

Use of a Marsh Dominated by the Introduced European Lake Sedge, *Carex acutiformis*, by Highly Localized Native Butterflies

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Catling, Paul M., and Brenda Kostiuk. 2014. Use of a marsh dominated by the introduced European Lake Sedge, *Carex acutiformis*, by highly localized native butterflies. *Canadian Field-Naturalist* 128(4): 358–362.

To determine whether native butterflies had colonized a marsh in Ottawa that was entirely dominated by the invasive alien European Lake Sedge (*Carex acutiformis*), we surveyed two adjacent stands of the sedge and surrounding habitats. Dion Skipper (*Euphyes dion*), Mulberry Wing (*Poanes massasoit*), Broad-winged Skipper (*P. viator*), and browns (*Lethe* spp.) were all abundant in the introduced sedge, but absent from surrounding habitats. This is the first report of the use of invasive-dominated wetland by native Canadian butterflies. Reduced nectar resources because of dominance of the invasive species over native nectar-producing plants did not prevent significant colonization. The known restriction of the butterflies to native Lakebank Sedge (*Carex lacustris*) as a larval host plant, but its absence in the area, coupled with dominance of its close relative, European Lake Sedge, provides strong circumstantial evidence of the use of the latter as larval food. This report doubles the number of recently localized native butterflies that have been able to increase their distribution by switching to habitat dominated by invasive plants.

Key Words: Ottawa; invasive alien; European Lake Sedge; *Carex acutiformis*; larval food plant; *Euphyes dion*; *Poanes massasoit*; *Poanes viator*; *Lethe eurydice*; localized butterflies; invasive management; food plant switch

Introduction

Invasive alien plants destroy habitat for butterflies and other native insects by displacing specific food plants. The invasion by Scotch Broom (*Cytisus scoparius* [L.] Link) in southeastern Vancouver Island provides a good example (Baron and Backhouse 1999). On the other hand, invasive plants have vastly increased the abundance of some native insect species that were rare and local only a few decades ago (Catling *et al.* 1998). In all cases of beneficial effects of invasive alien species, which are often dominant, the habitats have been disturbed, early successional or both (e.g., roadsides, old fields).

In the Stony Swamp Conservation Area west and southwest of Bells Corners in the city of Ottawa, an extensive area of sedge marsh is entirely dominated by the invasive alien, European Lake Sedge (*Carex acutiformis* Ehrh.) with scattered trees of Eastern White Cedar (*Thuja occidentalis* L.), Red Maple (*Acer rubrum* L.), and Ash (*Fraxinus* sp.). On 22 July 2013, we noticed that the native North American Dion Skipper butterfly (*Euphyes dion* [W. H. Edwards, 1879]) was common and widespread in this marsh (Figure 1). Use of invasive-dominated wetland by localized (sedentary) native butterflies had not been reported previously. To evaluate the extent of the use of this wetland by the skipper and other marsh butterflies, we completed a short survey, the results of which are reported here.

Study Area

The main marsh, stand 1, is approximately 4.2 ha in extent and is located at 45.3143, -75.8516 in the city of

Ottawa. Bounded by Robertson Road on the north and the Trans Canada Trail on the south, it is situated on a plateau of sandstone where water levels were apparently raised leading to the death or partial death of cedar woods and the submergence of open mesic meadow followed by colonization by the European Lake Sedge. The adjacent stand 2, to the north across Robertson Road, at 45.31440, -75.85337, has a treeless open part which is 0.1 ha. It has apparently also undergone an increase in water level and is equally dominated by European Lake Sedge as is the understory of the surrounding ash swamp. The dominance of the introduced sedge in these two adjacent stands is remarkably complete. The plants form a thick thatch of dead material along with dense leaves that reach a height of 1–1.5 m and exclude most light. Indeed over the entire area any other graminoid is extremely rare and other herbs (mostly ferns) account for less than 0.1% of the cover (Catling and Kostiuk 2003, Table 1). The marsh is sometimes dry for much of the year, but filled with water to a depth of 20 cm in spring and early summer.

Methods

To determine the extent to which native butterflies were localized in the area of the introduced sedge, we surveyed the two stands as well as adjacent areas to the north, south, east, and west. This survey was carried out on 24 July 2013 between 10:30 a.m. and 2 p.m.; the temperature was 18–22°C. Half an hour was spent at each of six sampling sites and approximately equal areas of 1.2 ha were sampled at each site. To the north of the European Lake Sedge stands are areas of marsh



FIGURE 1. Extensive marsh in Ottawa dominated by European Lake Sedge (*Carex acutiformis*). Inset: male Dion Skipper (*Euphyes dion*) on leaf of European Lake Sedge. Photo: P. M. Catling.

