydroporus* with strongly ascending elytral margins, although some *H. puberulus* have piceous proepipleurae.

*Hydroporus obtusus-group*

Fall (1923) described eight species in the *oblitus-group*, most of which were from the Appalachian Mountains and adjacent coastal states. He reported two species, *H. paugus* and *H. stagnalis*, as far west as Wisconsin and one other species from Oregon. More recently Balfour-Browne (1948) described *H. acadianus* from Nova Scotia and Larson (1975) described *H. rubyae* from Alberta. R.E. Roughley and D.J. Larson are presently revising this group. Four species were found in Wisconsin. Adults inhabit lentic habitats, except in autumn and winter when many or most may enter streams to overwinter.

**Key to Adult *Hydroporus obtusus-group* Species in Wisconsin**

1. Very small, < 3.2 mm long; lateral bead on pronotum narrow, half as wide at mid-length as penultimate antennomere; 2.9–3.2 mm long .................................................. 
   *rubyae*
   Larger, > 3.2 mm long; if near 3.2 mm long, lateral bead on pronotum broad, as wide at mid-length as penultimate antennomere ............. 2

2(1). Lateral bead on pronotum broad, as wide at mid-length as penultimate antennomere; smaller, 3.2–3.7 mm long .................... *stagnalis*
   Lateral bead on pronotum narrow, half as wide at mid-length as penultimate antennomere; mostly larger, ≥ 3.6 mm long ............... 3
3(2). Head relatively smaller; eyes closer together, separated by < 0.78 mm; width of head (H)/interocular width (I) > 1.5; mostly larger, 3.6-4.2 mm long ........................................... \textit{p. pauagus}

Head relatively larger; eyes farther apart, separated by > 0.78 mm; H/I < 1.5; mostly smaller, 3.6-3.8 mm long ............... \textit{p. persimilis}

\textbf{Hydroporus \textit{pauagus} Fall, 1923}

\textbf{Distribution and Abundance:} Fairly common in northern third to uncommon in southern third (Table 1). County records: 1-4, 6, 9-13, 16-21, 26, 29-32, 34-35, 40, 44, 48-49, 55, 57, 61-63, 67. Range: AK-NF-MA-WI.

\textbf{Habitat:} Three-fourths of adults were collected March–April, mostly from shallow ponds and marshes. In October and November 82% occurred in streams; none were found in streams at other times of the year.

\textbf{Life Cycle:} Adults apparently overwinter in streams or deeper ponds and invade shallow lentic habitats in spring to mate and oviposit. Teneral adults occurred 25 June and 2 August, suggesting larval development is completed in early summer.

\textbf{Identification:} Almost all adults are distinctly larger than those of \textit{H. stagnalis}, which have a much broader pronotal bead. They resemble adults of \textit{H. persimilis}, from which they can be separated by using the key. Females are dimorphic, with most resembling males; only one had dull elytra with dense microsculpture and shallower and more numerous punctures.

\textbf{Hydroporus \textit{persimilis} Crotch, 1873}

\textbf{Distribution and Abundance:} Very rare in extreme north (Table 1). County records: 1, 9. Range: PQ-NF-MA-WI.

\textbf{Habitat:} One adult was collected from a small brook below a beaver pond. The other two occurred in swamps, which I believe is their breeding habitat.

\textbf{Life Cycle:} All adults were collected 25 May–23 June.

\textbf{Identification:} Adults resemble small specimens of \textit{H. pauagus}. In addition to a relatively wider head, smaller eyes, and wider interocular space, elytra of adult \textit{H. persimilis} are more sparsely punctate and the penis is less abruptly narrowed to a thin point (Fig. 14) than in adults of \textit{H. pauagus} (Fig. 15); in \textit{H. stagnalis} the penis is abruptly narrowed at the apex.

\textbf{Hydroporus \textit{rubyae} Larson, 1975}

\textbf{Distribution and Abundance:} Very rare north (Table 1). County records: 1, 13. Range: YK-NF-WI.

\textbf{Habitat:} Both adults were collected from black spruce-tamarack swamps.

\textbf{Life Cycle:} Too few were collected to predict a life cycle.

\textbf{Identification:} Adults are rather uniformly dark rufous, with ventral thoracic segments infuscate or black. They are very small, and the narrow lateral bead on the pronotum distinguishes them from small \textit{H. stagnalis} adults.

