

# The Hydradephaga of the Magdalen Island Archipelago, Canada (Coleoptera: Dytiscidae, Gyrinidae, Haliplidae)

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## Abstract

Adults of 45 species of Hydradephaga (Coleoptera: Dytiscidae, Gyrinidae, Haliplidae) were collected in wetland habitats of the Magdalen Island Archipelago in eastern Canada. *Sanfilippodytes pseudovilis* (YOUNG), *Dineutus nigrrior* (ROBERTS), *D. hornii* (ROBERTS), and *Gyrinus maculiventris* LECONTE are recorded for the first time in the Atlantic Maritime Ecozone. *Dineutus nigrrior*, *D. hornii* and *Gyrinus maculiventris* are recorded for the first time in Atlantic Canada. In addition to these species *Agabus semipunctatus* (KIRBY), *Colymbetes sculptilis* HARRIS, *Hydroporus badiellus* FALL., *H. rectus* FALL., *Ilybius discedens* SHARP, *Laccophilus maculosus* SAY, *Neoscutopterus hornii* (CROTCH), *Rhantus binotatus* (HARRIS), *R. suturellus* (HARRIS), and *R. wallisi* HATCH are all newly recorded from the Magdalen Islands. This study brings to 53 the number of Hydradephaga recorded in the archipelago. The fauna is characteristic of the Boreal and Atlantic Maritime Ecozones and most species have a transcontinental distribution.

**Key words:** Coleoptera, Dytiscidae, Gyrinidae, Haliplidae, Faunistics, Atlantic Maritime Ecozone.

## Introduction

The Maritime Provinces are a region of eastern Canada on the Atlantic coast consisting of New Brunswick, Nova Scotia, and Prince Edward Island. These provinces lie within the Atlantic Maritime Ecozone along with Québec's Gaspé Peninsula 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. The Atlantic Ocean also provides moisture to the region, producing mean precipitation of 900 mm a year inland and 1500 mm a year on the coast. Geologically, this region is a mix of sedimentary and igneous bedrock.

The Magdalen Islands (Îles de la Madeleine) are an elongate archipelago of seven principal low-lying islands situated at 61°08'–62°13'W and 47°51'N in the Gulf of St. Lawrence, 288 km east of the Gaspé coast of Québec, 112 km north of Prince Edward Island and 88 km west of Cape Breton Island. Knowledge of the Hydradephaga fauna of the Magdalen Islands is hampered by lack of significant distributional data for most species. Based on described species alone, Hydradephaga are the most speciose lineage of freshwater insects rivaled only by the Diptera family Chironomidae (WILLIAMS & FELTMATE 1992). This study's objective is to produce the first list of Hydradephaga found on these islands. This is the first in a series of papers that analyse the distribution in Canadian Maritime Provinces of different groups of Hydradephaga (Dytiscidae, Gyrinidae, and Haliplidae).

### The study area

The interior landscape of the Magdalen Islands is gently rolling with elevation normally ranging from 3–45 m, with some islands having occasional steep hills reaching a maximum elevation of 170 m. Most shorelines have vertical cliffs less than 30 m high, which are composed of friable red sandstone that is easily eroded by wave and wind action (HILTON 1992). Six of the seven main islands are connected by narrow strands of sand dunes that frequently enclose salt-water lagoons.

The island vegetation consists of five categories: 1) maritime, 2) low-marsh, 3) *Sphagnum*-black spruce, 4) *Kalmia*-black spruce and 5) white spruce-balsam fir (GRANDTNER 1967).

Although the maritime and white-spruce vegetation areas are distributed over the archipelago, little old growth forest remains on these islands after decades of farming and agriculture. As of 1967, forest covered less than 26 % of the islands the rest being native maritime grassland vegetation, agricultural pastures and urban landscape (HILTON 1992).

### Material and methods

Sampling was unstructured and qualitative with the goal of obtaining a strict inventory of Hydradephaga of the region. Beetles were collected using D-net sweeps in a variety of microhabitats including macrophyte beds, rocky shores, organic-rich sediments, and open water. Except for two samples, which were collected 31 July 1987 and 2 August 1987 respectively, all other samples (= 22) were collected within the period comprised between 19–23 August 2002 (Table 1).