TABLE 1. Vascular plants, by frequency and percentage cover, recorded in 645-m² plots along transects through an open wetland dominated by European Lake Sedge (*Carex acutiformis*), near Bells Corners, Ottawa. Cover is the percentage of leaf surface in 1 m² of ground surface; thus, 200% means that 1 m² of ground contains 2 m² of leaf surface.

Species	Frequency (%)	Cover (%)
European Lake Sedge, <i>Carex acutiformis</i> Ehrh.	100	200
Reed Canary Grass, <i>Phalaris arundinacea</i> L.	1.70	0.79
Marsh Fern, <i>Thelypteris palustris</i> Schott var. <i>pubescens</i> (Lawson) Fernald	1.24	0.12
Five-leaved Virginia Creeper, <i>Parthenocissus quinquefolia</i> (L.) Planchon ex DC.	1.08	0.10
Red-osier Dogwood, <i>Cornus sericea</i> L.	0.46	0.04
White Elm, <i>Ulmus americana</i> L.	0.15	0.77
White Birch, <i>Betula papyrifera</i> Marshall	0.15	0.77
Willowherb, <i>Epilobium</i> sp.	0.15	0.15
Crested Wood Fern, <i>Dryopteris cristata</i> (L.) A. Gray	0.15	0.01
Common Elderberry, <i>Sambucus canadensis</i> L.	0.15	0.10
Sensitive Fern, <i>Onoclea sensibilis</i> L.	0.03	0.03
Northern Lady Fern, <i>Athyrium filix-femina</i> (L.) Mertens var. <i>angustum</i> (Willdenow) G. Lawson	0.03	0.10

Source: Catling and Kostiuk 2003.

dominated (98%) by Broadleaf Cattail (*Typha latifolia* L.), Reed Canary Grass (*Phalaris arundinacea* L.), and Purple Loosestrife (*Lythrum salicaria* L.) and woodlands. To the south, on the south side of the Trans Canada Trail is marsh strongly dominated by Reed Canary Grass and woodland. To the west on higher ground were dry, open meadows and semi-open woodlands of Jack Pine (*Pinus banksiana* Lamb.), Sugar Maple (*Acer saccharum* Marsh.) and Eastern White Cedar. The meadows were dominated by Awnless Brome (*Bromus inermis* Leyss.), Poverty Oatgrass (*Danthonia spicata* [L.] Beauv. Ex Roem. & Schult.), White Bed-

straw (*Galium album* Mill.), Early Goldenrod (*Solidago juncea* Aiton), Tufted Vetch (*Vicia cracca* L.) and Oregano (*Origanum vulgare* L.). The east side was largely woodland with few open areas.

The list of species found (Table 2) underestimates the numbers, because any individuals that could not be accurately identified were not listed. Close-focus binoculars were helpful, and some species were confirmed after capture in nets. Care was taken not to count an individual twice by noting direction of flight and moving quickly along the census path.

TABLE 2. Butterflies recorded in a survey of six adjacent areas in a marsh in Ottawa on 24 July 2013. Numbers are underestimates, because individuals that could not be accurately identified were omitted and extra care was taken not to count an individual twice by noting direction of flight and moving quickly along the census path.

Species	Stand 1	Stand 2	North	South	East	West
Delaware Skipper, <i>Anatrytone logan logan</i> (W. H. Edwards 1863)	2	—	—	—	—	—
Common Wood Nymph, <i>Cercyonis pegala nephele</i> (W. Kirby 1837)	—	—	1	—	5	7
Clouded Sulphur, <i>Colias philodice</i> (Godart 1819)	—	—	—	—	1	1
Dion Skipper, <i>Euphyes dion</i> (W. H. Edwards 1879)	23	6	—	—	—	—
Dun Skipper, <i>Euphyes vestris metacomet</i> (T. Harris 1862)	—	2	2	—	2	14
Northern Pearly-eye, <i>Lethe anthedon</i> (A. Clark 1936)	—	—	—	—	—	3
<i>Lethe eurydice</i> (L.), Eyed Brown	1	—	—	—	—	—
<i>Lethe</i> spp.	7	3	—	—	1	—
Viceroy, <i>Limenitis archippus archippus</i> (Cramer 1775)	—	1	3	—	—	—
Pearl Crescent, <i>Phycioides tharos tharos</i> (Drury 1773)	—	—	1	—	—	2
Cabbage White, <i>Pieris rapae</i> (L.)	1	1	2	1	1	1
Mulberry Wing, <i>Poanes massasoit</i> (Scudder 1863)	7	3	—	—	—	—
Broad-winged Skipper, <i>Poanes viator</i> (W. H. Edwards 1865)	5	2	—	—	—	—
Eastern Comma, <i>Polygonia comma</i> (T. Harris 1842)	—	—	—	—	1	1
Hickory Hairstreak, <i>Satyrrium caryaeorum</i> (McDunnough 1942)	—	—	—	—	—	1
Great Spangled Fritillery, <i>Speyeria cybele cybele</i> (Fabricius 1775)	2	1	1	1	3	4

