

An Investigation of Odonata in Vermont Rivers and Peatlands



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Front Cover: *Somatochlora elongata* (Ski-tailed Emerald), associated with fens and related slow-moving outlets and streams. Vermont Rank: S3

Back Cover: *Enallagma antennatum* (Rainbow Bluet), widely scattered at five known sites in Vermont, either lakes, reservoirs, ponds or slow-moving rivers. Vermont Rank: S2S3.

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Table of Contents

INTRODUCTION	1
METHODS	1
Survey Site Selection	1
Sites and Site Visits	2
Specimen and Data Collection	4
RESULTS	5
Highlights of Results	7
Results in Details – Species Accounts	7
DISCUSSION	13
REFERENCES	15
ACKNOWLEDGEMENTS	16
APPENDICES	
Appendix A: Project Sites	17
Appendix B: Species Encountered During the Project	22
Appendix C: State Ranking of Vermont Odonata	23
FIGURES	
Figure 1: Site Distribution (By Biophysical Region)	3
TABLES	
Table 1: Target Species	5
Table 2: Target Species Segregated by Habitat Type	6
Table 3: Other SGCN Encountered During the Project	6

INTRODUCTION

Dragonflies and damselflies (order Odonata) are among well-established indicators for the quality of aquatic natural communities and indicators of climate disruption (Hickling, 2005). They are even receiving attention from recreational wildlife enthusiasts. The State of Vermont, adjoining states and their citizens have demonstrated a growing interest in the distribution and abundance of Odonata. The Vermont Wildlife Action Plan (Kart, 2005) includes Odonata as a priority insect order among its invertebrate analyses and designation of Species of Greatest Conservation Need (SGCN).¹ In its “Invertebrate Research and Monitoring Needs” section,² the Wildlife Action Plan recognizes the need to obtain baseline distributional and abundance data for SGCN by conducting surveys throughout the state.

To that end, with funding from the State Wildlife Grant program, the Vermont Fish and Wildlife Department contracted Wings Environmental (its principal field investigator being Bryan Pfeiffer) to document the distribution of odonate³ SGCN in two priority habitats: peatlands and rivers. Peatlands and rivers were selected owing to their relative abundance of odonate SGCN and a general lack of knowledge of their respective odonate fauna in Vermont.

Of the 42 Vermont odonate SGCN, 27 fell under the scope of this project.⁴ As a result, this project has expanded knowledge of odonate distribution in Vermont and will help establish baseline information for population trend monitoring, as identified in various sections of the Wildlife Action Plan, and other conservation needs. It should be noted, however, that much work remains in order to gain a sufficient understanding of the distribution and abundance of Odonata (and most other insect orders) in Vermont.

METHODS

The broad scope of this project – surveys in varied peatlands and rivers – mandated intelligent choices about survey site selection. Potential sites in Vermont are vast and numerous. The intent, therefore, was to conduct field surveys in significant and representative peatlands and rivers.

Survey Site Selection

Prior to field work, a site-selection review relied upon various data sources, personal experience and communications with entomologists, botanists and other scientists. These resources included:

- ◆ **Vermont Nongame and Natural Heritage Peatland Data and Personnel** – For peatland location, type, hydrology and ownership.

¹ The Wildlife Action Plan defines SGCN this way: “...wildlife with declining populations; wildlife that are threatened or potentially threatened; and, wildlife that are so little known in the state that experts cannot yet ascertain their status.”

² page 4:23:3

³ The term “odonate” is widely used to describe members of the order Odonata – dragonflies and damselflies. The terms odonate and Odonata are used interchangeably in this report.

⁴ The Vermont Wildlife Action Plan lists 42 as Species of Greatest Conservation Need (32 Anisoptera and 10 Zygoptera). One listed SGCN, *Lestes disjunctus australis*, was subsequently determined to have no known occurrences in Vermont. Additionally, one species, *Somatochlora minor*, was inexplicably omitted from the Wildlife Action Plan but nonetheless included as a target peatland species in this investigation.

- ◆ **Geographic Information System (GIS)** – The Vermont Nongame and Natural Heritage Peatland Data layers were combined with US Geological Survey topographic maps and digital orthophotos for pre-visit site scrutiny.
- ◆ **Vermont Biomonitoring and Aquatic Studies Section** – Odonate data, primarily from lotic habitat surveys for macroinvertebrates, were used to identify significant and promising river sites.
- ◆ **US Geological Survey Stream Gauge Data** – Online, current-time stream flow data helped in river site visit timing.
- ◆ **Other Scientists** – Advisory scientists on this project included a fluvial geomorphologist, two botanists, various experts in Vermont’s natural community types and distribution, and several professional odonatologists.

Sites and Site Visits

Survey sites in this investigation are generally classified as peatlands and rivers. These comprise the vast majority of field visits. Neither transects nor point counts were employed because the intent of this investigation – essentially presence or absence of odonate SGCN – required sampling flexibility to account for microhabitat and other variable conditions encountered at many sites. A generalized view of sites is presented in Figure 1. A list of all sites visited for this project is included in Appendix A.

Peatland Sites and Peatland Site Visits

A variety of peatlands in most of Vermont’s biophysical regions comprise the peatlands portion of this investigation. Peatlands are represented by the following natural communities (Thompson and Sorenson, 2000): woodland spruce bog; spruce shrub bog; rich, intermediate and poor fens; black spruce-tamarack swamp.

This project included 73 site visits by the principal investigator to 46 peatland sites – 30 bogs and 16 fens.⁵ Among the more significant peatland sites were extensive bog and fen complexes in the Nulhegan Basin and the Peacham Bog area of Caledonia County.

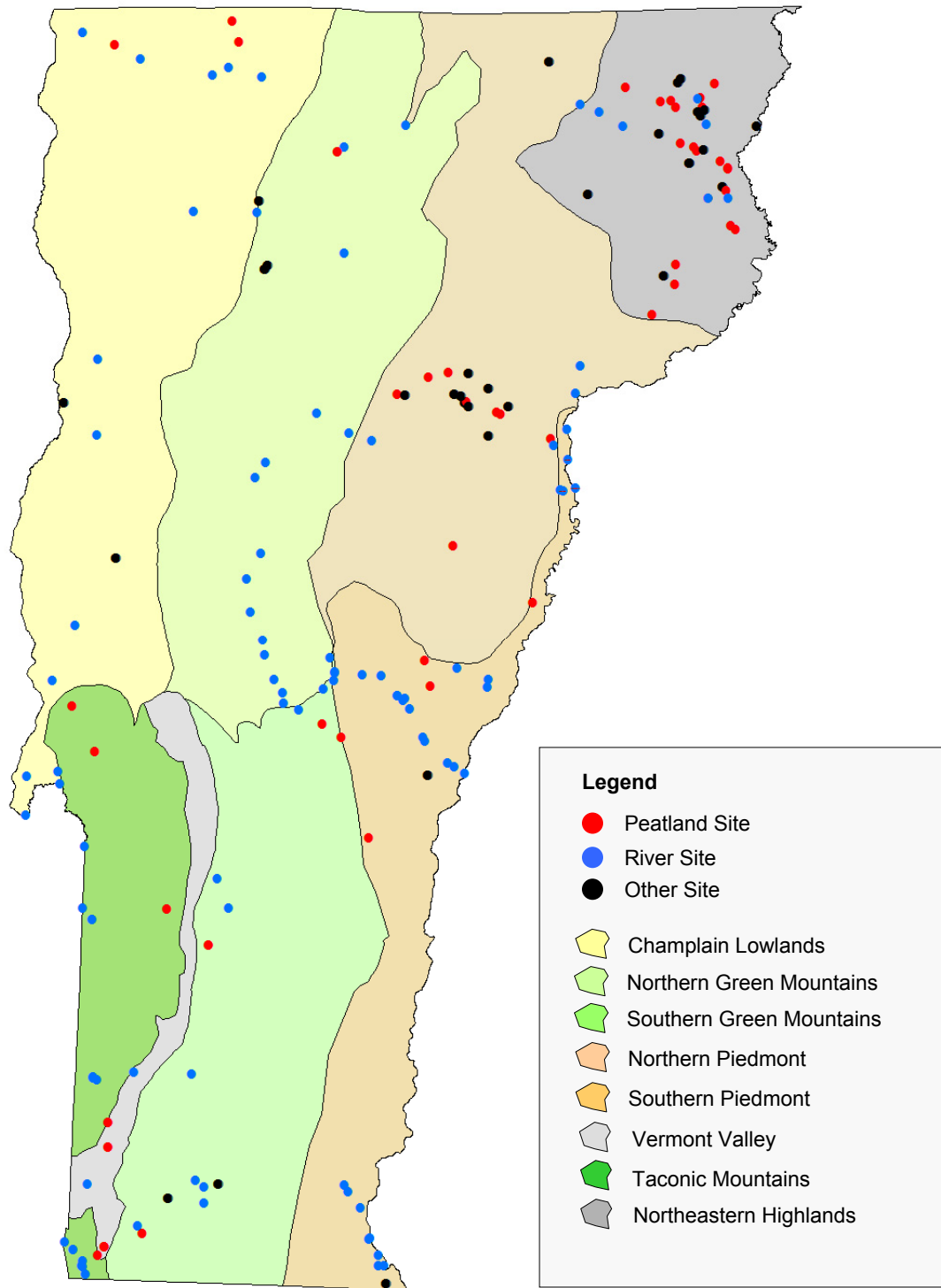
Odonate species have distinct flight periods. Multiple visits to peatland sites were spaced to account for likely target species and their known flight periods in Vermont or at similar latitudes. Peatland visits generally involved searching representative areas, such as dry and saturated areas of *Sphagnum* spp., bog pond edges, and adjacent woodland openings. In most cases, adult odonates were netted and identified in the field during peatland site visits. Specimens were collected in some instances (e.g. new state or county records or a need to confirm identification in the lab). The sampling season for peatlands generally ran from 15 April to 15 September during each year of the project.

