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THE ODONATA OF HAMILTON MARSH, VANCOUVER ISLAND, BRITISH COLUMBIA, CANADA

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Abstract – Specimen and sight records of Odonata from Hamilton Marsh, a small wetland on the east coast of Vancouver Island, British Columbia, are presented. Thirty-three species representing 14 genera and five families are listed. The biogeography of the fauna is discussed – the site lies at a crossroads of several faunal elements – and notes on behaviour, ecology, habitat structure and succession are included.

Study area

Hamilton Marsh (49°19'20"N, 124°29'10"W) is located 5 km south of Qualicum Beach, Vancouver Island, British Columbia (Fig. 1). It is about 0.5 km wide and 3 km long. A small stream, locally known as Hamilton Creek, flows through the marsh and into French Creek, which empties into the Strait of Georgia. Hamilton Marsh is located in the Georgia Depression Ecoprovince (MEIDINGER & POJAR,

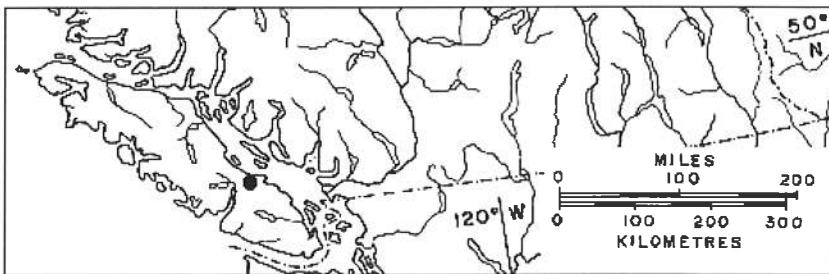


Fig. 1. Southern British Columbia showing the location of Hamilton Marsh (black dot) on Vancouver Island.

1991). Both peatland and mineral wetlands are common in this area of the province's south coast (MACKENZIE & MORAN, 2004), but peatlands are rare in the Nanaimo Lowland Ecoregion where Hamilton Marsh is located. The study site lies within the Moist Maritime Subzone of the Coastal Douglas-fir Biogeoclimatic Zone (COUSENS et al., 1996). This bio-

geoclimatic zone is restricted to low elevation (<150m) coastal areas in the rain shadow of the Vancouver Island Ranges. The climate is Mediterranean, characterized by warm, dry summers and mild, wet winters.

Hamilton Marsh is a combination of several wetland habitats (Fig. 2). COUSENS et al. (1996) described it as 20% shrub swamp; a band

