The Hydradephaga (Coleoptera, Haliplidae, Gyrinidae, and Dytiscidae) fauna of Cape Breton Island, Nova Scotia, Canada: new records, distributions, and faunal composition

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Abstract
The Haliplidae, Gyrinidae, and Dytiscidae (Coleoptera) of Cape Breton Island, Nova Scotia, Canada were surveyed during the years 2006–2007. A total of 2027 individuals from 85 species was collected from 94 different localities, which brings to 87 the number of species recorded for this locality. Among these, Heterosternuta allegheniana (Matta & Wolfe), H. wickhami (Zaitzev), Hydroporus appalachius Sherman, H. gossei Larson & Roughley, H. nigellus Mannerheim, H. puberulus LeConte, Ilybius picipes (Kirby), and I. wasastjernae (C.R. Sahlberg) are reported for the first time in Nova Scotia. The Nearctic component of the fauna is made up of 71 species (81.6%), the Holarctic component of 16 species (18.4%). Most species are characteristic of both the Boreal and Atlantic Maritime Ecozones and have a transcontinental distribution but 19 species (21.8%), which are generally recognized as species with eastern affinities. In an examination of the Hydradephaga of insular portions of Atlantic Canada, it was shown that the island faunas of Cape Breton Island and Prince Edward Island are very similar (87 and 84 species, respectively) despite differences in composition suggesting that more Hydradephaga species have yet to be found on Cape Breton Island.

Keywords
biodiversity, faunistic, Hydradephaga, Maritime Ecozone
Introduction

Cape Breton Island is a large (10,311 km$^2$) rugged and irregularly shaped island, approximately 175 km long by 135 km at is widest, located at 46 degrees latitude, 60 degrees longitude in northern Nova Scotia, Canada at the eastern extremity of the Gulf of St. Lawrence. It lies within the Atlantic Maritime Ecozone along with Québec's Gaspé Peninsula, Magdalen Islands Archipelago and portions of the south shore of the St. Lawrence River. The climate of this ecozone is strongly influenced by the Atlantic Ocean, which produces cooler summers (average 14 °C) and warmer winters (average -5 °C), with coastal areas having slightly warmer winters and cooler summers than inland. Geologically, this region is a mix of sedimentary and igneous bedrock (Alarie 2016). Cape Breton land mass slopes upward from south to north, culminating in the massive highlands of its northern cape, the highest elevation in the Atlantic region.

Water beetles make up a large part of aquatic invertebrates (Jäch and Balke 2008) and as such they play a vital role in terms of biodiversity and ecosystem functioning, and consequently in the stability of ecosystems (Wallace and Webster 1996). Investigating water beetle assemblages may be particularly illuminating considering the potential these groups are demonstrating as bioindicators of aquatic ecosystem viability (Foster et al. 1990; Fairchild et al. 2000; Lundkvist et al. 2001; Arnott et al. 2006). They also allow the diagnosis of alterations causes, the establishment of criteria for protection and restoration of interesting ecosystems and finally the integrated management of watersheds (Abellán et al. 2007). Thus, good knowledge of the species presence and distribution is necessary to protect biodiversity (Millán et al. 2014). Moreover, primary biodiversity data represent the fundamental elements of any study in systematics and evolutionary processes (May 1990; Funk and Richardson 2002; Hortal et al. 2015).

Investigations of the Hydradephaga (Dytiscidae, Haliplidae, Gyrinidae) of the Canadian Maritimes have been sporadic and regionally variable. Recent papers (Majka 2008; Majka and Kenner 2009; Alarie 2009, 2016; Majka et al. 2009; Webster et al. 2016) resulted in a better understanding of the Hydradephaga fauna in some areas. Despite this rapid increase in knowledge of faunal composition, there are still many Hydradephaga species waiting for discovery in eastern Canada. This is amply evidenced by the fact that 30 species were recently added to the list of Prince Edward Island (Alarie 2016).

Little is known about the Hydradephaga fauna of Cape Breton Island. Prior to this study, 51 species were reported as valid records in the faunal list for Cape Breton Island (Alarie 2016), a small proportion of the 118 (43.2%) reported in Nova Scotia (Bousquet et al. 2013). This study was conducted as part of a comprehensive baseline field survey of Hydradephaga biodiversity of Canadian Maritimes Islands (Alarie 2009, 2016). Its main objective is to improve knowledge of the Hydradephaga of Cape Breton Island. Of particular interest was the identification of new species additions to the known fauna of Nova Scotia.
Materials and methods

Study areas

All of Nova Scotia mainland and Cape Breton Island sit within the Acadian Forest region as described by Rowe (1972), which has a mixed-forest species composition consisting predominately of conifers, especially on sites where drainage is impeded. The major conifers include red, white, and black spruce; balsam fir; eastern white and red pine; and eastern hemlock. Common hardwoods include red and sugar maple; white and yellow birch; trembling and largetooth aspen; and beech (Neily et al. 2005).

Although physically separated from the Nova Scotia peninsula by the Strait of Canso, Cape Breton is artificially connected to mainland Nova Scotia by the Canso Causeway. The island is located east-northeast of the mainland with its northern and western coasts fronting on the Gulf of Saint Lawrence; its western coast also forming the eastern limits of the Northumberland Strait. The eastern and southern coasts front the Atlantic Ocean; its eastern coast also forming the western limits of the Cabot Strait. Cape Breton Island is composed mainly of rocky shores, rolling farmland, glacial valleys, barren headlands, mountains, woods and plateaus. The boreal highlands of Cape Breton reach elevations of 300–500 m and represent true boreal forest habitat, which is rare in Nova Scotia (Neily et al. 2005). Geological evidence suggests that at least part of Cape Breton was originally joined with present-day Scotland and Norway (www.newworldencyclopedia.org/entry/Cape_Breton_Island).

Cape Breton Island’s hydrological features include the Bras d’Or Lake system, a salt-water fjord at the heart of the island, and freshwater features including Lake Ainslie, the Margaree River system, and the Mira River. Innumerable smaller rivers and streams drain into the Bras d’Or Lake estuary and onto the Gulf of St. Lawrence and Atlantic coasts (www.newworldencyclopedia.org/entry/Cape_Breton_Island).

Geographically, Cape Breton Island is subdivided into four counties: Cape Breton, Inverness, Richmond, and Victoria. More than 70% of the total Cape Breton population live in the industrialized Cape Breton County. The boreal highlands of Cape Breton are located in the northern parts of Victoria and Cape Breton Counties. The climate of this region is influenced by the higher elevations, strong ocean winds and heavy blankets of dense fog that occur during spring and summer. The headwater streams of the highland regions flow over a primarily ancient metamorphic and granitic dominated geologic landscape, originating from cool springs or draining acidic, sphagnum bogs (Ogden et al. 2018). Inverness and Richmond Counties are largely rural and boast Nova Scotia’s most pristine areas. Located within Inverness County, the Margaree River is one of the world’s most famous fishing rivers. There are almost no lakes in this region, but there are many steep-fast flowing rivers and streams. Inverness County includes some of the most interesting old forests and undisturbed areas in Nova Scotia. Richmond County is the least well-known county in all Nova Scotia in terms of its beetle fauna. There are many lakes, marshes, and bogs in this area, which have been very little investigated.
Collecting methods

Collections were conducted over three periods, 05–10 May 2006, 17–22 August 2006, and 14–19 May 2007. Sampling was unstructured and qualitative with the goal of obtaining a strict inventory of Hydradephaga of Cape Breton Island. Beetles were collected using D-net sweeps in a variety of microhabitats including macrophyte beds, rocky shores, organic-rich sediments, and open water. Overall 94 samples were obtained, which are listed in Table 1, along with locality data and habitat information.