River Sites and River Site Visits

River sites in most of Vermont’s biophysical regions comprise the rivers portion of this investigation. The term “river” is used to describe sites generally known as rivers, streams or brooks – a channel between defined banks known to contain flowing water continuously in most years. River sites ranged in size from the Connecticut River to unnamed brooks, although larger rivers had priority because they are believed to be habitat for a relatively high proportion of Vermont odonate SGCN.

⁵ Other in-kind investigators made approximately additional 23 site visits to 13 peatland sites (eight bogs and five fens).

Figure 1. Site Distribution (By Biophysical Region)



This investigation included a total of 58 site visits by the principal investigator to 54 sites on 23 rivers.⁶ Significant rivers included the Connecticut River, the White River, the Lamoille River and Otter Creek. A relatively large portion of the river sites are in southern Vermont because of a suspected high relative number of river SGCN in that region.

A typical river visit included: walks of 50 meters or more along the river bank, longer paddles on a stretch of river, and wading into a river where promising and possible. A sizeable portion of river visits involved searches for larvae or exuviae. In most cases, this is a more efficient means for determining river species diversity and abundance because adults of many river species are difficult to locate and capture. For most species or genera (e.g. *Ophiogomphus* spp.) exuviae were collected for later determination in the lab. The sampling period for rivers generally ran from 1 May to 15 September during each year of the project.

Additional Sites and Site Visits

Certain river and peatland SGCN spend time away from their natal sites. *Williamsonia* spp. and *Somatochlora* spp., for example, spend a significant portion of their early adult life stages away from peatlands and in nearby woodland clearings. For some species (e.g. *Somatochlora albicincta* and *S. cingulata*), preferred habitats included acidic ponds and pond edges rather than bogs or fens. As a result, this investigation includes visits to sites that are neither rivers nor peatlands: 32 visits to 28 additional sites not listed above.

Specimen and Data Collection

The principal goal of this investigation was to gather as much data as possible on river and peatland SGCN. As a result, the investigator, during site visits, focused almost exclusively on target species and, in the interest of maximizing the benefits of field time, overlooked other more common species. A list of all odonate species encountered during the course of this investigation is included in Appendix B, however, it should be recognized as a purposely incomplete assessment of all species associated with peatland and river sites; it also includes species that are more typical of sites other than rivers or peatlands.

Upon completion of each site visit, data were entered into a Microsoft Access database maintained by Wings Environmental. Additional data from other investigators is housed in a similar database maintained by Dr. Michael Blust, one of the principal in-kind collaborators for this project. Similarly, specimens collected as part of this investigation are housed in the collections of Wings Environmental and Dr. Blust. Finally, data from Wings Environmental and Dr. Blust (and other investigators) were consolidated into Dr. Blust's database.

⁶ Other in-kind investigators made approximately 30 site visits to 34 river sites.

RESULTS

Vermont is known to have 142 regularly, rarely or accidentally occurring species of Odonata – 98 Anisoptera (dragonfly) species and 44 Zygoptera (damselfly) species.⁷ Of the 42 odonate SGCN, this investigation designates 27 as targets, meaning they are either peatland or river species. Of those 27 species, this investigation encountered 20 during field work, or 74 percent of the target species. All are presented in Table 1. Table 2 presents the same species but segregated as either peatland or river species. Finally, Table 3 presents three additional SGCN, neither river nor peatland species but normally associated with lakes and ponds, that were encountered during the course of this investigation.

Table 1: Target Species

Scientific Name	Common Name	Rank	Encountered During Project
<i>Hetaerina americana</i>	American Rubyspot	S2S3	x
<i>Argia apicalis</i>	Blue-fronted Dancer	S3	
<i>Coenagrion interrogatum</i>	Subarctic Bluet	SH	
<i>Enallagma antennatum</i>	Rainbow Bluet	S2S3	x
<i>Aeshna sitchensis</i>	Zigzag Darner	SU	
<i>Aeshna subarctica</i>	Subarctic Darner	S1	
<i>Gomphaeschna furcillata</i>	Harlequin Darner	S2S3	x
<i>Gomphus abbreviatus</i>	Spine-crowned Clubtail	S1S2	x
<i>Gomphus quadricolor</i>	Rapids Clubtail	S2	x
<i>Gomphus vastus</i>	Cobra Clubtail	S1	
<i>Gomphus ventricosus</i>	Skillet Clubtail	S1	
<i>Ophiogomphus aspersus</i>	Brook Snaketail	S4	x
<i>Ophiogomphus carolus</i>	Riffle Snaketail	S4S5	x
<i>Ophiogomphus mainensis</i>	Maine Snaketail	S3	x
<i>Ophiogomphus rupinsulensis</i>	Rusty Snaketail	S3?	x
<i>Stylurus amnicola</i>	Riverine Clubtail	S1	x
<i>Stylurus scudderii</i>	Zebra Clubtail	S3S4	x
<i>Neurocordulia yamaskanensis</i>	Stygian Shadowdragon	S3	x
<i>Somatochlora albicincta</i>	Ringed Emerald	S1	x
<i>Somatochlora cingulata</i>	Lake Emerald	S1S2	x
<i>Somatochlora elongata</i>	Ski-tailed Emerald	S3	x
<i>Somatochlora forcipata</i>	Forcinate Emerald	S2S3	x
<i>Somatochlora franklini</i>	Delicate Emerald	S1S2	x
<i>Somatochlora kennedyi</i>	Kennedy's Emerald	S1S2	x
<i>Somatochlora minor</i>	Oscellated Emerald	S2	x
<i>Williamsonia fletcheri</i>	Ebony Boghaunter	S1S2	x
<i>Sympetrum danae</i>	Black Meadowhawk	S2S2	

⁷ Five of these species, including two SGCN, have an S-rank designation of SNA owing mostly to a lack of incontrovertible evidence.

Table 2: Target Species Segregated By Habitat Type

River Species		
Scientific Name	Common Name	Encountered During Project
<i>Hetaerina americana</i>	American Rubyspot	x
<i>Argia apicalis</i>	Blue-fronted Dancer	
<i>Enallagma antennatum</i>	Rainbow Bluet	x
<i>Gomphus abbreviatus</i>	Spine-crowned Clubtail	x
<i>Gomphus quadricolor</i>	Rapids Clubtail	x
<i>Gomphus vastus</i>	Cobra Clubtail	
<i>Gomphus ventricosus</i>	Skillet Clubtail	
<i>Ophiogomphus aspersus</i>	Brook Snaketail	x
<i>Ophiogomphus carolus</i>	Riffle Snaketail	x
<i>Ophiogomphus mainensis</i>	Maine Snaketail	x
<i>Ophiogomphus rupinulensis</i>	Rusty Snaketail	x
<i>Stylurus amnicola</i>	Riverine Clubtail	x
<i>Stylurus scudderii</i>	Zebra Clubtail	x
<i>Neurocordulia yamaskanensis</i>	Stygian Shadowdragon	x
Peatland Species		
<i>Coenagrion interrogatum</i>	Subarctic Bluet	
<i>Aeshna sitchensis</i>	Zigzag Darner	
<i>Aeshna subarctica</i>	Subarctic Darner	
<i>Gomphaeschna furcillata</i>	Harlequin Darner	x
<i>Somatochlora albicincta</i>	Ringed Emerald	x
<i>Somatochlora cingulata</i>	Lake Emerald	x
<i>Somatochlora elongata</i>	Ski-tailed Emerald	x
<i>Somatochlora forcipata</i>	Forcipate Emerald	x
<i>Somatochlora franklini</i>	Delicate Emerald	x
<i>Somatochlora kennedyi</i>	Kennedy's Emerald	x
<i>Somatochlora minor</i>	Oscellated Emerald	x
<i>Williamsonia fletcheri</i>	Ebony Boghaunter	x
<i>Sympetrum danae</i>	Black Meadowhawk	