Nomenclature is based on the classification in NILSSON (2001). Species names were checked against recent works such as MORRISSETTE (1979), FERKINOFF & GUNDERSEN (1983), GUNDERSEN & OTREMBIA (1988), OYGUR & WOLFE (1991), BOUSQUET (1991), LARSON et al. (2000) and NILSSON & VONDEL (2005).

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

Table 1: Localities of the sampling sites in Magdalen Islands Archipelago and description of the habitat.

Sample	Locality	Habitat
01	Bassin de Île du Havre Aubert, Chemin du Bassin west of Chemin Chevrier; 19.viii.2002	<i>Typha</i> spp. pond
02	Bassin de Île du Havre Aubert, Chemin du Bassin, near chemin de la Montagne; 19.viii.2002	<i>Typha</i> spp. pond
03	Bassin de Île du Havre Aubert, junction chemin du Bassin and chemin de la Montagne; 19.viii.2002	Eutrophic brook; slow moving water with heavy accumulation of plant and sediment
04	Bassin de Île du Havre Aubert, Lac Solitaire, off Chemin de la Montagne; 20.viii.2002	Lake in white spruce-balsam fir forest

05	Étang du Nord, 1 km from La Martinique, junction Highway 199 and Chemin des Chalets; 20.viii.2002	<i>Typha</i> spp. pond contiguous to sea; saline water
06/07	Étang du Nord, étang Ben at Chemin Coulombe; 20.viii.2002	<i>Typha</i> spp. and <i>Scirpus</i> spp., pond
08	Étang du Nord, Chemin du Rivage, off Chemin de l'Hôpital; 20.viii.2002	<i>Scirpus</i> spp. pond with dense accumulation of algae; contiguous to sea
09	Fatima, junction of Chemin Grand-Ruisseau and Chemin Harvie; 21.viii.2002	<i>Typha</i> spp. pond; riparian vegetation scarce
10	Fatima, junction of Chemin Grand-Ruisseau and Chemin Aucoin; 21.viii.2002	Eutrophic brook, abundance of algae; rocky bottom
11	Fatima, marais Barachois at Chemin Poirier; 21.viii.2002	<i>Scirpus</i> spp. and <i>Typha</i> spp. pond; abundance of riparian bryophytes; sandy bottom
12	Fatima, at Chemin Marconi; 21.viii.2002	<i>Typha</i> spp. pond; heavy accumulation of organic material
13	Fatima, off Chemin Marconi; 21.viii.2002	Shallow pool; clay/rocky bottom; mats of <i>Juncus</i> spp.
14	Grande Entrée, at Chemin des Pealey; 22.viii.2002	<i>Typha</i> spp. pond
15	Grande Entrée, off Chemin du Bassin Ouest, near sea shore; 22.viii.2002	<i>Sphagnum</i> bog; <i>Kalmia</i> -black spruce
16	Grosse-Île, at Chemin Sand Cove; 22.viii.2002	Bog lake; <i>Kalmia</i> -black spruce forest
17	Grosse-Île, les Grandes Echoueries; 22.viii.2002	<i>Scirpus</i> spp. pond; landscape with abundance of Poaceae, near sea shore
18	Grosse-Île, Buttereau Vert; 22.viii.2002	<i>Juncus</i> spp. pond; saline water
19	Grosse-Île, 0.5 km east of Pointe au loup; 22.viii.2002	<i>Typha</i> spp. pond; abundance of sea lilies ( <i>Nuphar</i> spp.)
20	Les Sillons, 6 km east of Havre aux Maisons, at Highway 199; 23.viii.2002	<i>Sphagnum</i> bog with <i>Carex</i> spp.
21	Havre aux Maisons, at Highway 199, near Coop; 23.viii.2002	<i>Juncus</i> spp. pond with sea lilies ( <i>Nuphar</i> spp.)
22	Havre aux Maisons, at gros Button, at Chemin des Échouries; 23.viii.2002	Oligotrophic brook, rocky bottom
23	Havre aux Maisons, Chemin des Échoueries; 31.vii.1987	Ephemeral pond on clay bottom with <i>Scirpus</i> spp.
24	Havre aux Maisons, at Chemin des Échoueries; 02.viii.1987	<i>Typha</i> spp. pond with <i>Sagittaria</i> spp.