Nomenclature

Nomenclature is based on the classification in Oygur and Wolfe (1991) (Gyrinidae: *Gyrinus* Müller), Vondel (2005) (Haliplidae), Nilsson and Hájek (2019) (Dytiscidae) and Gustafson and Miller (2015) (Gyrinidae: *Dineutus* MacLeay).

Depositories

Voucher specimens are deposited in the author’s research collection (Department of Biology, Laurentian University, Sudbury, Ontario).

Results

In total, 2027 specimens representing 85 species of Hydradephaga were collected in this study (Table 2). Among these, eleven species are reported for the first time for Nova Scotia. Details of species added to the Nova Scotia’s fauna follow.

*Heterosternuta allegheniana* (Matta & Wolfe)

Notes. This species is reported from 39 specimens collected in Richmond County and Inverness County (samples R31, R32, R64, I72).

Habitat. All specimens were collected on pebble substrate or in leaf litter along the margin of cold creek and streams in accordance with Matta and Wolfe (1981).

Distribution in the Maritime Ecozone. Prior to this study, *Heterosternuta allegheniana* had only been reported from New Brunswick and southern Québec (Bousquet et al. 2013). Its presence in Nova Scotia therefore represents its easternmost distribution in Canada.
Table 1. Cape Breton Island, Nova Scotia (Canada) sampling localities and habitats (2006–2007): letter in sample code refers to the county. Key: C = Cape Breton; I = Inverness; R = Richmond; V = Victoria.