Table 3: Other SGCN Encountered During the Project

Scientific Name	Common Name
<i>Enallagma vernale</i>	Vernal Bluet
<i>Ischnura kellicotti</i>	Lilypad Forktail
<i>Aeshna verticalis</i>	Green-striped Darner

Highlights of Results

This investigation offers new insights into the distribution of peatland and river odonate SGCN. It reveals newly discovered populations of certain species and expanded knowledge of others. Summarized below are some of more notable results:

- ◆ Informal monitoring of *Hetaerina americana* (S2S3) on two rivers, one of which is being treated with a lampricide to control Sea Lamprey (*Petromyzon marinus*).
- ◆ A new site for *Enallagma antennatum* (S2S3) within the city of Montpelier, indicating that this species may be more common than what is suggested by the five sites from which it is currently known.
- ◆ New encounters with *Gomphus abbreviatus* (S1S2) on two rivers and a moderate gain in the knowledge of *Ophiogomphus* spp. (four species), particularly on the White River.
- ◆ A tremendous gain in knowledge of the distribution of *Stylurus scudderi* (S3S4).⁸ This lotic species may be more secure in Vermont than previously believed.
- ◆ Discovery of at least two previously unknown populations of *Neurocordulia yamaskinensis* (S3) on Vermont rivers. This species had been rarely encountered in Vermont.
- ◆ An expanded knowledge of *Somatochlora* spp. (seven species) distribution in and around peatlands, including *S. albicincta* (S1), *S. cingulata* (S1S2) and *S. franklini* (S1S2). Silvio Conte National Wildlife Refuge and West Mountain Wildlife Management Area have some of the highest *Somatochlora* diversity in New England.
- ◆ Two new peatland sites for *Williamsonia fletcheri* (S1S2). All three of Vermont's known *W. fletcheri* sites are fens currently owned by the Vermont chapter of The Nature Conservancy.
- ◆ One new species was added to the known list of Odonata in Vermont during the course of this investigation – *Enallagma durum* (S1) – on a river in Bennington County. Largely a coastal species, often inhabiting brackish areas of streams and rivers, this damselfly is also known to occur inland in slow waters with emergent plants, the habitat in which it was found in Vermont.
- ◆ Disappointments in these results include the failure to encounter *Coenagrion interrogatum* (SH), a peatland damselfly, at two known historic sites and failure to encounter and learn more about the distribution of *Sympetrum danae* (S1S2), a peatland dragonfly with only three known Vermont sites and scant data.

Results in Detail – Species Accounts

The field work from this investigation comprises the foundation for these findings. It is augmented, however, with Wings Environmental's own historical data as well as historical and current field data gathered by Michael Blust and Kevin Hemeon, principal in-kind contributors to this study. The intent here is to provide the most informed status on odonate SGCN based on the largest available data set. Indeed, a precursor to these

⁸ This ranking, assigned with some hindsight during the course of this investigation, most likely reflects a more secure ranking than what was assumed, but not formally assigned, during the drafting of the Vermont Wildlife Action Plan.

findings was the collaboration by Wings Environmental and Dr. Blust on the state ranking of Vermont odonata species, presented in Appendix C. As a result, the findings below include accounts of each target peatland and river species, even those not encountered during field investigations. Each account includes a distribution and habitat summary; global and national ranking (NatureServe, 2009), Vermont state ranking, and Vermont flight period.

***Hetaerina americana* (Fabricius, 1798) - American Rubyspot**

Known only from two sites: Lewis Creek in the Champlain Lowlands and the West River upstream from its confluence with the Connecticut River. It prefers rivers with emerged rocks and a richly vegetated shoreline, both for perching sites. (Two anomalous, unsubstantiated specimens in the University of Vermont collection are labeled from Grand Isle.) In New England, this species is one of our latest emerging damselflies and is possibly more widespread yet undiscovered owing to its late flight season. The known population on Lewis Creek inhabits a portion of the river treated with lampricide.

Status: G5 N5 S2S3

Flight Range: August 24 - October 5

***Argia apicalis* (Say, 1839) - Blue-fronted Dancer**

A. apicalis is a southern species first recorded in Vermont in 2002. All four known sites in Vermont are in low elevation, slow flowing, silty rivers on or close to the borders of Vermont, and all records are within the middle two of weeks in July. The records from the Poultney River represent the northernmost records of this species in eastern North America.

Status: G5 N5 S3

Flight Range: July 8 - July 23

***Coenagrion interrogatum* (Selys, 1876) - Subarctic Bluet**

Vermont's first evidence of this species came from a single specimen taken in the vicinity of Dennis Pond by a respected odonatologist on 6 July 1975. Additional investigations at the Dennis Pond site, and a nearby bog, over the course of this investigation produced no evidence of the species. On 25 June 2006, while conducting a survey for the Vermont Breeding Bird Atlas, an observer encountered and photographed one male *C. interrogatum* at Lost Pond Bog in Mt. Tabor. One subsequent visit to Lost Pond Bog in 2007⁹ produced no evidence of the species. At the southern edge of its range, this damselfly almost certainly warrants further investigation in Vermont.

Status: G5 N5 SH¹⁰

Flight Range: June 25 – July 6

***Enallagma antennatum* (Say, 1839) – Rainbow Bluet**

At the eastern edge of its United States range, this elegant damselfly is sparsely scattered in Vermont, occurring at roughly five sites, either lakes, ponds or slow-moving rivers. All sites are in relatively low-elevation valleys. A new site for *E. antennatum* within the city of Montpelier (2008) suggests that this species may be more common than currently known. The Connecticut River is the easternmost range for the species in the US (although it is found farther east in Canada).

Status: G5 N5 S2S3

Flight Range: May 31 – July 27

⁹ Visit by Bryan Pfeiffer and Michael Blust.

¹⁰ At the time of its state ranking (SH), the photographic evidence for *C. interrogatum* was unavailable to Vermont investigators. The photo evidence was subsequently produced and confirmed by this study's principal investigator.

***Aeshna sitchensis* Hagen, 1861 – Zigzag Darner**

In the Northeast, Vermont may represent the southernmost extent of this boreal dragonfly. It is known in Vermont from a lone report from a respected biologist at a bog-fen complex in the town of Ferdinand in the state's Northeastern Highlands. As a result, it is unknown whether this species has a breeding population in Vermont.

Status: G5 N3 SU

Flight Range: Unavailable

***Aeshna subarctica* Walker, 1908 – Subarctic Darner**

Near the southern end of its range in Vermont, this boreal species is known from only two records: one at a spruce bog in the Northeast Highlands (2003) and the other from a grassy opening at 825 meters in elevation at the top of a ski lift in the Green Mountains (2004). No peatland associated with this latter record has been identified. Additional investigation may yet reveal more sites for *A. subarctica* in Vermont. True to the nature of this species (T. Donnelly, pers. comm.), individuals encountered at the bog site seemed to prefer areas with saturated *Sphagnum*.

Status: G5 N2 S1

Flight Range: September 10 – September 27

***Gomphaeschna furcillata* (Say, 1839) – Harlequin Darner**

This species appears scattered in primarily peatland sites across the state. Encounters with it were mostly one or two individuals at any given site. Members of this family (Aeshnidae) can travel substantial distance from natal sites. And it is by no means solely a peatland species. Most occurrences were in the Nulhegan Basin in Vermont's Northeastern Highlands, with a pocket of reports from Rutland County. Although encounters away from bogs are few, the Vermont data suggests that it may occur in hardwood swamps and fens as well.

Status: G5 N5 S2S3

Flight Range: June 14 – July 5

***Gomphus abbreviatus* Hagen in Selys, 1878 – Spine-crowned Clubtail**

Small and stocky, *G. abbreviatus* is limited to but a few sites in western Rutland County (Poultney and Hubbardton rivers) and one site on the Connecticut River below Vernon Dam. With limited data, and variability in each known site (riffle area or a slow-and-mucky section of stream, or a large river) habitat preferences in Vermont would be difficult without additional encounters. *G. abbreviatus* can be locally common, with collection of exuviae during early stages (late May) of its flight period the most reliable survey method. One speculation: although egg-laying appears to be in riffle areas, larvae may drift downstream into mucky areas for emergence.