Results

The survey revealed 15 species of butterflies (Table 2). Recording of *Lethe* species was confused in the field and the only voucher specimen retained was referable to Eyed Brown (*L. eurydice* [L.]). We have listed the *Lethe* species as one *eurydice* and 11 *Lethe* sp. We believe that the largest source of error occurred with the Dion Skipper, and we suspect that the actual numbers of this fast-flying species were up to twice those recorded because individuals were difficult to observe in waving beds of sedge. The data for other species and other habitats are thought to be reliable. Although the surrounding habitats were not highly productive on the day in question, there are some definite patterns of restriction (Table 2). Mulberry Wing (*Poanes massasoit* [Scudder, 1863]), Broad-winged Skipper (*Poanes viator* [W. H. Edwards, 1865]), browns (*Lethe* sp.) and Dion Skipper were all abundant in the introduced sedge but absent in surrounding habitats. Common Wood-

nymph (*Cercyonis pegala nephele* [W. Kirby, 1837]) and Dun Skipper (*Euphyes vestris metacomet* [T. Harris, 1862]) were abundant in field habitats to the east and west, but mostly absent from the marshes.

Discussion

Wetland: a new invasive habitat

Habitats dominated by invasive alien species that are used by more or less sedentary eastern Canadian butterflies (Table 3) include weedy, disturbed areas; old fields; woody second growth; and roadsides. This report is the first case of the use of an invasive-alien-dominated wetland by native Canadian butterflies that have a reputation for sedentary behaviour and are widely reported to be highly localized.

A similar situation occurs in the coastal marshes in New Jersey, where later instar larvae of the Rare Skipper (*Problema bulenta* [Boisduval and Le Conte, 1837]) have been found on Common Reed (*Phrag-*

TABLE 3. Localized native eastern Canadian butterflies that have expanded locally or broadly by switching to habitat dominated by an invasive alien plant that, in most cases, serves as larval food.

Species	Introduced food plant and/or community dominant
Henry's Elf, <i>Callophrys henrici</i> (Grote and Robinson 1867)	Glossy Buckthorn <i>Frangula alnus</i> P. Mill. L. (Catling <i>et al.</i> 1998)
Common Ringlet, <i>Coenonympha tullia inornata</i> (W. H. Edwards 1861)	Kentucky Bluegrass, <i>Poa pratensis</i> L. (Eberlie and Hess 1980)
Eastern Tailed Blue, <i>Cupido comyntas</i> (Godart 1824)	Clovers (Layberry <i>et al.</i> 2014)
Wild Indigo Duskywing, <i>Erynnis baptisiae</i> (W. Forbes 1936)	Crownvetch, <i>Securigera varia</i> (L.) Lassen (Layberry <i>et al.</i> 2014)
Dion Skipper, <i>Euphyes dion</i> (W. H. Edwards 1879)	Lesser Pond Sedge, <i>Carex acutiformis</i> Ehrh. (this article)
Silvery Blue, <i>Glaucopteryx lydamus couperi</i> (Grote 1873)	Alfalfa, vetches, clovers (Catling and Layberry 2013)
Browns, <i>Lethe</i> spp. including <i>L. eurydice</i> (L.)	Lesser Pond Sedge (this article)
Mulberry Wing, <i>Poanes massasoit</i> (Scudder 1863)	Lesser Pond Sedge (this article)
Broad-winged Skipper, <i>Poanes viator</i> (W. H. Edwards 1865)	Lesser Pond Sedge (this article)

mites australis [Cav.] Trin. ex Steud.; Chazal and Hobson 2002), presumably the introduced subspecies *australis*, which dominates some of these marshes (P. Catling personal observation). The strong association of the Broad-winged Skipper with wetlands dominated by Common Reed in New England (Nakamura and Cooper 2005; Stichter 2014) provides another example since it is the European subspecies *australis* that dominates these wetlands (personal observation).