| Sample | Locality                                                                 | Habitat                                                                 |
|--------|---------------------------------------------------------------------------|-------------------------------------------------------------------------|
| C01    | Cape Breton Co., Leitches creek Road, 1 km off Hwy 223. 14.v.2007          | Bog lake with Carex and Ericaceae along margin                          |
| C02    | Cape Breton Co., Quarry Road, off Leitches creek Road, ca. 6 km off Hwy 223. 14.v.2007 | Shallow creek in spruce forest; bed with big boulders; swift current; littoral zone with alder, beech, yellow birch |
| V03    | Victoria Co., Mackillog Road Off Hwy 105 at exit to Cabot trail. 15.v.2007 | Bog pool on Sphagnum bed in white spruce forest; dark water; Carex along littoral zone |
| V04    | Victoria Co., St. Ann's Provincial Park, Mackillog Road off Hwy 105. 15.v.2007 | Pothole along shore of stream; mats of Gramineae and Scirpus             |
| V05    | Victoria Co., Meadow Road, 4 km off Cabot trail N. 15.v.2007              | Shallow creek with swift current, ca. 3–4 m wide; cold water             |
| V06    | Victoria Co., Meadow Road, 5 km off Cabot trail N. 15.v.2007              | Shallow creek                                                          |
| V07    | Victoria Co., Oregon Road, 2 km off Cabot trail N. 15.v.2007              | Pond covered with dead Scirpus                                          |
| V08    | Victoria Co., Cabot trail N., near junction to Meadow Road. 16.v.2007     | Shallow creek on rocky bed, with Sphagnum and bryophytes; spruce forest with Fagus; cold water (6 C) |
| V09    | Victoria Co., West Tarbot Road ca. 1 km off Cabot trail N. 16.v.2007       | Ephemeral pot holes on clay bed, in Scirpus and Graminea field; shallow with algae; white spruce forest |
| V10    | Victoria Co., West Tarbot Road ca. 1 km off Cabot trail N. 16.v.2007       | Ephemeral roadside ditch; very eutrophic, with heavy accumulation of Sphagnum, black sediments; dark water |
| V11    | Victoria Co., West Tarbot Road ca. 6 km off Cabot trail N. 16.v.2007       | Roadside ditch, slowly moving water; very shallow potholes (ca. 6 cm) with emerging vegetation |
| V12    | Victoria Co., Cabot trail N., near junction Tarbot Vale Road and Rear Barachois Road. 16.v.2007 | Large pools formed by the river; clear water; rocky bed covered with organic matters (dead wood, dead leaves) in white spruce forest |
| V13    | Victoria Co., Cabot trail N., 4 km south of Little River. 16.v.2007       | Man-made pond with mats of Scirpus                                      |
| V14    | Victoria Co., Cabot trail N., 4 km S. Little River. 16.v.2007             | Fen with Gramineae                                                     |
| V15    | Victoria Co., Rear Little River Road, off Cabot trail N. 16.v.2007        | Brook flowing over rocky bed, ca. 2 m wide; moderately moving water      |
| C16    | Cape Breton Co., Morrison Road, ca. 6 km off Hwy 22 S. 18.v.2007           | Sphagnum bog in white spruce forest; with Ericacea, Scirpus and Typha   |
| C17    | Cape Breton Co., Morrison Road, ca. 7 km off Hwy 22 S. 18.v.2007           | Sphagnum pool with Ericacea and Scirpus in white spruce forest          |
| C18    | Cape Breton Co., Morrison Road, ca. 8 km off Hwy 22 S. 18.v.2007           | Shallow roadside ditch with Gramineae and Sphagnum                      |
| C19    | Cape Breton Co., Broughton Road near junction to Morrison Rd. 18.v.2007   | Shallow eutrophic brook flowing over rocky bed                          |
| C20    | Cape Breton Co., Broughton Road, 2 km off junction to Morrison Rd. 18.v.2007 | Eutrophic lake                                                         |
| C21    | Cape Breton Co., Broughton Road, 3 km off junction to Morrison Rd. 18.v.2007 | Sphagnum bog                                                           |
| C22    | Cape Breton Co., Broughton Road, 4 km off junction to Morrison Rd. 18.v.2007 | Road-side ditch                                                       |
| C23    | Cape Breton Co., South Head, Sailor Dans Lane. 18.v.2007                  | Brook with heavy accumulation of bryophytes                            |
| C24    | Cape Breton Co., South Head, Sailor Dans Lane. 18.v.2007                  | Cattail pond with bryophytes and Carex                                 |
| C25    | Victoria Co., West Side Baddek Road, junction Hunter Mtn Rd. 19.v.2007    | Small eutrophic creek; heavy accumulation of organic debris; margin with dense vegetation including dead Gramineae |
| V26    | Victoria Co., West Side Baddek Road, junction Hunter Mtn Rd. 19.v.2007    | Pen with dark brown water; heavy accumulation of Gramineae              |
| V27    | Victoria Co., Baddekr Forks. 19.v.2007                                    | Ephemeral woodland pool with Scirpus; bed with heavy accumulation of dead leaves |
| V28    | Victoria Co., Baddeck Forks. 19.v.2007                                    | Pools beside river; very eutrophic                                      |
| Sample | Locality | Habitat |
|--------|----------|---------|
| R29    | Richmond Co., Road off Hwy 104E at exit 44 to Port Malcom. 05.v.2006 | Roadside bog with *Sphagnum* and *Typha*; in *Picea* and *Larix laricina* forest |
| R30    | Richmond Co., Road off Hwy 104E near Port Hawskberry. 05.v.2006 | Roadside ditch on rocky bed covered with mud; shore with *Typha* and *Alnus* |
| R31    | Richmond Co., Road off Hwy 104E towards Isle Madame. 05.v.2006 | Shallow creek on rocky bed, with mats of algae; shoreline with *Carex* and Gramineae |
| R32    | Richmond Co., Road off Hwy 104E towards Isle Madame. 05.v.2006 | Large creek flowing over rocky bed, presence of algae; in *Picea* and *Betula alleghenensis* forest; shoreline covered with dense bryophytes |
| R33    | Richmond Co., Road off Hwy 104E towards Isle Madame. 05.v.2006 | Pond with heavy accumulation of organic debris |
| R34    | Richmond Co., Isle Madame, Lake road off Hwy 206. 06.v.2006 | Man-made pond; rocky bed |
| R35    | Richmond Co., Isle Madame, Lake road off Hwy 206. 06.v.2006 | Lake on sandy bed |
| R36    | Richmond Co., Isle Madame, Hwy 206 at Anthony road. 06.v.2006 | Shallow puddle on muddy bed, in Gramineae field |
| R37    | Richmond Co., Isle Madame, Hwy 320 West at bridge, ca. 4 km East of D’Escousses. 06.v.2006 | Eutrophic creek |
| R38    | Richmond Co., Isle Madame, Hwy 320 West, ca. 1 km West of D’Escousses. 06.v.2006 | Pool with dark brown water, in a vast field of *Carex*; *Larix laricina* present |
| R39    | Richmond Co., Isle Madame, Hwy 320 West, ca. 2 km West of D’Escousses. 06.v.2006 | Shallow cattail pond in *Picea* forest |
| R40    | Richmond Co., Sporting Mountain Road, ca. 2 km off Hwy 4 at exit 47. 06.v.2006 | *Sphagnum* bog in *Picea* forest. |
| R41    | Richmond Co., Sporting Mountain Road, ca. 3 km off Hwy 4 at exit 47. 06.v.2006 | Small creek flowing on rocky bed with dense mats of *Sphagnum*/bryophytes; in *Abies balsamifera* and *Betula alleghenensis* forest |
| R42    | Richmond Co., Sporting Mountain Road, dead end of Hwy 4 at exit 47. 06.v.2006 | Man-made shallow pond |
| R43    | Richmond Co., Road off Sporting Mountain Road, towards St Peters lake. 06.v.2006 | Lake; shoreline with *Sphagnum* |
| R44    | Richmond Co., Fleur-de-Lis trail, 3 km East of Grand River. 07.v.2006 | Road-side bog ditch with slow-moving dark brown water; heavy accumulation of *Sphagnum* and *Scirpus*. |
| R45    | Richmond Co., Fleur-de-Lis trail at junction Barren Hill Road, ca. 6 km East Grand River. 07.v.2006 | *Carex* pool with *Saricina purpurea* |
| R46    | Richmond Co., Fleur-de-Lis trail, ca. 9 km E. Grand River. 07.v.2006 | Pond in *Picea* forest; littoral margin with abundance of *Scirpus* and *Ericaea* |
| R47    | Richmond Co., Fleur-de-Lis trail, ca. 6 km East of St. Esprit. 07.v.2006 | Inundated *Picea* forest; dark brown slow-moving water |
| R48    | Richmond Co., North Framboise, 5 km W. of Fleur-de-Lis trail. 07.v.2006 | Small roadside ditch with Gramineae |
| C49    | Cape Breton Co., East Bay, Morrison Road, off Hwy 4. 08.v.2006 | Shallow pond fed with flowing water; rocky bed; clear water; dense Gramineae along shoreline |
| C50    | Cape Breton Co., East Bay, Morrison Road, off Hwy 4, past bridge. 08.v.2006 | Ephemeral pond with accumulation of dead leaves, in *Acer*, *Fagus*, and *Abies* forest |
| C51    | Cape Breton Co., East Bay, Morrison Road, off Hwy 4, at bridge. 08.v.2006 | Discharge of lake; pond-like, very eutrophic; dense Gramineae along shoreline |
| C52    | Cape Breton Co., East Bay, Morrison Road, off Hwy 4, at bridge. 08.v.2006 | Shallow creek flowing over rocky bed; about 1 m wide |
| C53    | Cape Breton Co., East Bay, Chapei Road, off Meadows Road, about 7 km S. of Hwy 4. 08.v.2006 | Ephemeral very humic pond with dead leaves; very dark water; shoreline with dense mats of bryophytes |
| C54    | Cape Breton Co., Rear Big Pond Road, 6 km off junction with Chapei Road. 08.v.2006 | Small creek flowing over rocky bed |
| C55    | Cape Breton Co., Rear Big Pond Road, 6 km off junction with Chapei Road at Big Pond. 08.v.2006 | Muddy creek with cold water; shoreline with Gramineae and *Sphagnum*; in *Picea* and *Abies balsamea* forest |
| C56    | Cape Breton Co., Rear Big Pond Road, 1 km off junction with Chapei Road. 08.v.2006 | Man-made pond; full of organic debris |
| C57    | Cape Breton Co., Frank Macdonald Road, 9 km off junction with Soldier Cave Road, off Hwy 4. 09.v.2006 | *Sphagnum* bog |
| Sample | Locality                                                                                     | Habitat                                                                                                                                       |
|--------|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| C58    | Cape Breton Co., Frank Macdonald Road, 9 km off junction with Soldier Cave Road, off Hwy 4. 09.v.2006 | Roadside Typha pond                                                                                                                          |
| C59    | Cape Breton Co., Frank Macdonald Road, 8 km off junction with Soldier Cave Road, off Hwy 4. 09.v.2006 | Typha pond                                                                                                                                   |
| C60    | Cape Breton Co., Frank Macdonald Road, 5 km off junction with Soldier Cave Road, off Hwy 4. 09.v.2006 | Shallow narrow creek with bryophytes.                                                                                                       |
| C61    | Cape Breton Co., Frank Macdonald Road, 4 km off junction with Soldier Cave Road, off Hwy 4. 09.v.2006 | Shallow Carex puddles                                                                                                                       |
| R62    | Richmond Co., Loch Lamond West Road, 11 km of Grand River. 09.v.2006                       | Emissary of Loch Lamond lake; collecting along river arms; shoreline covered with vegetation                                               |
| R63    | Richmond Co., Loch Lamond Road, 14 km of Grand River. 09.v.2006                            | Pools covered with bryophytes; dark brown and cold water                                                                                     |
| R64    | Richmond Co., Loch Lamond Road, 14 km of Grand River. 09.v.2006                            | Small creek flowing over rocky bed                                                                                                          |
| I66    | Inverness Co., Greignish Mtns Road, 1 Km off junction Hwy B. 10.v.2006                     | Fen                                                                                                                                           |
| I67    | Inverness Co., Road 104E, 2 km off junction to Greignish Mtns Road, off Hwy 19 at Greignish. 10.v.2006 | Fen with Scirpus and mats of bryophytes; dark brown water                                                                                   |
| I68    | Inverness Co., Road 104E, 5 km off junction to Greignish Mtns Road, off Hwy 19 at Greignish. 10.v.2006 | Small brook in Sphagnum bog                                                                                                                  |
| I69    | Inverness Co., Road 104E, 12 km off junction to Greignish Mtns Road, off Hwy 19 at Greignish. 10.v.2006 | Shallow pools with mats of Gramineae and heavy accumulation of dead maple leaves; higher elevation                                            |
| I70    | Inverness Co., Road 104E, 4 km off junction to Greignish Mtns Road, off Hwy 19 at Greignish. 10.v.2006 | Bog with Carex and Sarracenia purpurea                                                                                                       |
| I71    | Inverness Co., Road 104E, off junction to Greignish Mtns Road, off Hwy 19 at Greignish. 10.v.2006 | Bog with Carex                                                                                                                               |
| I72    | Inverness Co., Graham River, at J. D. MacDonald Road near Judique South Hwy 19. 10.v.2006   | Stream flowing over rocky bed                                                                                                                 |
| I73    | Inverness Co., Margaree River North East, off Cabot Trail. 17.viii.2006                     | Larger river flowing over rocky bed                                                                                                          |
| I74    | Inverness Co., Ingram Charlie Brook, East Big Interval Road at bridge, 7 km of East Margaree Valley. 17.viii.2006 | Brook flowing over big boulders covered with bryophytes                                                                                      |
| I75    | Inverness Co., East Big Interval Road, 12 km of East Margaree Valley. 17.viii.2006         | Small brook; beetles collected underneath the banks                                                                                           |
| I76    | Inverness Co., East Big Interval Road, ca. 12 km of East Margaree Valley. 18.viii.2006     | Beaver dam ditch; dense mats of Carex along shoreline                                                                                         |
| I77    | Inverness Co., East Big Interval Road, ca. 21 km of East Margaree Valley. 18.viii.2006     | Small creek with very slow-moving water (almost still); muddy bed, dark brown to black sediment                                                |
| I78    | Inverness Co., Kingross Crossing Road, ca. 1 km off East Big Interval Road, ca. 20 km of East Margaree Valley. 18.viii.2006 | Small pool with crystal clear water; pool likely formed from a brook                                                                         |
| I79    | Inverness Co., East Big Interval Road, ca. 2 km off Kingross Crossing Road. 18.viii.2006  | Small beaver dam pool, almost still water, fed from a small creek; muddy bottom, dark brown to black sediment                                 |
| I80    | Inverness Co., North of St. Joseph du Moine, Bazile Road, off Cabot trail at bridge. 21.viii.2006 | Small eutrophic creek; flowing water at the middle over rocky bed; shoreline with dense vegetation (Eupatorium maculatum; Equisetum sp.; muddy shoreline; beetles collected along shoreline in shallow water |
| I81    | Inverness Co., North of Saint Joseph du Moine, Bazile Road, ca. 8 km off Cabot trail. 21.viii.2006 | Small creek with big boulders; swift currents                                                                                                 |
| I82    | Inverness Co., North of Saint Joseph du Moine, Bazile Road, off Cabot trail. 21.viii.2006 | Lake; littoral zone with Typha; muddy                                                                                                         |
| I83    | Inverness Co., North of Gold Brook, Cabot trail. 21.viii.2006                              | Roadside ditch; shoreline with Spirea, Alnus, and Carex; heavy accumulation of dead leaves                                                    |
| V84    | Victoria Co., Middle River, at Cabot trail. 21.viii.2006                                   | Roadside ditch with slow moving water; shoreline with Alnus and Carex                                                                      |
| V85    | Victoria Co., Egypt Road, at Cabot trail. 21.viii.2006                                    | Eutrophic brook with swift current; rocky bed; presence of algae                                                                          |
| Sample | Locality | Habitat |
|--------|----------|---------|
| 186    | Inverness Co., Cranton Cross Road, off Margaree Centre. 21.viii.2006 | Brook with crystal clear water; almost still water |
| 187    | Inverness Co., Southwest Margaree Road, ca. 4 km south of Cabot trail. 22.viii.2006 | Roadside ditch in spruce forest |
| 188    | Inverness Co., Southwest Margaree Road, ca. 8 km south of Cabot trail. 22.viii.2006 | Small eutrophic creek with dense vegetation along shoreline; deep, with slow moving water; rocky bed covered with sediments |
| 189    | Inverness Co., Hwy 395 off Hwy 19. 22.viii.2006 | Small creek with swift current; cold water, large boulders; abundance of Mentha along shoreline |
| 190    | Inverness Co., south west Margaree River at Bridge, Hwy 395 at junction to Kiltarlity Road. 22.viii.2006 | Arm of the river looking like a large ditch; shallow with clear water; dense vegetation (Carex, Scirpus, Myositis) along shoreline; accumulation of algae in the middle; extremely beetle rich |
| 191    | Inverness Co., south west Margaree River at Bridge, Hwy 395 at junction to Kiltarlity Road. 22.viii.2006 | I have sampled into algae along shoreline of the river |
| 192    | Inverness Co., Kiltarlity Road. 22.viii.2006 | Lake with clear water; Typha and nenuphar along shoreline |
| 193    | Inverness Co., Scotsville, junction Hwy 395 and Scotsville Road at bridge. 22.viii.2006 | Emissary of lake Ainslie |
| 194    | Inverness Co., near junction to Mountain Road and Scotsville Road. 22.viii.2006 | Shallow pond in open prairie overlooking lake Ainslie; main vegetation: Equisetum, Typha and Carex |