\textbf{Hydroporus \textit{stagnalis} Gemminger and Harold, 1868}

\textbf{Distribution and Abundance:} Uncommon in northern third to very rare in southern third (Table 1). County records: 2, 13-14, 31, 39, 61. Range: NT-NF-RI-IL.

\textbf{Habitat:} Twenty-two were collected 20–22 August from a recently-flooded sedge marsh (\textit{Carex stricta}) with water less than 15 cm deep. Other adults (9) were collected 23 March–28 June, all from similar temporary habitats, except one from a ditch and two from the margin of an ice-covered bog.
Life Cycle: Teneral adults occurred 26-28 June. Adults probably overwinter in deeper habitats and fly to temporary lentic habitats in spring to mate and oviposit. Larval development is likely completed by late spring before these habitats become dry. Adults apparently aestivate during the summer in dry sedges and become active if subjected to flooding.

Identification: Most adults are noticeably larger than those of H. rubyae, and smaller than H. paugus; they resemble the latter, except the pronotal bead is much broader and the pronotum is less broadly rufous. Females are dimorphic; eight of 18 had dull elytra with denser microsculpture and more numerous and shallower punctures than those resembling males.

**Neoporus Guignot, 1931**

*Neoporus* usually is treated as a subgenus (Nilsson et. al 1989). Adults are oval beetles that mostly are testaceous beneath and above, and have black maculae, fasciae, and/or vittae on their elytra. Larvae are generally unknown; those that have been reared lack lateral spiracles in the last instar and have secondary setae on the urogomphi. In those respects they are similar to larvae of *Heterosternota* and differ from those of other *Hydroporus* s.l. and *Hygrothus* (Alarie 1991). They also have natatory setae on tibiae and tarsi. *Neoporus* has not been revised in North America since Fall’s 1923 revision, although Wolfe (1979) studied the group intensively in Tennessee and surrounding areas where most species occur. Wolfe (1984) divided *Neoporus* into nine species groups and completed a revision of the *vittatipennis*-group; he plans to revise the other groups. Seven species were collected in Wisconsin; *Neoporus undulatus* is Wisconsin’s second most abundant species of Dytiscidae. Five species were predominantly or wholly lotic; two were predominantly lentic, but often entered streams to overwinter.

In the absence of a recent revision, it is difficult to define taxonomic limits of species and to determine their range with any degree of certainty. Publications by Fall (1923), Wolfe (1979), and Larson and Roughley (1991) provide the only clues to the identity of species that may occur in Wisconsin. Three species that have not been found in Wisconsin are included in the key below because their published range suggests they could occur there.

### Key to Species of Adult *Neoporus* in Wisconsin

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Matched Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Black or fuscous ventrally; penis not evenly tapered at apex and asymmetrical in dorsal view; 3.5-3.7 mm long (Fall 1923)</td>
<td><em>vittatus</em></td>
</tr>
<tr>
<td></td>
<td>Testaceous or rufous ventrally; penis evenly tapered at apex</td>
<td><em>vittius</em></td>
</tr>
<tr>
<td>2(1).</td>
<td>Very small, &lt; 3.0 mm long; elytra with narrow dark vittae; lotic</td>
<td><em>vittiosus</em></td>
</tr>
<tr>
<td></td>
<td>Larger, &gt; 3.5 mm long; elytra vittate, maculate, or mostly dark</td>
<td><em>vittius</em></td>
</tr>
<tr>
<td>3(2).</td>
<td>Elytron with a humeral dark spot and distinct vittae; 2.2-2.5 mm long (Wolfe 1984)</td>
<td><em>mellitus</em></td>
</tr>
<tr>
<td></td>
<td>Elytron lacking humeral dark spot and with a medial cloud connecting vittae; 2.6-2.9 mm long</td>
<td><em>tennetum</em></td>
</tr>
<tr>
<td>4(2).</td>
<td>Elytra with longitudinal dark vittae, which may be connected by transverse spots or obscured in dark individuals</td>
<td><em>vittius</em></td>
</tr>
<tr>
<td></td>
<td>Elytra with transverse dark fasciae or pale maculae</td>
<td><em>vittius</em></td>
</tr>
<tr>
<td>5(4).</td>
<td>Elytra with 3 broad vittae, one on each elytron and one on suture, and narrow marginal vittae; lotic; 4.0-4.5 mm long</td>
<td><em>vittatus</em></td>
</tr>
<tr>
<td></td>
<td>Elytra with 4 narrow vittae on each elytron and a sutural vitta</td>
<td><em>vittatus</em></td>
</tr>
<tr>
<td>6(5).</td>
<td>Each elytron with 4 distinct vittae, one nearest suture abbreviated in anterior third; abdominal sterna 3-5 with coarse punctures similar to</td>
<td><em>vittatus</em></td>
</tr>
</tbody>
</table>
those on rest of venter; anterior male protarsal claw shorter and more curved than posterior claw; lentic; 4.1–4.6 mm long ........ superiors
Each elytron with 4 vittae, connected basally, medially and apically by fasciae and often interrupted; abdominal sterna 3–5 extremely finely punctate, appearing granulate; male protarsal claws equal in length; lotic; 3.7–4.3 mm long .................. solitarius