Status: G3G4 N3N4 S1S2

Flight Range: June 2 – June 13

***Gomphus quadricolor* Walsh, 1863 – Rapids Clubtail**

G. quadricolor does not quite live up to its common name in Vermont. Like *G. abbreviatus*, it is known from few sites on the Poultney and Hubbardton rivers in western Rutland County, one outlying site on the Missisquoi River below the dam in Swanton and one on the Black River north of North Springfield Reservoir. None of these sites can be considered "rapids," but rather slower, flatter sections of the rivers.

Status: G3G4 N3N4 S2

Flight Range: May 30 – July 2

***Gomphus vastus* Walsh, 1862 – Cobra Clubtail**

Yet another rare Vermont clubtail, *G. vastus* is known only from one site on the Connecticut River below Vernon Dam. Although other sites may yet be discovered along the Connecticut River in Vermont, it should be pointed out that this species is abundant (huge hauls of exuviae) at sites on the Connecticut River in Massachusetts. Its typical habitat is large to medium mud- or silt-bottomed rivers. Adults can be found perching on vegetation near rivers, but investigation for exuviae or larvae remains the most effective survey method for this and other large-river species.

Status: G5 N5 S1

Flight Range: No adult records from Vermont

***Gomphus ventricosus* Walsh, 1863 – Skillet Clubtail**

This species was not encountered during the course of this project. Globally vulnerable, *G. ventricosus* is known from only two sites, which technically may not be in Vermont: two bridges over the Connecticut River in Windham County. Dates for these records are presently unavailable. Apparently sensitive to habitat and water quality degradation, this species appears to have been in decline. It may warrant further investigation in Vermont.

Status: G3 N3 S1

Flight Range: No adult records from Vermont

***Ophiogomphus aspersus* Morse, 1895 – Brook Snaketail**

Fairly well distributed in streams and rivers, mostly with sandy or fine gravel substrates, *O. aspersus* seems to show a preference to the Northeastern Highlands. (Sampling bias may be a factor.). It does not appear to be abundant at most of its sites. But this species may be more secure than once believed in Vermont, making it a potential candidate for removal from the list of SGCN. Like other members of its genus, it can sometimes be found resting on vegetation along riverbanks or, more often, on the emerged portion of rocks in a river or stream.

Status: G4 N4 S4

Flight Range: July 16 – August 18

***Ophiogomphus carolus* Needham, 1897 – Riffle Snaketail**

As expected, *O. carolus* is the most common member of its genus in Vermont. It is reasonably well distributed in streams and swift rivers (or portions thereof) with sandy or rocky substrate (explaining its absence from the Champlain Lowlands). It can be locally abundant at certain sites. Apparently secure in Vermont, it is a likely candidate for removal from the list of SGCN. One method for netting this species (and its congeners) on the river is to hold an insect net low and horizontal over the flowing water so that individuals investigate it as a potential resting spot.

Status: G5 N5 S4S5

Flight Range: May 25 – July 13

***Ophiogomphus mainensis* Packard in Walsh, 1863 – Maine Snaketail**

Somewhat similar to *O. carolus* in its distribution, *O. mainensis* is less common, scattered in brooks and streams (occasionally rivers) with noticeable current over coarse cobble. It may join *O. carolus* at certain sites. It does not appear to be abundant at its sites. This species may be a candidate for elevation to a rank of S4. Like other members of its genus, it prefers to rest on emerged tops of cobble in rivers.

Status: G4 N4 S3

Flight Range: June 18 – July 16

***Ophiogomphus rupinsulensis* (Walsh, 1862) – Rusty Snaketail**

This is the least common member of its genus in Vermont, scattered in only four or five known sites across the state. Seemingly more tolerant of silt than its relatives, it is known from slower streams and rivers in Vermont. Owing to the relative lack of data on this species in Vermont (hence the provisional state rank), its status warrants additional investigation.

Status: G5 N5 S3?

Flight Range: June 27 – August 24

***Stylurus amnicola* (Walsh, 1862) – Riverine Clubtail**

Vulnerable or imperiled across much of its range, this rare clubtail is known from a single site in Vermont, the Connecticut River below Vernon Dam (exuviae collected on the shoreline). It was not encountered during the course of this investigation. Its preferred habitat appears to be clear rivers with moderate current and gravel or sandy (perhaps silty) substrate. But the well-known elusiveness of adults suggests it may be found at other sites in Vermont, with searches for larvae or exuviae the most reliable survey method. Members of this genus, commonly known as the “hanging clubtails” spend portions of the day resting on vegetation high in the tree canopy.

Status: G4 N4 S1

Flight Range: Insufficient data

***Stylurus scudderi* (Selys, 1873) – Zebra Clubtail**

This investigation revealed that this striking dragonfly is more common in Vermont than once believed. Its scattered distribution includes rivers or streams with sandy substrates (occasionally silty substrates) at all but high elevations. Adults were also seen flying at two sites where a stream had flooded or been diverted to flow along a nearby sandy road. *S. scudderi* may be more nutrient tolerant than other members of its genus. Adults were obvious at certain sites, but the most effective method of detection would be to search for exuviae on streamside vegetation and rocks. This species may be a potential candidate for removal from the list of SGCN.

Status: G4 N3N4 S3S4

Flight Range: July 5 – September 1

***Neurocordulia yamaskanensis* (Provancher, 1875) – Stygian Shadowdragon**

A crepuscular species difficult to locate as an adult, this dragonfly has a scattered distribution on river sites and a few lake sites across the state. During the course of this study, new populations were found on the Lamoille River, Otter Creek and Poultney River. All were confirmed by the discovery of exuviae. Bridge abutments and hydroelectric power stations tend to be good search locations for exuviae. It is likely that this species will turn up in other locations across Vermont with additional investigations. Two of its northeastern congeners, *N. michaeli* and *N. obsoleta*, may yet be discovered in Vermont. Confirmation by exuviae requires careful observation.

Status: G5 N5 S3

Flight Range: No adult records¹¹

***Somatochlora albicincta* (Burmeister, 1839) – Ringed Emerald**

At the southern end of its range in the eastern United States, *S. albicincta* is confirmed from two ponds near the summit of Mt. Mansfield (discovered during the course of this investigation) and suspected from Lewis Pond in Lewis. It is a species of boreal ponds or slow-running waters. Other high-elevation ponds are

¹¹ Earliest record of exuviae is 31 May (on the Poultney River)

candidates for this species, including Sterling Pond and Skyline Pond in the Breadloaf Wilderness. *S. albicincta* warrants further investigation in Vermont.

Status: G5 N4 S1

Flight Range: June 11 – July 3

***Somatochlora cingulata* (Selys, 1871) – Lake Emerald**

Among Vermont's rarest member of this genus, *S. cingulata* is known from approximately six sites, mostly in the Northeastern Highlands. Its preferred habitat includes lakes, bog ponds and rivers, but the Vermont sites are all lakes. This species can be abundant at latitudes north of Vermont. It may yet turn up at more Vermont sites with additional investigation (particularly in the Green Mountains) but is nonetheless considered imperiled or vulnerable in adjoining states (and stable in Quebec).

Status: G5 N4 S1S2

Flight Range: June 29 – July 29

***Somatochlora elongata* (Scudder, 1866) – Ski-tipped Emerald**

This emerald is the most common among SGCN members of the genus. Associated with fens and related slow-moving outlets and streams, it has fairly good representation in the Northeastern Highlands and scattered sites elsewhere in Vermont (excluding the Champlain Valley). Like other members of the genus, it can be found feeding away from water or its natal peatland, including patrolling roads. Additional data may be required on this species before being considered for a ranking adjustment or removal from status as a SGCN.

Status: G5 N5 S3

Flight Range: June 22 – September 1

***Somatochlora forcipata* (Scudder, 1866) – Forcipate Emerald**

The vast and varied peatlands of the Yellow Bogs area of the Nulhegan Basin, in Vermont's Northeastern Highlands (Silvio O. Conte National Wildlife Refuge), appear to be the stronghold for this species in Vermont. Even so, it is recorded from a half-dozen or so other peatland sites around the state, including a surprise find at a marginal fen in Washington County. In the northeastern United States, *S. forcipata* is considered vulnerable or imperiled. Most encounters in Vermont were in forest openings away from its preferred habitat of peatlands and forested streams. *S. forcipata* often patrols forest roads roughly one to four meters above ground level.