**Heterosternuta wickhami** (Zaitzev)

**Notes.** This species is reported from nine specimens collected in Victoria County and Inverness County (samples I78, I79, V85).

**Habitat.** Like the previous species all specimens were collected in gravel along the margins of streams. Matta and Wolfe (1981) state this species is most common at the margin of medium to small streams.

**Distribution in the Maritime Ecozone.** This is the first record of *H. wickhami* in the Maritimes. Prior to this study it had only been reported from Ontario and Québec. Its presence on Cape Breton Island represents a significant extension of this species to eastern Canada (Bousquet et al. 2013).

**Hydroporus appalachius** Sherman

**Notes.** Several specimens of this distinctive species were collected at two different sites in Inverness County (samples I79, I86).

**Habitat.** *Hydroporus appalachius* is usually found in habitats where there are some water movements either along the margins of small lakes or in small streams and springs (Larson et al. 2000), which describe exactly the habitats where these beetles were found in Cape Breton Island.

**Distribution in the Maritime Ecozone.** This species has a wide range in North America east of the Rocky Mountains. It occurs from Labrador and New Hampshire west to the northern Great Plains and north into the boreal zone and southern limits of the low artic (Larson et al. 2000). Its presence in Cape Breton Island represents the first mention of the species in the Canadian Maritimes (Bousquet et al. 2013).
Table 2. Species of Hydradephaga (Dytiscidae, Gyrinidae, Haliplidae) collected in Cape Breton Island, Nova Scotia, Canada in 2006 and 2007 with sample numbers (as in Table 1), absolute (AF) and relative frequencies (%), and relative frequency of occurrence (RFO). Species in **bold** denote new records from Nova Scotia given in the present account.