## Results

A total of 1025 specimens representing 45 species of Hydradephaga were collected in this study (Table 2). Dytiscidae predominate both in abundance (68.9 %) and in species diversity (80 % of the species). The most common species were *Neoporus undulatus* (SAY) (18.5%), *Haliphus immaculicollis* HARRIS (17.8 %), *Hygrotus sayi* BALFOUR-BROWNE (10.4 %), *Gyrinus sayi* AUBÉ (6.2 %), and *Hydroporus striola* (GYLLENHAL) (4.0 %).

Table 2: Absolute (AF) and relative frequencies (%) of the species of Hydradephaga (Dytiscidae, Gyrinidae, Haliplidae) collected in Magdalen Islands Archipelago in 1987 and 2002 with sample numbers (as in Table 1).

Taxon	AF	%	Sample numbers
Dytiscidae			
<i>Agabus ambiguus</i> (SAY)	25	2.4	3, 6/7, 11, 22
<i>Agabus anthracinus</i> MANNERHEIM	5	0.5	15, 17, 18
<i>Agabus inscriptus</i> (CROTCH)	14	1.4	20
<i>Agabus semipunctatus</i> (KIRBY)	3	0.2	20
<i>Acilius semisulcatus</i> AUBÉ	5	0.5	13
<i>Colymbetes sculptilis</i> HARRIS	4	0.4	22, 24
<i>Coptotomus longulus</i> LECONTE	22	2.2	13, 15, 17, 18
<i>Dytiscus dauricus</i> GEBLER	1	0.1	24
<i>Graphoderus occidentalis</i> HORN	1	0.1	24
<i>Hydrocolus paugus</i> (FALL)	22	2.2	3, 10, 22
<i>Hydroporus badiellus</i> FALL	1	0.1	20
<i>Hydroporus dentellus</i> FALL	3	0.2	17, 20
<i>Hydroporus notabilis</i> LECONTE	1	0.1	3
<i>Hydroporus rectus</i> FALL	7	0.7	20
<i>Hydroporus signatus</i> MANNERHEIM	22	0.2	3, 15
<i>Hydroporus striola</i> (GYLLENHAL)	41	4.0	3, 6/7, 10, 11, 15, 17, 22, 24
<i>Hydroporus tenebrosus</i> LECONTE	11	1.1	3, 4, 10, 13, 17, 22
<i>Hydroporus tristis</i> (PAYKULL)	8	0.8	15
<i>Hygrotus impressopunctatus</i> (SCHALLER)	11	1.1	5, 6/7
<i>Hygrotus picatus</i> (KIRBY)	15	1.5	6/7, 15, 17, 18
<i>Hygrotus sayi</i> BALFOUR-BROWNE	107	10.4	2, 4, 5, 9, 11, 13, 14, 15, 16, 17, 18, 21, 24
<i>Hygrotus turbidus</i> (LECONTE)	7	0.7	15, 18
<i>Ilybiosoma seriatum</i> (SAY)	40	3.9	3, 10, 22