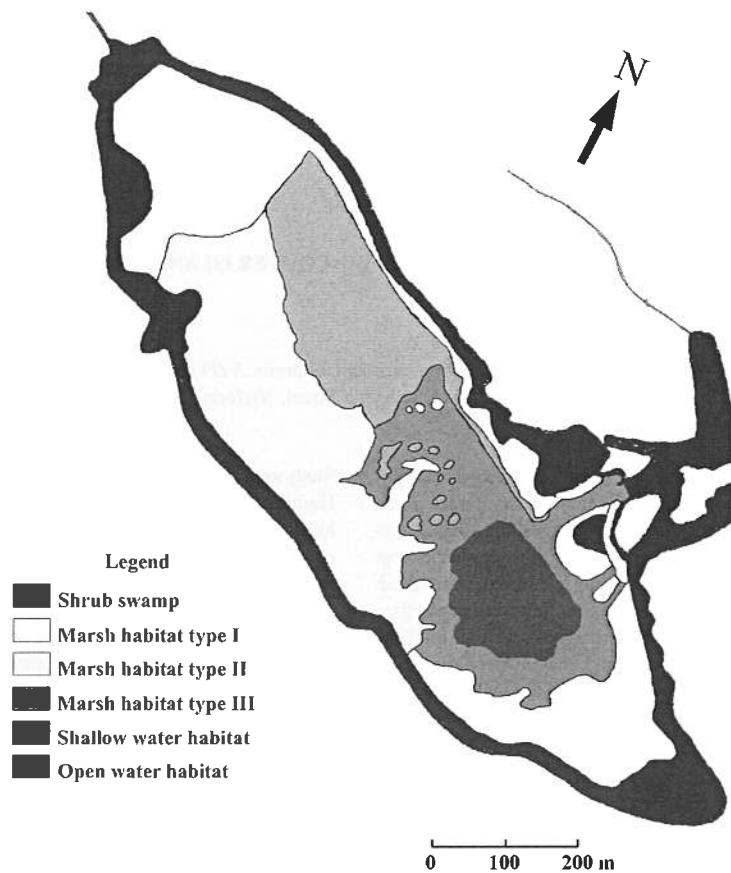


Fig. 2. Plant species community composition at Hamilton Marsh and study area. Dominant species in each habitat are: Shrub swamp: *Spiraea douglasii* and *Salix*; – Marsh habitat type I: *Carex lanuginosa*, *Menyanthes trifoliata*, *Comarum palustre*, *Dulichium arundinaceum*, *Juncus arcticus*; – Marsh habitat type II: *Carex* spp., *Juncus* spp., *M. trifoliata*, *C. palustre*, *D. arundinaceum*. This habitat is characterized by many small open pools, ponds, channels and firm patches of *S. douglasii* and other shrubs and forbs; – Marsh habitat type III: *M. trifoliata*, *D. arundinaceum*, *C. lanuginosa*, and *J. arcticus*; – Shallow water habitat: *Brasenia schreberi* and *M. trifoliata*; – Open water habitat: *Nuphar lutea* (Modified after COUSENS et al., 1996).

of *Salix* and *Spiraea douglasii* Hook. rings the wetland adjacent to the forest. Another 20% of the wetland is open water (<2 m deep) near the outlet. The plant community here is dominated by *Nuphar lutea* (L.) Sm., *Brasenia schreberi* Gmel. and *Menyanthes trifoliata* L. The remaining 60% is marsh, comprised of floating peat, root mats and associated plants; considerable open water occurs early in the year. Although the wetland is best classified overall as a marsh or marsh/shallow water complex, it has some fen characteristics – peat, aquatic mosses and other peatland plants are common. Several species of sedge form extensive beds along parts of the shore or extend into the marsh – *Carex cusickii* Mackenzie ex Piper & Beattie, *C. interior* Bailey, *C. lanuginosa* Michx., and *C. sitchensis* Prescott ex Bong. Other characteristic species are *Comarum palustre* (L.) Scop., *Dulichium arundinaceum* (L.) Britt. and *Sphagnum squarrosum* Crome. At the edge of the forest, *Pinus contorta* Dougl. ex Loud., *Spiraea douglasii* Hooker and *Malus fusca* (Raf.) Schneid. are common. The surrounding second growth

forest is dominated by *Thuja plicata* Donn ex D. Don, *Tsuga heterophylla* (Raf.) Sargent, *Pseudotsuga menziesii* (Mirbel) Franco and *Alnus rubra* Bong. (CANNINGS, 2005).

Two beaver dams at the outlets of the marsh account for its present high water mark of 88.75 m above sea level, recorded in 1995. This reading has not changed significantly since a 1981 survey. Low summer water levels range from 20 to 30 cm below the high water mark. This water level decline is the result of seepage, evaporation and annual irrigation use under a water license in effect since 1956. The total volume is estimated at 200,000 m³; the volume below the high water mark is 170,000 m³. During the summer, the declining water levels expose much of the dominant *Menyanthes trifoliata* and *Carex* spp. vegetation and may even expose the peat and root mat. Rapid succession is occurring; almost 100% of the marsh was open water in 1954, but only 20% or less of the area was open water in 1994 (COUSENS et al., 1996). From 1850 to 1950 much of the forest around the marsh was logged. Between 1940 and 1950,



Fig. 3. West end of Hamilton Marsh, view to East, 28 June 2004 (Modified after SIMAIKA, 2005). Vegetation in foreground is generally that of marsh habitat type III (i.e. *Menyanthes trifoliata*, *Carex lanuginosa*, and *Juncus arcticus*). Common species around the margin are *Pinus contorta*, *Spiraea douglasii* and *Tsuga heterophylla*.

attempts were made to farm beaver and muskrat. To do this, established beaver dams were destroyed and ditches dug to further drain the wetland. After these efforts failed, the owner of the wetland tried to raise American Bullfrogs (*Rana catesbeiana* Shaw) and Northern Leopard Frogs (*Rana pipiens* Schreber). To this day, a breeding population of bullfrogs remains.