| Taxon | Sample numbers | AF (%) | RFO |
|-------|----------------|--------|-----|
| **Haliplidae** | | | |
| *Haliplus canadensis* Wallis | C25, I78, I88 | 5 (0.25) | 3.19 |
| *Haliplus connexus* Matheson | I79, I80, I93 | 4 (0.20) | 3.19 |
| *Haliplus cribarius* LeConte | R62, I79 | 3 (0.15) | 2.13 |
| *Haliplus fulvus* (Fabricius) | R45, C42, I78, I79, I90 | 11 (0.54) | 5.32 |
| *Haliplus immaculicollis* Harris | V05, V11, V13, C25, V28, R37, R42, R44, C49, C58, R62, I76, I77, I78, I79, I80, V84, I86, I87, I88, I90, I91, I92, I93 | 112 (5.53) | 26.60 |
| *Haliplus longulus* LeConte | R45, I71 | 2 (0.10) | 2.13 |
| **Peltodytes elenetus** (LeConte) | | | |
| **Dytiscidae** | | | |
| *Acilius mediatus* (Say) | V09, I83, I87 | 5 (0.25) | 3.19 |
| *Acilius semisulcatus* Aubé | V04, R34, R39, I67, I92 | 7 (0.35) | 5.32 |
| *Agabus ambiguus* (Say) | V04, V09, V10, C25, V26, V28, C20, C49, I67, I76, I79, I80, I82, I83, V84, I90 | 76 (3.75) | 17.02 |
| *Agabus anthracinus* Mannerheim | V03, C21, C22, C24, V26, V28, R29, R40, R46, R47, C49, C57, C59, C61, R63, R65, I67, I69, I76, I80 | 95 (4.69) | 21.28 |
| *Agabus erythropterus* (Say) | V09, C25, R46, R48, I76, I77, I78, I79, I86, I90 | 76 (3.75) | 10.64 |
| *Agabus leptapsis* (LeConte) | V12, I75, I76, I79, I80 | 5 (0.25) | 5.32 |
| *Agabus phaeopterus* (Kirby) | V27 | 1 (0.05) | 1.06 |
| *Agabus semipunctatus* (Kirby) | V03, C16, C24, V27, R46, C59 | 6 (0.30) | 6.38 |
| *Agabus subfuscatus* Sharp | R29, R44, C61, R65, I83, V84, I90 | 13 (0.64) | 5.32 |
| *Clemnius lacophilinus* (LeConte) | I92 | 1 (0.05) | 1.06 |
| *Colymbetes paykulli* Erichson | V03, C61 | 2 (0.10) | 2.13 |
| *Colymbetes sculptilis* Harris | I76, I80 | 2 (0.10) | 2.13 |
| *Copelatus glyphicus* (Say) | V03, V04, V07, V27, C17, C18, C19, C24, R31, R44 | 64 (3.16) | 10.64 |
| *Coptotomus longulus* LeConte | C21, R33 | 2 (0.10) | 2.13 |
| *Demosphaeria convexa* (Aubé) | | | |
| *Dytiscus fasciventris* Say | V84, I88, I92 | 4 (0.20) | 3.19 |
| *Dytiscus verticalis* Say | R46, I69 | 2 (0.10) | 2.13 |
| *Heterosternuta allegheniana* (Matta & Wolfe) | R31, R32, R64, I72 | 39 (1.92) | 4.26 |
| *Heterosternuta pulchra* (LeConte) | R32, I73, V85, I88, I93 | 28 (1.38) | 5.32 |
| *Heterosternuta wickhami* (Zaitzev) | I78, I79, V85 | 9 (0.44) | 3.19 |
| *Hydaticus aruspex* Clark | C24, V26, C51, R65, I67, I70, I71, I94 | 9 (0.44) | 8.51 |
| *Hydrocorus pangus* (Fall) | V03, C17, V27, R40, I67, I75, I80, V84 | 12 (0.59) | 8.51 |
| *Hydrocolus stagnalis* (G. & H.) | V08, C18, C19, R46, C50, I90 | 7 (0.35) | 6.38 |
| *Hydroporus appalachius* Sherman | I79, I86 | 33 (1.63) | 2.13 |
| *Hydroporus badiellus* Fall | R40, C57, I70 | 13 (0.64) | 3.19 |
| *Hydroporus dentellus* Fall | V09, V28, R40, R45, R46, R47, R65, I92, I93 | 24 (1.18) | 9.58 |
| *Hydroporus gossei* Larson & Roughley | V12, V26, V27, C53, C59, I88, I90 | 11 (0.54) | 7.45 |
| *Hydroporus nigellus* Mannerheim | C21, V28 | 2 (0.10) | 2.13 |
| *Hydroporus niger* Say | C49, C59, I67, I88 | 7 (0.35) | 4.26 |
| *Hydroporus notabilis* LeConte | V04, C18, C21, C24, V26, V27, V28, R42, C49, C61, I69, I76, I78, I80, I81, I83, V84, I87, I88, I90, I93, I94 | 52 (2.57) | 23.40 |
| *Hydroporus obscurus* Sturm | I70 | 1 (0.05) | 1.06 |
| *Hydroporus puberulus* LeConte | C53, I71 | 9 (0.44) | 2.13 |
| *Hydroporus rufinasus* Mannerheim | R29, R45, R65 | 4 (0.20) | 3.19 |
| *Hydroporus signatus* Mannerheim | V07, V10, C18, C17, C21, C24, V28, R29, R42, R46, C49, C59, C61 | 34 (1.68) | 14.89 |
| *Hydroporus striola* (Gyllenhal) | V03, V07, V26, V28, C20, R30, R32, R36, R38, R45, R46, C49, C53, C59, C61, I80, I83, V84, I88, I90 | 56 (2.76) | 21.28 |
| Taxon | Sample numbers | AF (%) | RFO |
|-------|----------------|--------|-----|
| *Hydroporus tenebrosus* LeConte | C18, C53, I93 | 4 (0.20) | 3.19 |
| *Hydroporus tristis* (Paykull) | V07, V09, V14, C17, C18, C21, C24, V27, C50, C53, C59, C61, I77, I80, I83 | 44 (2.17) | 15.96 |
| *Hygrotopus impressopunctatus* (Schaller) | R35 | 1 (0.05) | 1.06 |
| *Hygrotopus piciatus* (Kirby) | V04, C20, R46, R47, I76, I94 | 8 (0.40) | 6.38 |
| *Hygrotopus sayi* Balfour-Browne | V14, C25, V26, V28, R45, C58, I80, I87, I88, I94 | 25 (1.23) | 11.70 |
| *Hygrotopus turbidus* (LeConte) | R39, I66 | 11 (0.54) | 2.13 |
| *Ilybius angustior* (Gyllenhal) | R39, R46, I83 | 6 (0.30) | 3.19 |
| *Ilybius biguttulus* (Germar) | V03, V04, C21, C24, V28, R34, R47, C49, C59, R64, I75, I76, I80, I87, I88, I90, I92, I93, I94 | 106 | 5.23 |
| *Ilybius confusus* Aubé | I80 | 1 (0.05) | 1.06 |
| *Ilybius discedens* Sharp | V27, R29, R46, C49, C57, I71, I92 | 11 (0.54) | 7.45 |
| *Ilybius erichsoni* G. & H. | V07, C53 | 7 (0.35) | 2.13 |
| *Ilybius ignarus* (LeConte) | I66 | 6 (0.30) | 4.26 |
| *Ilybius larsoni* (Fery & Nilsson) | V04, V06, V09, C18, C21, V27, V40, R48, C50, C61, I74 | 22 | 11.70 |
| *Ilybius picipes* Kirby | V26, I76 | 6 (0.30) | 2.13 |
| *Ilybius wasastjernae* (C.R. Sahlberg) | C02, V05, V08, C19, C23, C25, R31, C50, C52, C54, C60, R64, I67, I68, I74, V85 | 76 | 3.75 |
| *Ilybius angustior* (Gyllenhal) | R39, R46, I83 | 6 (0.30) | 3.19 |
| *Ilybius biguttulus* (Germar) | V03, V04, C21, C24, V28, R34, C49, C59, R64, I75, I76, I77, I80, I87, I88, I90, I92, I93, I94 | 106 | 5.23 |
| *Ilybius confusus* Aubé | I80 | 1 (0.05) | 1.06 |
| *Ilybius discedens* Sharp | V27, R29, R46, C49, C57, I71, I92 | 11 (0.54) | 7.45 |
| *Ilybius erichsoni* G. & H. | V07, C53 | 7 (0.35) | 2.13 |
| *Ilybius ignarus* (LeConte) | I66 | 6 (0.30) | 4.26 |
| *Ilybius larsoni* (Fery & Nilsson) | V04, V06, V09, C18, C21, V27, V40, R48, C50, C61, I74 | 22 | 11.70 |
| *Ilybius picipes* Kirby | V26, I76 | 6 (0.30) | 2.13 |
| *Ilybius wasastjernae* (C.R. Sahlberg) | V27 | 1 (0.05) | 1.06 |
| *Laccophilus m. maculosus* Say | V13, C20, C22, C24, V28, R33, R34, R35, R42, C49, I66, I69, I80, I87 | 32 | 1.58 |
| *Laccornis latens* (Fall) | R29 | 6 (0.29) | 1.06 |
| *Liodessus affinis* (Say) | V04, V26, V28, R34, R35, R42, C49, C59, R62, I90, I93 | 55 (2.71) | 11.70 |
| *Meridiorhantus sinuatus* (LeConte) | R38, C52 | 3 (0.15) | 2.13 |
| *Neoborus spurius* (LeConte) | I80, I88, I90, I92, I93, I94 | 15 (0.74) | 5.32 |
| *Neoborus sulcipennis* (Fall) | R32, R62, I90, I93 | 14 (0.69) | 5.32 |
| *Neophorus undulatus* (Fall) | V09, V12, V13, V15, V28, R40, R41, C49, I76, I78, I79, I80, I86, I88 | 97 | 4.79 |
| *Neoborus sayi* (Aubé) | I66 | 6 (0.30) | 4.26 |
| *Oreodytes s. scitulus* (LeConte) | C25, R32, I73, I88 | 35 (1.73) | 4.26 |
| *Platambus obtusatus* (Say) | R32, R62, I90, I93 | 14 (0.69) | 5.32 |
| *Rhantus binotatus* (Harris) | V04, V07, V26, R40, C49, I92, I93 | 69 (3.40) | 5.32 |
| *Rhantus suturellus* (Harris) | V28, R46, R65 | 4 (0.20) | 3.19 |
| *Rhantus wallisi* (Harris) | V24, R45, C59, C56, I66 | 11 (0.54) | 5.32 |