	<i>Ilybius angustior</i> (GYLLENHAL)	1	0.1	6/7
	<i>Ilybius biguttulus</i> (GERMAR)	6	0.6	3, 4, 12, 13, 22
	<i>Ilybius discedens</i> SHARP	2	0.2	20
	<i>Ilybius erichsoni</i> (GEMMINGER & HAROLD)	2	0.2	20, 22
	<i>Ilybius pleuriticus</i> (LECONTE)	37	3.6	2, 6/7, 11, 12, 13, 14, 18, 24
	<i>Laccophilus maculosus</i> SAY	15	1.5	13, 22, 24
	<i>Neoporus carolinus</i> (FALL)	28	2.7	3, 10, 22
	<i>Neoporus undulatus</i> (SAY)	190	18.5	1, 2, 3, 4, 9, 10, 11, 13, 18, 21, 22, 24
	<i>Neoscutopterus hornii</i> (CROTCH)	2	0.2	20
	<i>Rhantus binotatus</i> (HARRIS)	3	0.2	10, 15, 22
	<i>Rhantus suturellus</i> (HARRIS)	1	0.1	24
	<i>Rhantus wallisi</i> HATCH	22	2.2	13, 15, 17, 18
	<i>Sanfilippodytes pseudovilis</i> (YOUNG)	12	1.2	22
Gyrinidae				
	<i>Dineutus hornii</i> ROBERTS	16	1.6	4, 5, 11, 18
	<i>Dineutus nigrrior</i> ROBERTS	3	0.3	4
	<i>Gyrinus aquiris</i> LECONTE	33	3.2	2, 3, 4, 6/7, 9, 11
	<i>Gyrinus maculiventris</i> LECONTE	2	0.2	4
	<i>Gyrinus minutus</i> FABRICIUS	9	0.9	4, 18
	<i>Gyrinus pugionis</i> FALL	3	0.3	4
	<i>Gyrinus sayi</i> AUBÉ	63	6.2	2, 3, 4, 5, 11, 13, 18, 24
Haliplidae				
	<i>Haliplus cribarius</i> LECONTE	8	0.8	11, 13
	<i>Haliplus immaculicollis</i> HARRIS	182	17.8	1, 2, 3, 4, 5, 6/7, 8, 9, 10, 11, 17, 18, 21, 22, 24

### Discussion

On the basis of geological evidence, the Magdalen Island Archipelago is considered to have been an ice-free glacial refugium during the Pleistocene glaciations (GRANT 1977, PREST 1977, PREST et al. 1976). The Pleistocene history of this area, however, is still subject to some debate and interpretation. It is possible that there were ice-free areas, but there is a substantial body of science that indicates that most of the area may have been ice covered (STEA 2001). A common characteristic feature of the Magdalen Islands is that populations there are isolated from mainland populations, which can result in evolution of endemic species. This seems supported biologically by *Melanoplus madeleineae* VICKERY & KEVAN (Orthoptera: Acrididae) (VICKERY 1989) and several species of Homoptera (HAMILTON 2002), which are found only on these islands.

No endemic species of Hydradephaga were found in the Magdalen Island Archipelago (Table 3). Indeed most species are characteristic of both the Boreal and Atlantic Maritime Ecozones and have a transcontinental distribution (except for *Gyrinus pugionis* FALL, *Laccophilus maculosus* SAY, *Neoporos carolinus* (FALL) and *Ilybius biguttulus* (GERMAR), which are generally recognized as species with eastern affinities (BOUSQUET 1991, LARSON et al. 2000)). Several species deserve separate treatment. *Sanfilippodytes pseudovilis* (YOUNG), *Dineutus nigrrior* (ROBERTS), *D. hornii* (ROBERTS), and *Gyrinus maculiventris* LECONTE are recorded for the first time in the Atlantic Maritime Ecozone (Table 3). Whereas *S. pseudovilis* was previously recorded from Newfoundland (LARSON et al. 2000), presence of *Dineutus nigrrior*, *D. hornii* and *Gyrinus maculiventris* are first records of these species in Atlantic Canada and represent important extension of their range of distribution. In addition to these species, *Agabus semipunctatus* (KIRBY), *Colymbetes sculptilis* HARRIS, *Hydroporus badiellus* FALL, *H. rectus* FALL, *Ilybius discedens* SHARP, *Laccophilus maculosus* SAY, *Neoscutopterus hornii* (CROTCH), *Rhantus binotatus* (HARRIS), *R. suturellus* (HARRIS), and *R. wallisi* HATCH are all newly recorded from the Magdalen Island. According to this study and literature, 53 species of Hydradephaga are currently known from the Magdalen Islands.

Table 3: Checklist of the Hydradephaga species recorded in the Magdalen Island Archipelago compared to records in the Canadian Maritime Provinces (0: absent, 1: present) following MORRISSETTE (1979), BOUSQUET (1991), LARSON et al. (2000) and NILSSON & VONDEL (2005).

NB: New Brunswick, NS: Nova Scotia, PE: Prince Edward Island; \* not recorded in this study, \*\* first record in the Canadian Maritime Provinces, \*\*\* first record in the Magdalen Island Archipelago.