Status: G5 N4 S2S3

Flight Range: June 26 – July 30

***Somatochlora franklini* (Selys, 1878) – Delicate Emerald**

The only reliable encounters with this vulnerable species were among the peatlands of the Yellow Bogs area of the Nulhegan Basin, in Vermont's Northeastern Highlands (Silvio O. Conte National Wildlife Refuge). One additional encounter was at Peacham Bog in Caledonia County. Although sphagnum bogs are its presumed breeding habitat, most encounters were along dirt roads or woodland openings near peatlands. *S. franklini* is among our earliest flying *Somatochlora* species. Vermont remains toward the southern edge of this species' range. Like *S. forcipata*, it often patrols roughly one to four meters above ground level.

Status: G5 N3N4 S1S2

Flight Range: May 31 – July 17

***Somatochlora kennedyi* Walker, 1918 – Kennedy's Emerald**

Similar to *S. franklini* in its known distribution, the only encounters with this species were in Vermont's Northeastern Highlands, notably in the peatlands of the Yellow Bogs area of the Nulhegan Basin (Silvio O. Conte National Wildlife Refuge). It may indeed be rarer and more vulnerable than *S. franklini*. Bog ponds or other standing

or flowing water may be included among its habitat preferences, but this has not been confirmed in Vermont. Like its congeners in peatlands, most encounters were with along dirt roads or woodland openings near peatlands. Vermont remains toward the southern edge of this species' range. It is ranked S3 in Maine and S1 in Massachusetts¹² (L. Harper, B. Nikula, pers. comm.).

Status: G5 N3N4 S1S2

Flight Range: June 6 – July 5

***Somatochlora minor* Calvert in Harvey, 1898 – Ocellated Emerald**

With occurrences only in Vermont's Northeastern Highlands, this small emerald is associated with fens with noticeable flow. Toward the southern edge of its range on the continent, this species may warrant further investigation. It is listed as secure in Quebec but either vulnerable, at higher risk or unranked across much of its range.

Status: G5 N4 S2

Flight Range: June 11 – July 26

***Williamsonia fletcheri* Williamson, 1923 – Ebony Boghaunter**

Known previously from only one site in Vermont, *W. fletcheri* was discovered at two additional sites during the course of this project. All three sites are in fens, all three of which are under conservation protections. Conditions at each site vary slightly, with one, a gramminoid fen, having a bog pond and another with little in the way of open water. Additional sites for this species may yet be discovered in Vermont. One strategy for finding *W. fletcheri* is to look for adults in sunny woodland openings near the peatland. An addendum to this species: Moderate effort has been devoted to locating its congener, *W. lintneri*, in Vermont yet without success.

Status: G4 N4 S1S2

Flight Range: May 9 – June 25

***Sympetrum danae* (Sulzer, 1776) – Black Meadowhawk**

The only Libellulid among this project's target species, not encountered during the investigation, remains somewhat of a mystery in Vermont. It is known from roughly six sites, mostly peatlands or acidic ponds in the Northeastern Highlands. One odd sightings comes from Grand Isle. In Vermont *S. danae* is toward the southern edge of its range. But, owing in part to its unpredictability, the species warrants further investigation in the state. One explanation for the scarcity of records may be its relatively late flight period.

Status: G5 N5 S1S2

Flight Range: August 19 – September 20

DISCUSSION

The particular investigation follows a limited yet vital course of prior inquiries into the distribution and abundance of Odonata in Vermont. This includes work by entomologists such as Frank Carle, Jim MacDougall, Donald Miller and others. This study also complements more recent additional investigations by the principal author, Bryan Pfeiffer, and his chief collaborator in the state, Michael Blust.

This investigation differs from earlier works in Odonata, however, in that its goals were broad – surveys not in particular parks or regions, but rather statewide assessments of habitats that tend to support a relative abundance of odonate SGCN diversity. In its invertebrate section, the Vermont Wildlife Action Plan notes that among the state's invertebrate fauna, "the vast majority are un-cataloged, unstudied and just plain

¹² Two records, non-breeding.

unknown.” Accordingly, this investigation has supported specific goals of the plan, including:

- ◆ “Obtain baseline SGCN distributional and abundance data by conducting surveys throughout the state.”
- ◆ “Conduct inventories to detect and gather information on new SGCN populations.”

At the very least, this work will aid in the plan’s goal of “keeping common species common.” Beyond that, it will serve as a foundation for the development of additional investigations and conservation strategies for odonate SGCN. In short, the results have contributed to a greater understanding of odonate SGCN distribution, particularly when combined with other historic data.

Specific recommendations on SGCN conservation strategies are beyond the scope of this project. Yet many are offered in the detailed results section of this report. Perhaps these may contribute to sound decisions on future investigations of specific odonate species in Vermont.

Moreover, the results presented here should assist in subsequent modifications of rankings for the state’s 142 species of Odonata and, combined with additional field work, updates to the state list of SGCN.

With this field investigation now complete, below are some general recommendations on individual species:

- ◆ Continue investigations for Vermont’s rarest peatland odonates, such as *Coenagrion interrogatum*, *Aeshna subarctica* and *Williamsonia fletcheri*, and consider protecting bogs and fens with those species. (All known Vermont sites for these three species are currently in public ownership or under protection through private ownership.)
- ◆ Initiate additional surveys for *Hetaerina americana* (two known river sites in Vermont) and consider regular monitoring of the population on Lewis Creek, which is periodically treated with lampricide.
- ◆ Investigate other high-elevation ponds for *Somatochlora albicincta* and *Somatochlora cingulata*, both of which are known from so few sites in Vermont and could face risks owing to rising average global temperatures.
- ◆ Continue investigations for rare river odonates along the Connecticut River in Windham County, including *Gomphus abbreviatus*, *Gomphus vastus* and *Gomphus ventricosus*. The discovery of rare populations of these and other species may warrant temporary modifications to river use (temporary no-wake zones and modifications to rip-rap, for example) in order to protect vulnerable populations.

Finally, it should be pointed out that, in a sense, this report is a “living document.” Knowledge of the state’s odonate fauna is continually expanding. Field investigations continue; a publication on the complete odonate fauna of Vermont is currently being drafted. Updates to the results of this report and to the list of Vermont odonate SGCN are inevitable – and welcome.

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Appendix A: Project Sites*

Site Name	Habitat	Town	Latitude	Longitude	Elevation (m.)
Adams Reservoir	still water - reservoir	WOODFORD	42.889	-73.03727	707
Alder Meadow Brook - S. Granville Meadow	River	Granville	43.99553	-72.85265	
Barber Bog	bog - dwarf shrub	POWNAL	48.80214	-73.19131	487
Barber Fen	fen	POWNAL	48.80214	-73.19131	487
Barnard Fen	fen - intermediate	BARNARD	43.71222	-72.61916	480
Batten Kill - Covered Bridge	running water - river	ARLINGTON	43.1041	-73.22032	158
Batten Kill - Near Covered Bridge	running water - river	ARLINGTON	43.09969	-73.21146	200
Battenkill - Covered Bridge Rd.	River	Arlington	43.10353	-73.22063	
Battenkill - Hill Farm Resort	River	Manchester	43.1135	-73.123	
Bear Lake	still water - pond	CAMBRIDGE	44.55478	-72.80476	1079
Beaver Brook Fen	fen	MARSHFIELD	44.36501	-72.35323	447
Belvidere Bog	bog - dwarf shrub	BELVIDERE	44.75843	-72.6292	349
Belvidere Bog	Peatland	Belvidere	44.75833	-72.62917	
Birch Lane Fen	Peatland	Williamston	44.0547	-72.342	
Black Creek	River	Shedon	44.89488	-72.94476	
Broad Brook	running water - brook	VERNON	42.81918	-72.54804	124
Broad Brook Mouth	River	Vernon	42.81959	-72.54694	
Broad Brook West	River	Vernon	42.81868	-72.54899	
Burgess Branch	running water - stream	LOWELL	44.80619	-72.4602	254
Butterfly Boulevard	opening - woods road	MARSHFIELD	44.32194	-72.32277	409
Calavale Brook	running water - brook	BELVIDERE	44.76696	-72.6142	353
Chickering Fen	fen	CALAIS	44.32519	-72.48163	
Clover Hill Fen	fen	STRAFFORD	43.84833	-72.41278	
Clyde River - Five Mile Square Access	running water - river	BRIGHTON	44.80165	-71.91484	359
Clyde River - School Road Crossing	running water - river	CHARLESTON	44.84105	-72.02209	350
Clyde River - Ten Mile Square Access	running water - river	CHARLESTON	44.82757	-71.97379	350
Connecticut River - Below Vernon Dam	running water - river	VERNON	42.77	-72.5141	58
Connecticut River - Cercosimo Lumber	running water - river	VERNON	42.78938	-72.52618	61
Connecticut River - McIndoe Bridge	running water - river	BARNET	44.26205	-72.06032	142
Connecticut River - Near White River	running water - river	HARTFORD	43.648	-72.31479	103
Connecticut River - No Mans Island	running water - river	RYEGATE	44.1566	-72.04029	163
Connecticut River - Route 135 Bridge	running water - river	RYEGATE	44.20769	-72.057	188
Crescent Fen	fen	STRAFFORD	43.80258	-72.39873	411
Dailey (Shaftsbury) Gravel Pit Fen	Peatland	Shaftsbury	42.9796	-73.1841	
Daley Wetlands	fen	SHAFTSBURY	42.98004	-73.18391	265
Deerfield River	River	Searsburg	42.91	-72.95	