**Hydrusporus tenebrosus** LeConte & Roughley

**Notes.** This species is reported for the first time in Nova Scotia from eleven specimens collected in Cape Breton County, Inverness County and Victoria County (samples V12, V26, V27, C53, C59, I88, I90).
**Habitat.** In Newfoundland and Prince Edward Island, this species has been collected from among flooded grasses and emergent *Carex* along the margins of beaver ponds and roadside ponds, which is similar to the habitats where these beetles were collected in Cape Breton Island which include also eutrophic creeks.

**Distribution in the Maritime Ecozone.** This large, distinctive *Hydroporus* species has generally been confused with *Hydroporus rectus* Fall. In the Maritime ecozone, *H. gossei* is also reported from the neighboring province New Brunswick and Prince Edward Island (Larson et al. 2000; Bousquet et al. 2013; Alarie 2016).

**Hydroporus nigellus** Mannerheim

**Notes.** This species is reported from only two specimens collected in Cape Breton County and Victoria County (samples C21, V28).

**Habitat.** These beetles are common in small pools with dense emergent vegetation. The two specimens collected in Cape Breton Island were from a sphagnum bog and a eutrophic pool besides a river.

**Distribution in the Maritime Ecozone.** Prior to this study, this species had only been reported from the neighboring province New Brunswick (Larson et al. 2000; Bousquet et al. 2013). The North American range of this Holarctic species includes most of the boreal zone and extends north to the southern arctic (Larson et al. 2000).

**Hydroporus puberulus** LeConte

**Notes.** *Hydroporus puberulus* is reported from nine specimens form two localities in Cape Breton County and Inverness County (samples C53, I71).

**Habitat.** These beetles were generally collected from small pools where the water is cool, such as small pools in bogs or habitats where the water is densely shaded by *Carex* (Larson et al. 2000), which is similar to the habitats where these beetles were collected in Cape Breton Island.

**Distribution in the Maritime Ecozone.** In North America this Holarctic species occurs in the boreal zone from western Newfoundland to Alaska (Larson et al. 2000). Prior to this study, this species had only been reported from the neighboring province New Brunswick in the Maritime Ecozone (Larson et al. 2000; Bousquet et al. 2013).

**Ilybius picipes** (Kirby)

**Notes.** *Ilybius picipes* is closely similar to *I. angustior* (Gyllenhal) from which it can be differentiated by the relative expansion of the protarsal claw (Larson et al. 2000). In Cape Breton Island this species is reported from six specimens from two localities in Victoria County and Inverness County (samples V26, I76).
Habitat. These beetles are generally collected from peatland pools (Larson et al. 2000), which is similar to the habitats where these beetles were collected in Cape Breton Island.

Distribution in the Maritime Ecozone. This species has a Holarctic distribution. In North America it is transcontinental in the boreal region (Larson et al. 2000). Its presence in Cape Breton Island represents the first mention in the Canadian Maritimes (Bousquet et al. 2013).

*Ilybius wasastjernae* (C.R. Sahlberg)

Notes. *Ilybius wasastjernae* is reported in Cape Breton Island from only one specimen collected in Victoria County (sample V27).

Habitat. These beetles are generally collected from sphagnum pools, usually in, or adjacent to forest (Larson et al. 2000). In Cape Breton Island it was collected in an ephemeral woodland pool covered with *Scirpus*.

Distribution in the Maritime Ecozone. This species has a Holarctic distribution more or less throughout the boreal zone. In North America it is transcontinental in the boreal region (Larson et al. 2000). Prior to this study, this species had only been reported from the neighboring province New Brunswick in the Maritime Ecozone (Larson et al. 2000; Bousquet et al. 2013).

Discussion

A total of 85 Hydradephaga species was recovered from 94 samples during a survey conducted on Cape Breton Island, Canada, between 2006–2007. According to this study and literature (Majka and Kenner 2009) 87 species of Hydradephaga are currently known from Cape Breton Island (Table 3). There are records of 48 species from Cape Breton County, 68 from Inverness County, 56 from Richmond County and 50 from Victoria County. The significantly larger number of species from both Inverness and Richmond Counties is noteworthy knowing that this region includes some of the most undisturbed areas in Nova Scotia.

Included among the species surveyed were eight new Nova Scotia records consisting of the dytiscid species *Heterosternuta allegheniana* (Matta & Wolfe), *H. wickhami* (Zaitzev), *Hydroporus appalachius* Sherman, *H. gossei* Larson & Roughley, *H. nigellus* Mannerheim, *H. puberulus* LeConte, *Ilybius picipes* (Kirby), and *I. wasastjernae* (C.R. Sahlberg) (Table 2). Among these, *Heterosternuta allegheniana* and *H. wickhami* stand out as representing the easternmost reports of these species in Canada.