7(4). Pronotum testaceous anteriorly; lateral margin of elytra strongly ascending in basal third; 3.8–4.2 mm long .............. hybridus
Pronotum with anterior infuscation or black mark; lateral margin of elytra straight, or nearly so, in basal third ........... 8

8(7). Anterior protarsal claw of male very short, not more than 1/2 length of posterior claw; sides of pronotum sinuate before front angle in female (Fig. 16); predominantly lotic; 3.9–4.8 mm long ........ clypealis
Anterior protarsal claw of male 3/4 to equal length of posterior claw; sides of pronotum evenly curved at front angle in female (Fig. 17); lentic or lotic .................................................. 9

9(8). Anterior pronotal infuscation abbreviated laterally, extending only to inner margin of eyes; male protarsal claws equal; elytra usually predominantly dark with pale marks; 3.9–4.7 mm long .... undulatus
Anterior pronotal fascia extending almost to lateral margin; anterior male protarsal claw 3/4 length of posterior claw; elytra predominantly pale with dark markings; 3.7–4.1 mm long (Wolfe 1979) ........ semiflavus

**Neoporus clypealis** (Sharp, 1882)

**Distribution and Abundance:** Fairly common northern third, common southern two-thirds (Table 1). County records: 4, 11, 13, 15–16, 21, 23, 26, 32, 34–37, 41, 43, 49–52, 54, 56–58, 60–64, 68, 72. Range: WI-NF-GA-KS.

**Habitat:** Almost all adults were collected from streams of various sizes, backwaters, spring ponds, and ponds adjacent to streams. Rarely they occurred in other ponds or ditches.

**Life Cycle:** Teneral adults (37) were found in four collections (31 May, 28


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June, 9 and 10 September), more than ten each month. About 71% of adults occurred 1 September – 13 December, with less than 17% occurring 27 February -31 May, when teneral adults first appeared. This indicates adults overwinter in lotic habitats, but suggests many may have mated, oviposited, and died the previous autumn, allowing eggs or larvae to overwinter. Only 7.6% of the adults were found June – August, 40% of which were teneral. The life cycle is probably univoltine, with larvae developing rapidly in the spring in warm habitats and more slowly in colder habitats.

Identification: Adults have predominantly dark elytra and closely resemble those of the abundant *N. undulatus*. Adults of both sexes can be readily identified by the key, which also separates them from dark adults of *N. solitarius*. The lateral sinuation on the pronotum of females, while distinct, is not pronounced (Fig. 16), and the lateral margins do not curve strongly inward as in *N. undulatus* (Fig. 17). The pair of pale marks just posterior to and laterad from the basal pale marks on the elytra are more narrow and linear than those in most *N. undulatus*, which is helpful when looking for *H. clypealis* among large collections of *N. undulatus* from lotic or semilotic habitats.

*Neoporus hybridus* (Aubé 1838)

**Distribution and Abundance:** Very rare south (Table 1). County records: 56, 60. Range: WI-NC-GA-AR.

**Habitat:** One adult was collected from the margin of the Wisconsin River and another from a pond close to that river.

**Life Cycle:** Adults, which probably overwinter, were found 25 February and 28 September.

**Identification:** Adults resemble *N. undulatus*, but are recognized because they lack an anterior black mark on the pronotum. The strongly ascending elytral margins and concave clypeus that appears truncate from above are other distinctive characters.

*Neoporus mellitus* (LeConte, 1855)

**Distribution and Abundance:** Not collected in Wisconsin, but recorded from western Michigan. Range: ON-NB-GA-LA-MI.

**Habitat:** Wolfe (1984) found adults only along undercut banks of streams.

**Life Cycle:** Teneral adults occurred in May and June in southeastern states (Wolfe 1984).

**Identification:** The only other very small *Neoporus* is *N. tennetum*. The key separates these two species. The penis is bluntly rounded at its apex; in *N. tennetum* it is pointed.