Deerfield River #2	River	Searsburg	42.922	-72.972	
Deerfield River at Rt 9	River	Searsburg	42.8805	-72.94937	
Dennis Pond - North Side	bog	BRUNSWICK	44.72597	-71.65362	320
Dennis Pond Bog	bog - dwarf shrub	BRUNSWICK	44.72462	-71.65411	320
Deweys Pond	still water - pond	HARTFORD	43.64515	-72.40642	167
Doloff Pond (Lower)	still water - pond	SUTTON	44.68048	-72.0033	450
Dugger Brook Wetland	road/roadside	CALAIS	44.32422	-72.46094	292
East Creek - North Fork	River	Orwell	43.80984	-73.3307	
Fairlee Bog	bog - dwarf shrub	FAIRLEE	43.953	-72.146	335
Ferdinand Bog	bog	FERDINAND	44.67313	-71.70404	450
Ferdinand Bog Stream	running water - stream	FERDINAND	44.67313	-71.70404	450
Ferdinand-21Jun2006	opening	FERDINAND	44.73594	-71.75001	450
Fifefield Stream	River		43.40736	-72.89308	
Franklin Bog	Peatland	Franklin	44.99142	-72.89432	
Ghost Hollow Rd. Stream	River	West Haven	43.63912	-73.39112	
Goslant Pond	still water - pond	PEACHAM	44.30261	-72.30451	420
Half-Acre Fen	fen	MAIDSTONE	44.61626	-71.63499	407
Haystack Pond	still water - pond	WILMINGTON	42.9159	-72.91635	276
Hollister Hill Poor Fen	fen - poor	CALAIS	44.35529	-72.40185	414
Hoosic River by Dion Site	River	Pownal	42.7532	-73.2346	
Hoosick River	River	Pownal	42.7972	-73.2658	
Hoosick River - Dion Site	running water - river	POWVAL	42.77683	-73.2439	160
Hoosick River Bridge	running water - river	POWVAL	42.76853	-73.24435	172
Hoosick River Rt. 346	River	Pownal	42.80963	-73.28615	
Hoosick River, Lincoln St. Pownal	River	Pownal	42.766	-73.24315	
Hubbardton River	River	West Haven	43.6475	-73.3149	
John Boylan State Airport	opening - field	BRIGHTON	44.78868	-71.82617	361
Lake Carmi Bog	Peatland	Enosburg Falls	44.954	-72.87889	
Lake Groton - Outlet	still water - lake	GROTON	44.25082	-72.25473	329
Lake of the Clouds	still water - pond	CAMBRIDGE	44.54831	-72.8107	1212
Lake of the Clouds, Mansfield	Other	Cambridge	44.54854	-72.81045	
Lamoille Riv - Caddys Falls	River	Morristown	44.57663	-72.61395	
Lamoille River - Fairfax Falls	running water - river	FAIRFAX	44.65024	-72.98959	142
Lamoille River - Route 108 Bridge	running water - river	CAMBRIDGE	44.64992	-72.82991	142
Lamoille RR Bed	beaver pond	CAMBRIDGE	44.6699	-72.82628	152
Lanesboro Bog	bog - dwarf shrub	MARSHFIELD	44.31208	-72.30895	446
Lanesboro Marsh	marsh - cattail/reed	MARSHFIELD	44.30795	-73.30989	428
LaPlatte at Rt. 7	River	Shelburne	44.38651	-73.22502	
Lareau Swimming Hole	running water - river	WAITSFIELD	44.17558	-72.83336	224
Lemon Fair North	River	Shoreham	43.9107	-73.27531	
Lewis Creek	running water - river	FERRISBURG	44.24975	-73.22648	59
Lewis Pond	still water - pond	LEWIS	44.87962	-71.77777	503
Lewis Pond Road	road/roadside	LEWIS	44.8857	-71.76995	488
Lily Pond - West Access	still water - pond	VERNON	42.7376	-72.5093	34
Little Lake Salem	still water - lake	DERBY	44.91871	-72.1	293

Lost Pond Bog	bog - dwarf shrub	MOUNT TABOR	43.34036	-72.94243	830
Lost Pond Bog	Peatland	Mount Tabor	43.34056	-72.94181	
Lower Symes Brook	running water - brook	RYEGATE	44.23288	-72.09226	208
Lower Symes Pond Peatland	bog - dwarf shrub	RYEGATE	44.24478	-72.10035	247
Mad River - Line	River	Warren	44.04142	-72.8172	
Mad River - Waitsfield	River	Waitsfield	44.20422	-72.80778	
Maidstone Bog	bog - dwarf shrub	MAIDSTONE	44.62229	-71.64651	422
Maquam Bog	bog	SWANTON	44.9476	-73.189	31
Marshfield Pond	still water - pond	MARSHFIELD	44.32477	-72.33898	391
Marshfield Reservoir	still water - reservoir	CABOT	44.36334	-72.30285	374
Martins Pond	still water - pond	PEACHAM	44.304	-72.20555	473
Metawee River by School	River	Pawlet	43.38586	-73.22702	
Mettawee River 1	River	Pawlet	43.40465	-73.25041	
Miles Pond Bog	bog - dwarf shrub	CONCORD	44.46606	-71.84565	339
Missisquoi River - Sheldon	River	Sheldon	44.908	-72.90413	
Missisquoi River - Swanton below	River	Swanton	44.92182	-73.12579	
Mollie Beattie Bog	bog - black spruce woodland	LEWIS	44.8355	-71.781	411
Mollie Beattie Bog Road	bog - black spruce woodland	LEWIS	44.84547	-71.81911	340
Moose Bog	bog - dwarf shrub	FERDINAND	44.76397	-71.73825	364
Moscow Road Bog	Peatland	Fair Haven	43.68512	-73.22453	
Mud Creek Dam	River	Alburg	44.9676	-73.2703	
Mud Pond Bog	bog - dwarf shrub	BRUNSWICK	44.73782	-71.67196	318
Niles School Fen	fen - intermediate	POWNAI	42.7872	-73.2054	
No-Name Bog	bog - dwarf shrub	LEWIS	44.84709	-71.79442	429
Notch Pond Road Peatlands	opening - woods road	BRUNSWICK	44.7592	-71.7151	347
Nulhegan - Black Branch Bridge Crossing	running water - river	BLOOMFIELD	44.80376	-71.70759	353
Nulhegan - Black Branch North	running water - stream	LEWIS	44.85005	-71.72744	378
Nyes Swamp	fen - intermediate	BARNARD	43.73555	-72.66389	533
Ompompanoosuc - Copper Flats	River	Stratford	43.8352	-72.33356	
Ompompanoosuc - Dam	River	Thetford	43.8009	-72.25902	
Ompompanoosuc - Sandy Beach	River	Thetford	43.81506	-72.25682	
Passumpsic River - Barnet Bridge	running water - river	BARNET	44.32693	-72.03706	206
Passumpsic River - Passumpsic Station	running water - river	BARNET	44.37579	-72.02608	163
Paul Stream1	running water - stream	MAIDSTONE	44.67185	-71.65402	350
Peacham Bog	bog - dwarf shrub	PEACHAM	44.29325	-72.23383	475
Peacham Bog - Pond	bog - dwarf shrub	PEACHAM	44.28962	-72.22526	470
Peacham Pond	still water - lake	PEACHAM	44.33614	-72.25534	427
Peanut Dam Road	opening - woods road	LEWIS	44.82945	-71.71218	378
Poultney River - below Carver's Falls	River	Fair Haven	43.62697	-73.30812	
Poultney River - Galick Bridge	River	West Haven	43.57035	-73.39185	