Collections and other data

Many of the specimens from the marsh were collected by R.A. Cannings at various times and are housed in the Royal British Columbia Museum (RBCM) in Victoria, BC. Other significant collections were made by G.E. Hutchings and are in his collection in Victoria. The site was visited by participants in the 2000 Dragonfly Society of the America's field meeting on 29 July 2000 (HUTCHINGS, 2000). However, the only intensive study on the Odonata is that of SIMAIKA (2005), which looked at the relationships among dragonflies and plants over a four-month period. Most of the records from the above collections are summarized in the present work, but the data are not intended to be comprehensive. In addition, some larvae and exuviae occur in these collections, but we have not analyzed these and do not report on them herein. Plant names follow DOUGLAS et al. (2001).

Faunal elements

Species may be grouped with others that share similar distributions to form what can be termed faunal elements. The following classification is modified from PORSILD (1958) and SCUDDER (1979) and is used in the annotated list below to indicate the ranges of individual species. Those elements relevant to the study area are:

- (1) Boreal – species occurring in the northern spruce (*Picea*) forests, across the boreal zone from treeline to the southern margin. In general, these species range from the Atlantic Provinces across the northern New England states, Quebec, northern Ontario, parts of the northern tier of midwestern states, the Prairie Provinces north of the Great Plains, and northern British Columbia, often ranging considerably southward in the higher mountains and plateaus of the western Cordillera.
- (2) Transition – species generally most common in the southern boreal forests and adjacent montane forests in the West and mixed and deciduous forests in the East.
- (3) Cordilleran – species confined to the western mountains and their intervening valleys and plateaus.
- (4) Pacific Coastal – species confined to the lowlands of the Pacific Coast.
- (5) Western – species confined to west of the 100th meridian, but otherwise ranging widely in North America.
- (6) Austral – species transcontinental in the southern part of North America and, at the northern extremities of their ranges, entering Canada to varying degrees along the international boundary.
- (7) Widespread – species with broad distributions in North America, from north to south and east to west, overlapping several of the other elements listed. These species range into boreal regions to varying degrees.

Annotated list of species

Lestidae

– *Lestes congener* Hagen

Faunal element: Widespread

18-VI (2004) to 9-X (1988). A few teneral on 29-VII-2000; pairs in tandem 09-VIII (2004) to 14-VIII (2004); copulation from 9-VIII (2004) to 9-X (1988). On average, this is the latest *Lestes* to emerge in BC and the latest to fly in the autumn; emergence before early July is unusual and adults often fly well into November (CANNINGS, 2002).

– *Lestes disjunctus* Selys

Faunal element: Widespread

29-VI (1981) to 25-VIII (1990); copulation from 12-VII (2004) to 25-VIII (1990); oviposition from 12-VII (2004) to 30-VIII (2004). *L. disjunctus* is the most common lested at Hamilton Marsh. Pairs evidently oviposited on only *Carex lanuginosa* and *Juncus arcticus*. On *C. lanuginosa* they oviposited into fresh stems, low above the water surface; on *J. arcticus*, eggs were placed into dead tissue about 10cm from tip of stem.