A significant addition to recently localized occupants of invasive habitat

Many butterflies native to Canada switched to introduced plants as larval food before 1900 and have always been considered widespread. Examples included the Black Swallowtail (*Papilio polyxenes* Fabricius, 1775) feeding on Queen Anne's Lace (*Daucus carota* L.), the Clouded Sulphur (*Colias philodice* Godart, 1819) feeding on Alfalfa (*Medicago sativa* L.), the American Copper (*Lycaena phlaeas* [Linnaeus, 1761]) feeding on Sheep Sorrel (*Rumex acetosella* L.), and the Silver Spotted Skipper (*Epargyreus clarus* [Cramer, 1775]) feeding on Black Locust (*Robinia pseudoacacia* L.). Any of these may have been rare and local, but their switch to introduced species occurred so early in the settlement period that their original distributions and food plants were not recorded and remain a mystery.

In other cases, the switch to a new larval food has been more recent, has involved previously localized species, and has sometimes been accompanied by substantial range expansion. Examples include the increase in Henry's Elfin (*Callophrys henrici* (Grote and Robinson) in Eastern Ontario accompanying the invasion of Glossy Buckthorn (*Frangula alnus* P. Mill., Catling *et al.* 1998) and the similar effect of introduced legumes on the Silvery Blue (*Glaucopteryx lygdamus couperi* Grote, Catling and Layberry 2013; Layberry *et al.* 2014). A switch in food source and spread has been recent in some cases. For example the Wild Indigo Duskywing (*Erynnis baptisiae* (Forbes)) has only recently adopted introduced Purple Crown-Vetch (*Coronilla varia*) and areas dominated by it along highways in eastern Canada (personal observation), although its use of Purple Crown-Vetch in the United States dates back to 1979 (Shapiro 1979). Other Hesperidae, such as the Hobomok Skipper (*Poanes hobomok* [T. Harris, 1862]), Long Dash (*Polites mystic* [W. H. Edwards, 1863]), Peck's Skipper (*P. peckius* [W. Kirby, 1837]), and Tawny-edged Skipper (*Polites themistocles* [Latreille, 1824]), may have switched to introduced Kentucky Bluegrass (*Poa pratensis* L.) as larval food and colonized areas dominated by it long ago, but information is lacking. Some species of *Erynnis* may also have switched to invasive clovers, but information in eastern Canada is incomplete. Regardless, the four new species occupying wetlands strongly dominated by an

invasive plant almost doubles the number of localized butterflies that have recently switched to invasive habitats (Table 3).

Although races that have switched to non-native larval food plants may be much less sedentary than those confined to the native food plants from which they developed, many are still more localized than wandering. This requires more study, but clearly rare and local species have increased and in some cases become widespread and abundant by using an invasive plant habitat.

Potential use of European Lake Sedge as a larval food plant

The butterfly species found to be confined to the invasive-dominated marsh are often very localized and do not wander far from the native broad-leaved sedges that serve as their larval food plant (P. Catling personal observation; Layberry *et al.* 1998). As no native sedges were available in the marsh surveyed, it seems likely that European Lake Sedge was used by larvae as a food plant. Dion Skipper, Broad-winged Skipper, and Appalachian Brown are all reported to use the native Lakebank Sedge (*Carex lacustris* Willd.) as larval food (Layberry *et al.* 1998); Lakebank Sedge is closely related to the introduced European Lake Sedge (Reznicek and Catling 2002). This is the first circumstantial evidence of the use of an introduced sedge as larval food by native Canadian butterflies.

Limitations of domination by European Lake Sedge

In the marsh surveyed, nectar-producing herbs were rare and evidently outcompeted by European Lake Sedge. Swamp Milkweed (*Asclepias incarnata* L.) was sparse over the entire area, but its flowers were much visited by Dion Skippers, Mulberry Wings, and Broad-winged Skippers. Nectar may be a limiting factor, but the apparently high abundance of butterflies indicates that this has not prevented colonization.

Conclusions

We report for the first time the use of wetlands dominated by an invasive alien plant species by native Canadian butterflies with a reputation for sedentary behaviour. Our observations have almost doubled the number of butterfly species that have been able to increase their distribution by switching to habitat dominated by invasive plants. There is circumstantial evidence of the use of an introduced sedge species as larval food by native Canadian butterflies. Limited nectar resources resulting from invasive dominance over native nectar-producing plants did not prevent significant colonization by localized native butterflies.

A number of aspects require further study, including the impact of limited nectar resources, precise determination of the *Lethe* species present in the marsh, and proof of the use of European Lake Sedge as a larval food plant.

Acknowledgements

Ross Layberry and Peter Hall provided helpful reviews of this report. Don Lafontaine kindly checked the identification of voucher specimens.

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Received 28 January 2014

Accepted 13 March 2014