*Neoporus semiflavus* (Fall, 1917)

**Distribution and Abundance:** Not yet found in Wisconsin, but the type locality is in northern Illinois. Range: IL-IN-TN-MO

**Habitat:** A woodland pond and margins of streams were mentioned by Wolfe (1979) as habitats.

**Identification:** The key should readily distinguish this species. The elytral pattern is predominantly pale.

*Neoporus solitarius* (Sharp, 1882)

**Distribution and Abundance:** Fairly common in northern third, rare farther south (Table 1). County records: 2-4, 6-8, 11, 14-16, 19-21, 25-27, 30, 34, 63. Range: SK-NF-CT-OH-MN.
Habitat: Adults were almost entirely lotic and usually occurred in medium-sized streams. A flowage, a shallow sandy lake, and a quarry pond were the only other collection sites.

Life Cycle: Eleven of 12 teneral adults occurred 17 August – 5 September; one was found 7 November. Larvae apparently develop mostly during the summer and adults probably overwinter in streams, since one-third were collected October – November. One-fifth of the adults occurred in the spring, only two before late May. This suggests overwintering adults do not become active before late May and early June, when they likely mate and oviposit.

Identification: The key readily identifies adults, except some that are almost completely dark. The granulose appearance of the last three abdominal sternae is distinctive.

**Neoporus superioris** (Balfour-Browne, 1944) = *Hydroporus sericeus* LeConte, 1850

Distribution and Abundance: Uncommon in northwest quarter (Table 1). County records: 1, 3, 7, 25. Range: NT-ON-WI-MN

Habitat: Eight were collected from margins of lakes. The remaining three were found in a pond, a swamp, and a medium-sized stream.

Life Cycle: Too few were found to predict a life cycle.

Identification: Adults are most similar to those of *N. solitarius*, from which they can be separated by the key. Elytral vittae are broader than in *N. solitarius* and not interrupted, and elytral maculae are much smaller. Adults of the larger *Nebrioporus rotundatus* are similarly marked.

**Neoporus tennetum** Wolfe, 1984

Distribution and Abundance: Rare in eastern and southern thirds (Table 1). County records: 19, 21, 24, 46, 57, 60, 70. Range: ON-NY-TN-KS-WI.

Habitat: All adults were collected from margins of streams.

Life Cycle: Adults occurred 24 April – 23 December; none were teneral. Wolfe (1984) collected teneral specimens in June from areas farther south. The life cycle is probably univoltine, with adults overwintering in streams and larvae completing development in early summer.

Identification: Separation from *N. mellitus*, the only other very small *Neoporus*, is discussed under that species.

**Neoporus undulatus** (Say, 1823) = *Hydroporus consimilis* LeConte, 1850

Distribution and Abundance: Abundant statewide (Table 1). County records: 1-18, 20-72. Range: NT-NF-NC-AR-OR.

Habitat: Adults typically inhabit permanent ponds, but also occur in deep marshes, ditches, sloughs, and margins of streams. They may use lotic habitats as overwintering sites, occurring there most frequently in autumn and spring.

Life Cycle: Almost one-third of the adults were collected October – May, documenting that they overwinter in aquatic habitats. About 57% were found June – September; teneral adults occurred 9 June – 10 September, the largest numbers in the last half of June. The life cycle probably is mostly univoltine, with larvae completing development in late spring or early summer, or later in colder habitats.

Identification: Following Larson and Roughley (1991), I treat *N. consimilis* as a junior synonym, but if a revision determines it is a distinct species, most or all Wisconsin specimens will be *N. consimilis*. Adults of *N. undulatus* in Wisconsin have a variably fasciate elytral pattern with the anterior discal...
pale marks typically broad and usually confluent. In dark specimens, pale elytral marks are greatly reduced and in pale specimens they are enlarged and about equal in area to the dark fasciae. Male protarsal claws are subequal in length with the anterior one distinctly bent at the base and sinuate on the inner margin. Separation from similar species is discussed under those species.

**Neoporus vitiosus** (LeConte, 1855)

Distribution and Abundance: Not yet found in Wisconsin, but it was described from Illinois and occurs north to Quebec. Range: MI-PQ-NY-IL.

Identification: Because of their size, elongate shape, and dark ventral surface, adults are similar to those of *Heterosternuta wickhami*, but lack erect setae anterior to the procoxae, a bifid penis, and pronotal infuscations.