- *Lestes dryas* Kirby
Faunal element: Widespread (Holarctic)
18-VI (2004) to 21-VII (2004). This is the least common *Lestes* at Hamilton Marsh and the first one to emerge in the year.
 - *Lestes forcipatus* Rambur
Faunal element: Austral
18-V (2004) to 4-IX (2004); copulation from 28-VI (2004) to 16-VIII (1986); oviposition 12-VII (2004) to 14-VIII (2004). Part of Simaika's 2004 study (SIMAIKA, 2005) examined the sympatry of *L. forcipatus* and *L. disjunctus*. Patterns of pruinescence are the best characters for distinguishing males of these two similar species in the field (SIMAIKA & CANNINGS, 2004). Throughout most of BC, at least, male *L. disjunctus* has the top of abdominal segment 2 completely covered with pruinescence while that of *L. forcipatus* has the apical third bare. Because acetone damages these patterns on *Lestes* and other species, we recommend that the usual acetone treatment not be used on species with pruinescence. Unlike *L. disjunctus*, *L. forcipatus* prefers to oviposit in the living stems of *Juncus arcticus*. The species will also lay eggs in *Carex lanuginosa* and *Menyanthes trifoliata*.
- C o e n a g r i o n i d a e
- *Enallagma amnexam* (Hagen)
Faunal element: Boreal
21-VII (2004) to 18-VIII (1984); in tandem 21-VII (2004).
 - *Enallagma boreale* Selys
Faunal element: Boreal
18-V (2004) to 25-VIII (1990); in tandem 29-VII (2000); copulation from 18-V (2004) to 15-VIII (1986). *E. boreale* is the most common *Enallagma* at the site.
 - *Enallagma carunculatum* Morse
Faunal element: Austral
20-VII-1986.
 - *Ischnura cervula* Selys
Faunal element: Cordilleran
18-V (2004) to 25-VIII (1990); in tandem 29-VII (2000). This is a common species at Hamilton Marsh, and one of the earliest odonates to appear in spring.
 - *Ischnura erratica* Calvert
Faunal element: Pacific Coastal
18-V (2004) to 15-VI (1996). This *Ischnura* is probably more abundant than the few collections suggest; flies early in the season and disappears before most visits were made to the marsh.
 - *Ischnura perparva* Selys
Faunal element: Western
18-V (2004) to 21-VIII (1990). The pruinose females, ovipositing alone, are much more conspicuous than the more delicate males.
- A e s h n i d a e
- *Aeshna canadensis* Walker
Faunal element: Transition
15-VI (1995) to 9-X (1988). *A. canadensis* is perhaps the most common *Aeshna* at Hamilton Marsh in midsummer.
 - *Aeshna eremita* Scudder
Faunal element: Boreal
15-VI (1995). This *Aeshna* usually prefers lakeshores with less dense aquatic vegetation than occurs at Hamilton Marsh; the site is not typical of the species. *A. eremita* normally appears in July; the mid-June date is extremely early.
 - *Aeshna interrupta* Walker
Faunal element: Boreal
20-VII (1986) to 9-X (1988).
 - *Aeshna palmata* Hagen
Faunal element: Cordilleran
14-VII (2004) to 9-X (1988); copulation on 4-VIII (2004).
 - *Aeshna tuberculifera* Walker
Faunal element: Transition
20-VII (1986) to 25-VIII (1990). Hamilton Marsh is one of the best places to see this uncommon species on the BC coast. The big blue females behave like males, flying back and forth over the sedges, especially near the outlet of the marsh. They oviposit in aquatic plant stems above the water surface.
 - *Anax junius* (Drury)
Faunal element: Austral
29-VII (2000) - 13-VIII (1992).
 - *Rhionaeschna californica* (Calvert)
Faunal element: Cordilleran
18-V (2004). Probably more common at the marsh than the single record indicates because most collecting has occurred after the main flight period of the species, which be-