The Nearctic component of the fauna is made up of 71 species (81.6%), the Holarctic component of 16 species (17.4%). Most species are characteristic of both the Boreal and Atlantic Maritime Ecozones and have a transcontinental distribution except for *Agabus erythropterus* (Say), *Copelatus glyphicus* (Say), *Coptotomus longulus* LeConte,
| Taxon                        | Counties | Distribution in northeastern North America |
|-----------------------------|----------|-------------------------------------------|
| **GYRINIDAE**               |          |                                           |
| Gyrininae                   |          |                                           |
| Enhydrini                   |          |                                           |
| *Dineutus hornii* Roberts   | 1 1 1 1 1| CT, MA, ME, MI, NB, NH, NS, NY, ON, PE, QC, RI |
| *Dineutus nigrior* Roberts  | 1 1 1    | CT, MA, ME, MI, NB, NH, NS, ON, PE, QC, RI |
| Gyrinini                    |          |                                           |
| *Gyrinus affinis* Aubé      | 1 1 1 1 1| LB, MA, ME, MI, NB, NF, NH, NS, NY, ON, PE, QC, RI, VT |
| *Gyrinus aquilus* LeConte    | 1 1 1    | LB, MA, ME, MI, NB, NF, NS, NY, ON, PE, QC, RI |
| *Gyrinus castatus* Atton†    | 1        | LB, MA, ME, NF, NH, NS, NY, ON, QC, RI |
| *Gyrinus confinis* Fall     | 1        | CT, LB, MA, ME, NB, NF, NH, NS, NY, ON, PE, QC, SM, VT |
| *Gyrinus fraternus* Couper  |          | MA, ME, NB, NH, NS, NY, ON, PE, QC, VT |
| *Gyrinus gebrungi* Chamberlain | 1 1 1 1 1| NB, NS, NF, NH, ON, PE, QC |
| *Gyrinus impressicollis* Kirby† | 1        | NS, ON, QC |
| *Gyrinus latilimbus* Fall   | 1 1 1 1 1| CT, LB, MA, ME, NB, NF, NH, NS, NY, ON, PE, QC, SE |
| *Gyrinus pagoniensis* Fall  | 1 1 1    | MA, ME, MI, NB, NH, NS, NY, ON, PE, QC, VT |
| *Gyrinus sayi* Aubé         | 1 1 1 1 1| CT, MI, LB, MA, ME, MI, NB, NF, NH, NS, NY, ON, PE, QC, RI, SM |
| **HALIPLIDAE**              |          |                                           |
| Haliplus canadensis* Wallis | 1 1      | MA, NB, NS, ON, PE, QC |
| Haliplus connexus* Matheson | 1        | CT, MA, ME, NB, NH, NS, NY, ON, PE, QC, VT |
| Haliplus cribarius* LeConte  | 1 1      | CT, LB, MA, ME, MI, NB, NF, NH, NS, NY, ON, PE, QC, SM |
| Haliplus fulves* (Fabricius)* | 1 1 1     | ON, MA, ME, NB, NF, NH, NS, NY, ON, QC |
| Haliplus immaculicollis* Harris | 1 1 1 1 1| CT, LB, MA, ME, MI, NB, NF, NH, NS, NY, ON, PE, QC, RI, SM, VT |
| Haliplus longulus* LeConte   | 1 1      | MA, ME, NB, NH, NS, NY, ON, PE, QC, RI |
| Peltodytes dentatus* (LeConte) | 1        | MA, NB, NH, NS, ON, QC, PE, RI |
| **DYTISCIDAE**              |          |                                           |
| Agabinae                    |          |                                           |
| Agabini                     |          |                                           |
| *Agabus ambiguus* (Say)     | 1 1 1 1 1| LB, MA, ME, MI, NB, NF, NH, NS, ON, PE, QC, RI, SM |
| *Agabus anthracinus* Mannheimer | 1 1 1 1 1| LB, MA, ME, MI, NB, NF, NH, NS, ON, PE, QC, SM, VT |
| *Agabus erythropterus* (Say) | 1 1 1 1 1| CT, LB, MA, ME, NB, NE, NS, NY, ON, PE, QC, RI |
| *Agabus leptisatus* (LeConte) | 1 1      | LB, ME, NB, NF, NS, NY, ON, QC, VT |
| *Agabus phaopterus* (Kirby)  | 1 1 1 1 1| CT, LB, MA, ME, MI, NB, NF, NH, NS, NY, ON, QC, RI |
| *Agabus subfuscatus* Sharp   | 1 1 1 1 1| CT, LB, MA, ME, NB, NF, NH, NS, ON, PE, QC, VT |
| *Ilybiosoma seriatum* (Say) | 1 1 1 1 1| CT, LB, MA, ME, MI, NB, NF, NH, NS, ON, PE, QC, SM |
| *Ilybius angustior* (Gyllenhal)* | 1 1 1 1 1| LB, MI, ME, NB, NF, NH, NS, ON, PE, QC, SM, VT |
| *Ilybius biguttatus* (Germar) | 1 1 1 1 1| MA, ME, MI, NB, NF, NH, NS, ON, PE, QC, RI, SM, VT |
| *Ilybius confusus* Aubé     | 1        | CT, MA, ME, NB, NH, NS, NY, ON, RI, VT |
| *Ilybius disciden* Sharp*    | 1 1 1 1 1| LB, ME, MI, NB, NF, NH, NS, ON, PE, QC, SM |
| *Ilybius eichhorni* G. & H.* | 1 1      | LB, MA, ME, MI, NB, NF, NH, NS, NY, ON, PE, QC |
| *Ilybius ignarius* (LeConte) | 1 1 1    | CT, MA, ME, NH, NS, ON, QC, RI |
| *Ilybius larsoni* (Ferry & Nilsson) | 1 1 1 1 1| NB, NS, ON, PE, QC |
| *Ilybius picipes* (Kirby)*   | 1 1      | LB, NF, NS, ON, QC |
| *Ilybius pleuriticus* (Leconte) | 1 1 1    | CT, LB, MA, ME, MI, NB, NF, NS, ON, PE, QC, RI, SM, VT |
| *Ilybius wasatjernae* (C. R. Sahlberg)* | 1 1 1 1 1| ME, LB, NB, NF, NS, ON, QC |
| *Platambus obtusatus* (Say)  | 1 1 1 1 1| CT, MA, ME, NB, NH, NS, NY, ON, QC, VT |
| Colymbetinae                |          |                                           |
| Colymbetini                 |          |                                           |
| *Colymbetes paykulli* Erickson* | 1 1 1 1 1| LB, ME, NB, NF, NS, ON, PE, QC |
| Taxon                                      | Counties | Distribution in northeastern North America |
|-------------------------------------------|----------|-------------------------------------------|
| Colymbetes sculptilis Harris              | 1        | CT, LB, MI, NB, NF, NH, NS, NY, ON, PE, QC, RI |
| Meridiorhantus sinuatus (LeConte)         | 1 1      | LB, MA, ME, NB, NF, NH, NS, NY, ON, PE, QC |
| Rhantus binotatus (Harris)                | 1 1 1    | CT, LB, ME, MI, NB, NF, NH, NS, ON, PE, QC, RI, SM |
| Rhantus naturelulus (Harris)*             | 1 1      | CT, LB, MA, ME, MI, NB, NF, NH, NS, NY, ON, PE, QC, SM |
| Rhantus wallisi Hatch                     | 1 1 1    | LB, MA, MI, NB, NF, NH, NS, ON, PE, QC, SM |
| Copelatini                                 |          |                                           |
| Copelatus glyphicus (Say)                 | 1 1 1    | CT, ME, NF, NH, NB, NS, ON, PE, QC, RI |
| Copelatini                                 |          |                                           |
| Coptotomus longulus LeConte               | 1 1      | MA, ME, MI, NB, NH, NS, NY, ON, QC, NB, PE, RI |
| Copelatini                                 |          |                                           |
| Acilius mediatus (Say)                    | 1        | CT, MA, NB, NH, NS, ON, PE, QC, RI |
| Acilius seminulatus Aubé                  | 1 1 1    | CT, LB, MA, ME, MI, NB, NF, NH, NS, ON, PE, QC, RI, SM |
| Dytiscini                                  |          |                                           |
| Dytiscus fasciventris Say                 | 1        | CT, LB, ME, NB, NH, NS, ON, PE, QC, RI |
| Dytiscus verticalis Say                   | 1        | CT, MA, ME, NB, NH, NS, NY, ON, PE, QC, RI |
| Hydraticini                                |          |                                           |
| Hydaticus arupex Clark*                   | 1 1 1    | CT, LB, MA, ME, NB, NF, NH, NS, ON, PE, QC |
| Hydroporinae                               |          |                                           |
| Liodessus affinis (Say)                   | 1 1 1    | CT, ME, NF, NH, NS, ON, PE, QC, RI |
| Hydroporinae                               |          |                                           |
| Heterosternuta allegheniana (Matta & Wolfe) | 1 1      | NB, NS, QC |
| Heterosternuta pulchra (LeConte)          | 1 1 1    | CT, ME, LB, NB, NF, NS, ON, QC, SM |
| Heterosternuta wickhami (Zaitzev)         | 1 1      | NS, ON, QC |
| Hydrocorys patuxus (Fall)                 | 1 1 1    | LB, MA, ME, MI, NB, NF, NH, NS, NY, ON, PE, QC, SM |
| Hydrocorys stagnalis (G. & H.)            | 1 1 1    | CT, MA, ME, NB, NH, NS, NY, ON, PE, QC |
| Hydroporus appendicularis Sherman          | 1        | LB, MA, ME, NH, NS, ON, QC |
| Hydroporus badiellus Fall                 | 1 1 1    | LB, ME, MI, NB, NF, NH, NS, ON, QC |
| Hydroporus dentellus Fall                 | 1 1 1    | LB, MA, ME, MI, NB, NH, NS, NY, ON, PE, QC |
| Hydroporus gossei Larson & Roughley       | 1 1 1    | ME, NB, NF, NS, NY, ON, PE, QC |
| Hydroporus nigellus Mannheim*             | 1 1      | LB, NB, NS, ON, QC |
| Hydroporus niger Say                      | 1 1      | CT, MA, MI, NB, NF, NH, NS, NY, ON, PE, QC, RI |
| Hydroporus notabilis LeConte*             | 1 1 1    | LB, MA, ME, MI, NB, NF, NH, NS, ON, PE, QC, SM |
| Hydroporus obscurus Sturm*                | 1        | LB, NB, NF, NS, ON, PE, QC, SM |
| Hydroporus paleatus LeConte*              | 1 1      | LB, ME, NB, NF, NS, ON, QC |
| Hydroporus rufinaus Mannheim*             | 1        | ME, NB, NS, ON, QC |
| Hydroporus signatus Mannheim*             | 1 1 1    | CT, LB, MA, ME, MI, NB, NF, NH, NS, NY, ON, PE, QC, RI, SM |
| Hydroporus striola (Gyllenhal)*           | 1 1 1    | LB, ME, MI, NB, NF, NH, NS, ON, PE, QC, RI |
| Hydroporus tenebrinus LeConte              | 1 1 1    | MA, ME, MI, NB, NH, NS, NF, ON, PE, QC |
| Hydroporus tristis (Paykull)*             | 1 1 1    | LB, ME, MI, NB, NF, NH, NS, NY, ON, PE, QC, RI, SM |
| Nebrioporus rotundatus (LeConte)           | 1 1 1    | LB, MA, ME, NB, NF, NH, NS, NY, ON, PE, QC, RI |
| Neoporus carolinus (Fall)                 | 1 1 1    | LB, MA, ME, NB, NF, NH, NS, NY, ON, PE, QC, SM |
| Neoporus elypleas (Sharp)                 | 1 1      | ME, NB, NH, NS, ON, PE, QC |
| Neoporus dimidiatus (G. & H.)             | 1 1      | CT, LB, MA, ME, MI, NB, NF, NH, NS, ON, PE, QC, RI |
| Neoporus spurinus (LeConte)               | 1 1      | NB, NS, ON, QC |
| Neoporus sulcipennis (Fall)               | 1 1      | NB, NS, ON, PE, QC |
| Neoporus undulatus (Say)                  | 1 1 1    | CT, LB, MA, ME, MI, NB, NF, NH, NS, NY, ON, PE, QC, RI, SM |
| Oreozytes s. scitulus (LeConte)            | 1        | ME, LB, NB, NF, NH, NS, NY, ON, QC, SM |
| Hygrotris balfour-browne                  | 1 1 1    | LB, MA, ME, MI, NB, NF, NH, NS, NY, ON, PE, QC, RI, SM, VT |
The Hydradephaga of Cape Breton Island