**Neoporus vittatus** (LeConte, 1855)

Distribution and Abundance: Uncommon statewide (Table 1). County records: 1, 8, 12-13, 17, 21, 23-24, 29-31, 33-37, 39-41, 43-45, 51, 53-54, 57, 61, 63, 66, 68-72. Range: AB-ON-IL-WY.

Habitat: Almost all adults were collected from medium-sized to small streams; exceptions were four from a pond adjacent to a stream, one from a ditch, and ten from a spring pond.

Life Cycle: Adults occurred 3 March-12 November, 31% October - November, and only 6% in July. Two teneral adults were found 24 August in northern Wisconsin. Adults apparently overwinter in streams, and mate and oviposit in the spring. Most larvae probably develop in late spring and early summer.

Identification: The broad elytral vittae bordered by narrow rufous vittae are distinctive. In occasional dark specimens vittae coalesce to various degrees. The anterior protarsal claw of males is wider and three-fourths the length of the posterior claw.

**Sanfilippodytes** Franciscolo 1979

Fall (1923) reported eight species (as *Hydroporus vilis-group*) from North America. He found only *S. planiusculus* in eastern North America, except for a questionable record of *S. vilis* in New Jersey. More recently Young (1953) described *S. pseudovilis* from Michigan, comparing adults with those of *S. planiusculus* and *S. brumalis* (Brown, 1930). R.E. Roughley has begun a much needed revision; known species and their ranges are not clearly defined and additional species may exist. Adults occur in cold, lotic habitats. Because of their small size, adults may be easily overlooked; only 16 were collected, four of which were males. All were identified as *S. pseudovilis*.

**Sanfilippodytes pseudovilis** (Young, 1953)

Distribution and Abundance: Rare statewide (Table 1). County records: 1-2, 49, 57, 61. Range: WI-MI.

Habitat: Almost all adults were found in pools below springs, or in small, spring-fed streams and adjacent pools; one was collected from a drainage ditch in April.

Life Cycle: Adults were collected in April, June, July, September and November; those found 27 July, and 3 and 21 September were teneral. The life cycle is likely univoltine with larval development in spring and summer.
Identification: This is probably the only species in Wisconsin, but more collections and study are needed (Roughley, personal communication).

SUMMARY

Part I of this study (Hilsenhoff 1992) included only beetles collected before 1992. It did not include 3,116 adult and 1,392 larval *Laccophilus* and 2 adult *Agabetes acuductus* collected at the Leopold Memorial Reserve; 11,655 other adult dytiscids and 266 larvae collected there were included in part II and subsequent parts of this study. Information from other collections made after 1991 was included in part II and subsequent parts if beetles had been identified before the manuscript was sent to the publisher. Thus, 102,609 adult Dytiscidae were ultimately used in this study. Because of ongoing revisions of *Agabus* and *Hydroporus* s.l., and a critical examination of all beetles within these genera, the number of species of Dytiscidae found in Wisconsin was 143 instead of 148 as stated in part I.

I concluded from this study that most species of Dytiscidae are primarily univoltine and overwinter as adults in aquatic habitats, but some species may be partially bivoltine in certain years and others (several Agabini) are partially semivoltine. Only in *Laccophilus maculosus* was bivoltinism common and only in *Neoscutopterus* and one or two species of *Agabus* did semivoltinism predominate. Overwintering in the egg stage is apparently confined to several species of *Agabus* and possibly *Neoporus clypealis*. Only in *Ilybius*, some species of *Agabus*, and *Neoscutopterus* did larvae typically overwinter, although occasional larvae of other species probably also overwintered. Overwintering of adults in terrestrial habitats was not confined to *Agabus*, *Ilybius*, *Rhanlus*, and *Hydaticus* (Galewski 1964), but also occurred in *Thermonectus* and several species of *Hydroporinae*. Aestivation of adults in terrestrial habitats, especially in dry summers, was a common phenomenon among Dytiscidae. Based on collection records and laboratory observations, I believe most adults of all species die shortly after mating and oviposition, with unmated adults surviving after the normal mating period. Predicted life cycles are for Wisconsin. Emergence will occur later farther north and earlier farther south, and in some species bivoltinism will be more prevalent farther south and semivoltinism more frequent farther north. References to seasons are based on the solstice; thus summer begins 20–21 June and ends 20–21 September.

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LITERATURE CITED