- gins in April and is almost over by August (CANNINGS, 2002).
- *Rhionaeschna multicolor* (Hagen)
Faunal element: Western
18-VI (2004) to 25-VIII (1990); copulation on 29-VII (2000).
- Corduliidae**
- *Cordulia shurtleffii* Scudder
Faunal element: Boreal
18-V (2004) to 29-VII (2000); oviposition on 18-V (2004).
 - *Somatochlora semicircularis* (Selys)
Faunal element: Cordilleran
18-V (2004) to 21-VIII (1990); oviposition on 23-VI (2004) to 12-VII (2004). The most common of its genus in BC; at Hamilton Marsh it is mostly seen hovering over *Carex* beds.
- Libellulidae**
- *Erythemis collocata* (Hagen)
Faunal element: Austral
29-VII (2004) to 4-VIII (2004). This Blue-listed species is uncommon at the site; it is mostly restricted to open water habitats where it perches on Yellow Pond-lily (*Nuphar*) leaves.
 - *Ladona julia* Uhler
Faunal element: Transition
18-V (2004) to 15-VI (1995). It is common for a short period in May and June in habitats with open water; perches horizontally on Yellow Pond-lily (*Nuphar*) leaves, logs and pathways along the shore.
 - *Leucorrhinia hudsonica* (Selys)
Faunal element: Boreal
18-V (2004) (copulation). This, the most widespread and common *Leucorrhinia* in BC, is surprisingly uncommon at Hamilton Marsh, where conditions for it seem good.
 - *Leucorrhinia proxima* Calvert
Faunal element: Boreal
15-VI (1995) to 29-VII (2000). *L. proxima* is fairly common around *Nuphar* and *Brasenia* leaves floating in open patches of water.
 - *Libellula forensis* Hagen
Faunal element: Cordilleran
14-VII (2004) - 29-VII (2000). Although abundant on southern Vancouver Island, this species is uncommon at Hamilton Marsh; it is more at home in more eutrophic waters such as cat-tail (*Typha*) marshes.
 - *Libellula quadrimaculata* Linnaeus
Faunal element: Widespread (Holarctic)
18-V (2004) to 25-VIII (1990); copulation and oviposition on 18-V (2004).
 - *Pachydiplax longipennis* (Burmeister)
Faunal element: Austral
29-V (2004) to 29-VII (2000). Blue-listed, but rather common at the site. Males are common at the margins of open water, where they perch on plant stems.
 - *Sympetrum danae* (Sulzer)
Faunal element: Boreal
13-VIII (1992) - 21-VIII (1990).
 - *Sympetrum illotum* Hagen
Faunal element: Cordilleran
22-V (2004) (copulation). Although abundant on southern Vancouver Island, *S. illotum* is rare at Hamilton Marsh; it is more at home in more eutrophic waters.
 - *Sympetrum obtusum* (Hagen)
Faunal element: Transition
18-VI (2004) to 9-X (1988); many emerging 29-VII (2000); in tandem from 12-VII (2004) to 29-VII (2000); copulation from 28-VI (2004) to 25-VIII (2004); oviposition from 21-VII (2004) to 30-VIII (2004). The most common *Sympetrum* at Hamilton Marsh; males of this highly territorial species prefer to perch on the leaves of *Menyanthes trifoliata* and *Comarum palustre*. *Aeshna* species captured perching males on several occasions; forcing the males to perch low on the stems of *Carex*.
 - *Sympetrum occidentale* Bartenev
Faunal element: Western
8-VI (2004) to 30-VIII (2004); emerging, in tandem 29-VII (2000); in copula from 14-VII (2004) to 25-VIII (1990); ovipositing 26-VII (2004).
 - *Sympetrum pallipes* (Hagen)
Faunal element: Western
28-VI (2004) to 9-X (1988); copulation from 21-VII (2004) to 4-IX (2004), in tandem 31-VII (2004); oviposition from 9-VIII (2004) to 4-IX (2004).
 - *Sympetrum vicinum* (Hagen)
Faunal element: Austral
21-VIII (1990). On Vancouver Island, *S. vicinum* is usually the last libellulid to

emerge in the summer and the last to disappear in the autumn.

Discussion

The trends in dragonfly biogeography on eastern Vancouver Island are exemplified at Hamilton Marsh. The region is a crossroads of a number of faunal elements: Boreal, Cordilleran, Austral, and Widespread North American. Seldom in British Columbia does a locality support almost equal numbers of boreal and austral species; at Hamilton Marsh there are eight boreal and six austral species recorded. Other unusual mixes include some cordilleran and austral species; for example, here, unlike elsewhere, it is common to see the Cordilleran species *Somatochlora semicircularis* flying with the Austral species *Pachydiplax longipennis* and *Erythemis collocata*. *Aeshna tuberculifera* (Transition element) is rarely seen with the southern-ranging *Sympetrum illotum* (Cordilleran element). As far as Odonata are concerned, the marsh's value lies in the diversity of these geographical elements that it supports as well as its relative rarity as a peatland habitat on the dry east side of the Island.