Heterosternuta allegheniana, H. pulchra (LeConte), H. wickhami, Hydroporus gossei, H. niger Say, Ilybius confusus Aubé, Ilybius ignarus (LeConte), I. larsoni (Ferry & Nilsson), Laccornis latens (Fall), Liodessus affinis (Say), Nebrioporus rotundatus (LeConte), Neoporus carolinus (Fall), Neoporus clypealis (Sharp), N. spurius (LeConte), N. sulcipennis (Fall), and Platambus obtusatus (Say), which are generally recognized as species with eastern affinities (Larson et al. 2000; Bousquet et al. 2013) (Table 3).

The 87 Hydradephaga species known from Cape Breton Island represent approximately 74% of the fauna known for all Nova Scotia (Bousquet et al. 2013). As is typical of Hydradephaga, the Dytiscidae accounts for the largest share (78.2%) of the fauna, while Gyrinidae (13.8%) and Haliplidae (8.1%) are represented in lesser proportions. Forty-five species were observed at more than 5% of the sites (Table 2). The most common ones (RFO > 15 %) included the haliplid species Haliplus immaculicollis Harris and the dytiscid species Agabus ambiguus (Say), A. anthracinus Mannerheim, Hydroporus notabilis (LeConte), H. signatus Mannerheim, H. striola (Gyllenhal), H. tristis (Paykull), Ilybiosoma seriatum (Say), Ilybius biguttulus (Germar), Laccophilus m. maculosus Say, and Neoporus carolinus (Fall) (Table 2). Considering the relatively large number of species recorded in such a short time, confirm that this region is very important for wetland beetle biodiversity, and its continued conservation.

This research considerably extends the list of reported species in Richmond and Inverness counties both of which were considered the least well-known counties in all Nova Scotia in terms of its beetle fauna prior to this study. Many species recorded in this region are interesting in zoogeographic terms as representing new records for Nova Scotia (see above). The extraordinary species richness of rheophilic species (e.g., Agabus leptapsis (LeConte), A. erythropterus (Say), Heterosternuta allegheniana, H. pulchra, H. wickhami, Hydroporus appalachius, Neoporus clypealis (Sharp), Neoporus dimidiatus (G. & H.), N. spurius, N. sulcipennis (Fall), and Oreodytes s. scitulus (LeConte)) are worth emphasizing in that they illustrate the high abundance of lotic habitats in this portion of Cape Breton Island. In general, coexisting species may be more closely related than expected by chance if environmental features of a given habitat select for certain traits that are shared.
by closely related species (Vamosi and Vamosi 2007), which may explain particularly the highest diversity of Neoporus Guignot and Heterosternuta Strand in that region.

The 87 species of Hydradephaga reported in this study represent an important richness, proportionally comparable to the number of species found in Prince Edward Island with similar environmental conditions (Alarie 2016). It is worth mentioning, however, that several species (Agabus leptapsis, Dineutus hornii Roberts, Dytiscus fasciventris Say, Gyrinus cavatus Atton, G. fraternus Couper, G. gebrigi Chamberlain, G. impressicolis Kirby, Haliphus fulvus (Fabricius), Heterosternuta alleghanienesis, H. pulchra, H. wickhami, Hydroporus appalachius, H. badiellus Fall, H. nigellus, H. puberulus, H. rufinasus Mannerheim, Ilybius ignaris, I. picipes, I. wasastijernae, Neoporus spurius, Oreodytes s. scitulus, and Platambus obtusatus) collected in Cape Breton Island have yet to be discovered in Prince Edward Island. The absence in Cape Breton Island of 12 species listed in the latter province (Acilius sylvanus Hilsenhoff, Agabus punctulatus Aubé, Boreonectes griseostriatus (DeGeer), Dytiscus dauricus Gebler, D. harrisii Kirby, Graphoderus liberus (Say), G. perplexus Sharp, Gyrinus bifarius Fall, G. lecontei (Hope), Hygrotus compar Fall, Peltodytes tortulosus Roberts, and Sanfilippodytes planiusculus (Fall)) is worth mentioning as it suggests that the number of Hydradephaga species on Cape Breton island may be even greater than suggested by this study.

Conclusions

Our study adds considerably to the previous knowledge about Hydradephaga in the Canadian Maritimes, with eight new records for the province of Nova Scotia. The composition of the Cape Breton fauna reflects that of the Maritime Provinces as a whole. Whereas all the species found on Cape Breton Island have also been recorded in New Brunswick (Webster 2016) (except Gyrinus cavatus Atton, Heterosternuta wickhami, Hydroporus appalachius, and Ilybius picipes) the presence on Prince Edward Island (Alarie 2016) of 12 species not reported on Cape Breton Island suggests that additional species could potentially still be found.

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