Poultney River in Poultney	River	Poultney	43.5147	-73.2473	
Pownal Bog	Peatland	Pownal	42.802	-73.1915	
Reading Hill Bog	fen - poor	READING	43.53333	-73.55083	457
Roadside Fen	fen	LEWIS	44.87672	-71.68331	442
Roaring Brook Trib.	River	Wallingford	43.46	-72.9225	
Sand Pit	opening - woods road	FERDINAND	44.73595	-71.74994	457
Shaftsbury Bog	Peatland	Shaftsbury	43.02322	-73.18272	
Shaftsbury Fen	fen - intermediate	ARLINGTON	43.02322	-73.18272	
South America Pond Road Wetland	bog - other	FERDINAND	44.75649	-71.7318	364
Spruce Pond	Peatland	Orwell	43.7654	-73.2805	
Stamford Meadows	bog - dwarf shrub	STAMFORD	42.82638	-73.09806	701
Stamford Stream	River	Woodford	42.8396	-73.11061	
Stevens Brook Road	running water	FERDINAND	44.73595	-71.74994	457
Stevens Road	opening	BLOOMFIELD	44.8	-71.58	300
Stockbridge Bridge - Tweed River	River	Stockbridge	43.77223	-72.7602	
Stone Dam Road - The Y	opening - woods road	LEWIS	48.81922	-71.71988	380
Third Branch - Peavine	running water - river	BETHEL	43.8271	-72.63523	172
Third Branch - Peavine Upstream	running water - river	BETHEL	43.82907	-72.63538	172
Tin Shack Road Bog	bog - black spruce woodland	LEWIS	44.85184	-71.72131	407
Tinmouth Fen - South	Peatland	Wallingford	43.4045	-73.0445	
Tyler Branch	River	Enosburg	44.89075	-72.82111	
Underpass Wetlands	fen	MORGAN	44.87226	-71.90649	408
Vernon Dam - below	River	Vernon	42.77	-72.526	
Victory Basin WMA - Bog Proper	bog - dwarf shrub	VICTORY	44.51944	-71.78944	
Victory Basin WMA - Rogers Brook Wetlands	bog	VICTORY	44.5551	-71.78522	396
Victory Basin WMA - Trail	marsh - sedge/grass	VICTORY	44.53443	-71.81739	364
Waloosac - North Bennington Bridge	running water - river	BENNINGTON	42.91277	-73.23393	2411
Wells River - Access	running water - river	NEWBURY	44.15349	-72.07653	161
Wells River - Fishing Access	running water - river	NEWBURY	44.15212	-72.07071	195
Wells River Rail Bed - Lanseboro	marsh	MARSHFIELD	44.30942	-72.3144	503
Wenlock Fen	fen	FERDINAND	44.77151	-71.77135	348
West Mountain Pond Bog	bog - dwarf shrub	MAIDSTONE	44.68577	-71.659	378
West Mountain Pond Bog - West of Bog	marsh	MAIDSTONE	44.69261	-71.6674	391
West River - Dummerston	running water - river	DUMMERSTON	42.90228	-72.60114	310
West River - I-91 Bridge	running water - river	BRATTLEBORO	42.87411	-72.57098	137
West River 2	River	Dummerston	42.91389	-72.6087	
White River - 3rd Branch #1	River	Bethel	43.85347	-72.6469	
White River - Bethel1	running water - river	BETHEL	43.81337	-72.63821	171
White River - Bethel2	running water - river	BETHEL	43.79828	-72.66299	190
White River - Boat Launch	running water - river	SHARON	43.76261	-72.4499	132
White River - Central Hrtfd	running water - river	HARTFORD	43.66655	-72.35637	119

White River - Hancock	River	Hancock	43.93563	-72.84205	
White River - Hartford Bridge	running water - river	HARTFORD	43.65918	-72.34084	100
White River - I-89 Overpass	running water - river	HARTFORD	43.70442	-72.41218	134
White River - Near I-89	running water - river	SHARON	43.78673	-72.48022	117
White River - North Royalton	running water - river	ROYALTON	43.82275	-72.566	154
White River - Peavine	running water - river	STOCKBRIDGE	43.79039	-72.76315	263
White River - Roadside	running water - river	STOCKBRIDGE	43.76015	-72.72293	276
White River - Rochester	River	Rochester	43.88527	-72.81174	
White River - Sharon (South Side of River)	running water - river	SHARON	43.77854	-72.46566	128
White River - Sharon Bridge	running water - river	SHARON	43.78138	-72.46188	511
White River - Sharon River Access	running water - river	SHARON	43.78673	-72.48022	117
White River - South Royalton Downtown Bridge	running water - river	ROYALTON	43.8219	-72.51967	140
White River - Talcville	River	Rochester	43.85939	-72.80752	
White River - Tupper	River	Rochester	43.81427	-72.78426	
White River - West Hartford Bridge	running water - river	HARTFORD	43.71246	-72.41759	139
Winhall River - Stratton Pd.	River	Stratton	43.11147	-72.9827	
Winooski River - Middlesex Hydro Station	running water - river	MIDDLESEX	44.29116	-72.68105	173
Winooski River - Montpelier Cemetery	running water - river	MONTPELIER	44.25679	-72.60024	159
Winooski River - Woodbury Auto	running water - river	MONTPELIER	44.24218	-72.5434	197
Wright Park	opening	MIDDLEBURY	44.0315	-73.17698	102
Yellow Bogs	bog - black spruce woodland	LEWIS	44.83567	-71.71506	389
Yellow Bogs - West	opening - woods road	LEWIS	44.82672	-71.72675	416

* Variations in presentation of data terms is due to slight differences in field recording methods by in-kind participants.

Appendix B: Species Encountered During the Project

Hetaerina americana
Calopteryx aequabilis
Calopteryx maculata
Lestes disjunctus
Lestes eurinus
Lestes vigilax
Argia fumipennis violacea
Argia moesta
Chromagrion conditum
Enallagma antennatum
Enallagma aspersum
Enallagma boreale
Enallagma carunculatum
Enallagma civile
Enallagma cyathigerum
Enallagma vernale
Enallagma ebrium
Enallagma exsulans
Enallagma geminatum
Enallagma hageni
Enallagma signatum
Enallagma traviatum
Enallagma vesperum
Enallagma species
Ischnura posita
Ischnura verticalis
Nehalennia gracilis
Nehalennia irene
Aeshna canadensis
Aeshna constricta
Aeshna eremita
Aeshna interrupta
Aeshna tuberculifera
Aeshna umbrosa
Gomphaeschna furcillata
Anax junius
Basiaeschna janata
Boyeria vinosa
Gomphaeschna furcillata
Arigomphus furcifer
Dromogomphus spinosus
Gomphus abbreviatus
Gomphus borealis
Gomphus descriptus
Gomphus exilis
Gomphus spicatus
Gomphus quadricolor
Hagenius brevistylus
Lanthus parvulus
Lanthus vernalis
Ophiogomphus aspersus
Ophiogomphus carolus
Ophiogomphus mainensis
Ophiogomphus rupinsulensis
Stylogomphus albistylus
Stylurus amnicola
Stylurus scudderi
Stylurus spiniceps
Cordulegaster diastatops
Cordulegaster maculata
Didymops transversa
Macromia illinoensis
Cordulia shurtleffi
Dorocordulia lepida
Dorocordulia libera
Epitheca princeps
Epitheca canis
Epitheca spinigera
Neurocordulia yamaskanensis
Somatochlora albicincta
Somatochlora cingulata
Somatochlora elongata
Somatochlora forcipata
Somatochlora franklini
Somatochlora kennedyi
Somatochlora minor
Somatochlora tenebrosa
Somatochlora walshii
Somatochlora williamsoni
Williamsonia fletcheri
Celithemis elisa
Celithemis eponina
Ladona julia
Leucorrhinia frigida
Leucorrhinia glacialis
Leucorrhinia hudsonica
Leucorrhinia intacta
Leucorrhinia proxima
Libellula incesta
Libellula luctuosa
Libellula pulchella
Libellula quadrimaculata
Nannothemis bella
Pachydiplax longipennis
Pantala hymenaea
Perithemis tenera
Plathemis lydia
Sympetrum obtrusum
Sympetrum semicinatum
Sympetrum vicinum
Tramea lacerata