The marsh harbours three species on the provincial Blue List (indigenous species particularly sensitive to human activities or natural events but not endangered or threatened) — *Pachydiplax longipennis*, *Erythemis collocata* and *Sympetrum vicinum*. Although these species are not uncommon at the localities where they live on the BC south coast, their distributions are restricted and the majority of the small lakes and ponds where they occur are susceptible to destruction or modification. *Pachydiplax* and *Erythemis* are not uncommon at Hamilton Marsh, but *S. vicinum* is rare.

Although it has been removed from the provincial Blue List because of many recent locality additions in the central interior of BC, *Aeshna tuberculifera* is still known only from a few peatland sites on Vancouver Island. Hamilton Marsh has perhaps the largest population of the known localities in the province.

Lestes forcipatus can be as abundant as *L. disjunctus* in some cold fen habitats in BC, but generally is much less common than its close relative. *L. forcipatus* has been collected at only

three localities on Vancouver Island; Hamilton Marsh is by far the best place to find this damselfly on the BC coast. Both species can occur at the same site; SIMAIKA & CANNINGS (2004) successfully differentiated the males of the species for easier identification in the field. SIMAIKA (2005) subsequently attempted to differentiate the microhabitats used by the species (see also CANNINGS & SIMAIKA 2005).

The totals of 33 species and 14 genera known from Hamilton Marsh will certainly be increased with further study; several species, even some common ones, known from the region still have not been found at the site. Species expected, but not yet recorded, include: *Lestes unguiculatus* Hagen, *Amphiagrion abbreviatum* (Selys), *Aeshna juncea* (Linnaeus) *A. umbrosa* Walker, *Epitheca spinigera* (Selys), *Somatochlora walshii* (Scudder), *Leucorrhinia glacialis* Hagen, *L. intacta* (Hagen), *Plathemis lydia* (Drury), *Sympetrum costiferum* (Hagen) and *S. madidum* (Hagen). Other species that lack suitable habitat for breeding in the marsh proper, but may wander in from nearby, include *Aeshna sitchensis* Hagen, *Cordulegaster dorsalis* Hagen and *Somatochlora minor* Calvert.

Until the mid-1900s, the basin was filled with open water and was mostly a forest lake (COUSENS et al., 1996). Many of the dragonfly species recorded in the marsh today would have been absent from such a habitat. In this open water habitat with a different shoreline structure, lake species such as *Aeshna eremita*, *A. palmata* and *Cordulia shurtleffii* would have been more common; *Somatochlora albicincta* may have been present. The accumulation of peat and the extensive floating mats of *Comarum palustre* and *Menyanthes trifoliata* are ideal for colonization by *A. tuberculifera*, *A. canadensis* and *Pachydiplax longipennis*. Finally, with continued succession to a sedge-dominated fen-like habitat, *Somatochlora semicircularis* and *Lestes forcipatus* would have colonized the marsh. The succession of the basin into a marsh with some fen characteristics has likely increased the diversity of the Odonata community. The future succession of the plant communities at Hamilton Marsh will affect the present dragonfly fauna. Species such as *Pachydiplax*

longipennis and *Leucorrhinia proxima* prefer habitats with open water. With continued peat build-up, the marsh will probably become more fen-like and, if irrigation use and climate warming increase, the reduced flow of water may promote even stronger peatland characteristics to develop. Such a future would favour species such as *Aeshna sitchensis* and *A. subarctica*.

Hamilton Marsh is currently owned by Timberland Inc. The company intends to cut the second-growth forest surrounding the wetland in the near future. However, there is public opposition to this decision and, since the 1980s, interest in protecting the wetland has strengthened. Should the forest surrounding Hamilton Marsh be logged, the dragonfly fauna may be affected, especially through changes in water levels and water flow. Ongoing monitoring of the site should be undertaken to assess any changes in dragonfly populations.

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