Taxon	NB	NS	PE
Dytiscidae			
<i>Agabus ambiguus</i> (SAY)	1	1	1
<i>Agabus anthracinus</i> MANNERHEIM	1	1	1
<i>Agabus bifarius</i> (KIRBY)*	1	1	0
<i>Agabus inscriptus</i> (CROTCH)	0	1	0
<i>Agabus phaeopterus</i> (KIRBY)*	1	1	1
<i>Agabus semipunctatus</i> (KIRBY)***	1	1	0
<i>Acilius semisulcatus</i> AUBÉ	1	1	1
<i>Colymbetes sculptilis</i> HARRIS	1	1	1
<i>Coptotomus longulus</i> LECONTE	1	1	1
<i>Desmopachria convexa</i> (AUBÉ)*	1	1	1
<i>Dytiscus dauricus</i> GEBLER	1	1	1
<i>Graphoderus occidentalis</i> HORN	0	0	0
<i>Hydrocolus paugus</i> (FALL)	1	1	0
<i>Hydroporus badiellus</i> FALL***	1	1	0
<i>Hydroporus dentellus</i> FALL	1	1	1
<i>Hydroporus niger</i> SAY*	1	1	1
<i>Hydroporus notabilis</i> LECONTE	1	1	1

	<i>Hydroporus rectus</i> FALL***	1	1	0
	<i>Hydroporus signatus</i> MANNERHEIM	1	1	1
	<i>Hydroporus striola</i> (GYLLENHAL)	1	1	0
	<i>Hydroporus tenebrosus</i> LECONTE	1	1	0
	<i>Hydroporus tristis</i> (PAYKULL)	1	1	0
	<i>Hygrotus impressopunctatus</i> (SCHALLER)	1	1	1
	<i>Hygrotus nubilus</i> (LECONTE)*	1	1	0
	<i>Hygrotus picatus</i> (KIRBY)	1	1	1
	<i>Hygrotus sayi</i> BALFOUR-BROWNE	1	1	1
	<i>Hygrotus turbidus</i> (LECONTE)	0	1	1
	<i>Ilybiosoma seriatum</i> (SAY)	1	1	0
	<i>Ilybius angustior</i> (GYLLENHAL)	1	1	1
	<i>Ilybius biguttulus</i> (GERMAR)	1	1	0
	<i>Ilybius discedens</i> SHARP***	1	1	0
	<i>Ilybius erichsoni</i> (GEMMINGER & HAROLD)	1	1	0
	<i>Ilybius larsoni</i> (FERY & NILSSON)*	1	1	0
	<i>Ilybius picipes</i> (KIRBY)*	0	0	0
	<i>Ilybius pleuriticus</i> (LECONTE)	1	1	1
	<i>Laccophilus maculosus</i> SAY***	1	1	1
	<i>Neoporus carolinus</i> (FALL)	1	1	0
	<i>Neoporus undulatus</i> (SAY)	1	1	1
	<i>Neoscutopterus hornii</i> (CROTCH)***	1	0	0
	<i>Rhantus binotatus</i> (HARRIS)***	1	1	1
	<i>Rhantus suturellus</i> (HARRIS)***	0	1	0
	<i>Rhantus wallisi</i> HATCH***	1	1	0
	<i>Sanfilippodytes pseudovilis</i> (YOUNG)**	0	0	0
	<i>Stictotarsus griseostriatus</i> (DE GEER)*	1	1	1
Gyrinidae				
	<i>Dineutus hornii</i> ROBERTS**	0	0	0
	<i>Dineutus nigrrior</i> ROBERTS**	0	0	0
	<i>Gyrinus aquiris</i> LECONTE	1	0	1
	<i>Gyrinus maculiventris</i> LECONTE**	0	0	0
	<i>Gyrinus minutus</i> FABRICIUS	1	1	0
	<i>Gyrinus pugionis</i> FALL	1	1	0

	<i>Gyrinus sayi</i> AUBÉ	1	1	1
Haliplidae				
	<i>Haliplus cribarius</i> LECONTE	1	1	1
	<i>Haliplus immaculicollis</i> HARRIS	1	1	1

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