Appendix C: State Ranking of Vermont Odonata *

Zygoptera (Damselflies)			
Calopterygidae			
<i>Hetaerina americana</i>	American Rubyspot	S2S3	Very few sites (3-4); on edge of range
<i>Calopteryx aequabilis</i>	River Jewelwing	S5	Commonly found, can be abundant; large rivers
<i>Calopteryx amata</i>	Superb Jewelwing	S4	Widely scattered, can be locally common to abundant
<i>Calopteryx maculata</i>	Ebony Jewelwing	S5	Widespread, abundant
Lestidae			
<i>Lestes congener</i>	Spotted Spreadwing	S5	Widespread, abundant
<i>Archilestes grandis</i>	Great Spreadwing	SNA	One record of a single individual; this is a western species
<i>Lestes disjunctus</i>	Common Spreadwing	S5	Widespread, abundant
<i>Lestes dryas</i>	Emerald Spreadwing	S5	Widespread, abundant
<i>Lestes eurinus</i>	Amber-winged Spreadwing	S4	Locally common, not widespread; somewhat a habitat specialist
<i>Lestes forcipatus</i>	Sweetflag Spreadwing	S4S5	Scattered populations, can be locally abundant
<i>Lestes inaequalis</i>	Elegant Spreadwing	S4S5	Widely scattered, not abundant
<i>Lestes rectangularis</i>	Slender Spreadwing	S5	Widespread, abundant
<i>Lestes unguiculatus</i>	Lyre-tipped Spreadwing	S3S4	Very scattered distribution; few populations, though easily identified; may be under-surveyed; low elevations
<i>Lestes vigilax</i>	Swamp Spreadwing	S5	Fairly widespread, abundant
Coenagrionidae			
<i>Amphiagrion saucium</i>	Eastern Red Damsel	S5	Widely scattered; predictable, locally abundant; likes fens
<i>Argia apicalis</i>	Blue-fronted Dancer	S3	Limited but stable populations; south VT
<i>Argia fumipennis</i>	Variable Dancer	S5	Widespread, not locally abundant (generally true of genus)
<i>Argia moesta</i>	Powdered Dancer	S5	Not so widespread, but abundant; large rivers
<i>Coenagrion interrogatum</i>	Subarctic Bluet	SH	Two records: one is SH (1975), the other SR (photo, but not submitted)
<i>Coenagrion resolutum</i>	Taiga Bluet	S4S5	widely scattered, can be locally abundant
<i>Chromagrion conditum</i>	Aurora Damsel	S5	Widely distributed, but not locally abundant
<i>Enallagma annexum</i>	Northern Bluet	S3S4	Spotty distribution; fishless ponds; id of older specimens suspect due to confusion with another species
<i>Enallagma antennatum</i>	Rainbow Bluet	S2S3	Very few sites, but may be more widespread than data indicates
<i>Enallagma boreale</i>	Boreal Bluet	S4S5	Not widespread; predictable, locally common; may be somewhat vulnerable (bog species)
<i>Enallagma carunculatum</i>	Tule Bluet	S5	Not found statewide, but abundant around Lake Champlain; also along Connecticut River
<i>Enallagma civile</i>	Familiar Bluet	S4S5	Widespread in North America, abundant in other northeast states, but not often seen in VT; no records before year 2000

<i>Enallagma divagans</i>	Turquoise Bluet	SNA	Nymphs collected, identification confirmed by expert, but still some question due to difficulty; subsequent sampling unsuccessful (i.e., not confidently present)
<i>Enallagma durum</i>	Big Bluet	S1	One Hoosic River specimen; a southern species of large rivers
<i>Enallagma ebrium</i>	Marsh Bluet	S5	Widespread, abundant
<i>Enallagma exsulans</i>	Stream Bluet	S5	Widespread, abundant
<i>Enallagma geminatum</i>	Skimming Bluet	S5	Southern VT distribution, but abundant in its habitat
<i>Enallagma hageni</i>	Hagen's Bluet	S5	Widespread, abundant
<i>Enallagma laterale</i>	New England Bluet	S1	One population
<i>Enallagma signatum</i>	Orange Bluet	S5	Fairly widespread, abundant where found
<i>Enallagma traviatum</i>	Slender Bluet	S1S2	Two sites; one site with good numbers/abundant (Retreat Meadows)
<i>Enallagma vernale</i>	Springtime Bluet	S5	Locally abundant; some gradation with another species
<i>Enallagma vesperum</i>	Vesper Bluet	S4	Scattered, can be locally abundant; may be under reported (an evening species)
<i>Enallagma. aspersum</i>	Azure Bluet	S4	Widely scattered, locally common
<i>Ischnura hastata</i>	Citrine Forktail	SNA	Only collected one year, all 3 sites within one week period
<i>Ischnura kellicotti</i>	Lilypad Forktail	S1S2	Two sites; one site considered stable (multiple year collections); a southern species of lakes/ponds
<i>Ischnura posita</i>	Fragile Forktail	S4S5	Abundant in south VT, less so north
<i>Ischnura verticalis</i>	Eastern Forktail	S5	Widespread, abundant
<i>Nehalennia gracilis</i>	Sphagnum Sprite	S3	Few sites; only found abundant at one site; a peatland species not found in all peatlands
<i>Nehalennia irene</i>	Sedge Sprite	S5	Widespread, abundant
Anisoptera (Dragonflies)			
Aeshnidae			
<i>Anax junius</i>	Common Green Darner	S5	Widespread, abundant
<i>Anax longipes</i>	Comet Darner	SU	One specimen record; breeding evidence, but don't know if regularly occurring
<i>Aeshna canadensis</i>	Canada Darner	S5	Widespread, abundant
<i>Aeshna clepsydra</i>	Mottled Darner	S2S3	Only 3 sites; can be locally common
<i>Aeshna constricta</i>	Lance-tipped Darner	S5	Dominant odonate around Lake Champlain; fairly well distributed elsewhere, though missing from some lakes
<i>Aeshna eremita</i>	Lake Darner	S4S5	Reasonably well distributed, some sites with abundant populations
<i>Aeshna interrupta</i>	Variable Darner	S5	Widespread in north VT, abundant where found; boggy habitat
<i>Aeshna sitchensis</i>	Zig-zag Darner	SU	One specimen record, specimen not verified; don't know if it would represent breeding population or vagrant
<i>Aeshna subarctica</i>	Subarctic Darner	S1	Two sites; one is breeding site, the other is likely accidental
<i>Aeshna tuberculifera</i>	Black-tipped Darner	S4	Scattered statewide, more limited habitat preference (wooded marshy areas)

<i>Aeshna umbrosa</i>	Shadow Darner	S5	Widespread, abundant
<i>Aeshna verticalis</i>	Green-striped Darner	S3S4	Not common; may be year-to-year variation in abundance
<i>Basiaeschna janata</i>	Springtime Darner	S5	Widespread, abundant
<i>Epiaeschna heros</i>	Swamp Darner	SU	Two sites; at least one not a breeding site; not enough information to determine status
<i>Gomphaeschna furcillata</i>	Harlequin Darner	S2S3	Restricted range, few populations low numbers
<i>Nasiaeschna pentacantha</i>	Cyrano Darner	S1	One site; breeding evidence
<i>Rhionaeschna mutata</i>	Spatterdock Darner	S1	One site
<i>Boyeria grafiana</i>	Ocellated Darner	S4	Widely scattered; hard to assess populations (adults patrol streams)
<i>Boyeria vinosa</i>	Fawn Darner	S5	Widespread, abundant
Gomphidae			
<i>Arigomphus furcifer</i>	Lilypad Clubtail	S3S4	Few encounters, though not difficult to observe; never abundant
<i>Arigomphus villosipes</i>	Unicorn Clubtail	S3	Few sites; limited to SW corner of VT (Bennington to Rutland counties)
<i>Dromogomphus spinosus</i>	Black-shouldered Spinyleg	S4S5	Scattered distribution, can be somewhat locally common; predictable in right habitat
<i>Gomphus abbreviatus</i>	Spine-crowned Clubtail	S1S2	Two sites - Poultney and lower Connecticut rivers; may be in other areas; a large river species
<i>Gomphus adelphus</i>	Mustached Clubtail	S3	Few populations, low numbers
<i>Gomphus borealis</i>	Beaverpond Clubtail	S4	Can be locally abundant in north VT, though there are several Bennington Co. records
<i>Gomphus descriptus</i>	Harpoon Clubtail	S3	Relatively few populations, never abundant
<i>Gomphus exilis</i>	Lancet Clubtail	S4S5	Scattered populations, can be abundant
<i>Gomphus lividus</i>	Ashy Clubtail	S2S3	4-5 sites; all in Rutland County except one Hoosic River population
<i>Gomphus quadricolor</i>	Rapids Clubtail	S2	Limited number of sites, though stable; 3 populations known
<i>Gomphus spicatus</i>	Dusky clubtail	S5	Widespread, abundant
<i>Gomphus vastus</i>	Cobra Clubtail	S1	One site, with 3 collection dates in 2005
<i>Gomphus ventricosus</i>	Skillet Clubtail	S1	Two sites?; nymphal skins
<i>Hagenius brevistylus</i>	Dragonhunter	S3S4	Scattered, low numbers at sites
<i>Lanthus parvulus</i>	Northern Pygmy Clubtail	S4	Widely scattered; common in headwater streams; could be under-sampled
<i>Lanthus vernalis</i>	Southern Pygmy Clubtail	S3	Relatively few populations, low numbers
<i>Ophiogomphus aspersus</i>	Brook Snaketail	S4	Widely scattered; difficulty with nymph ID
<i>Ophiogomphus carolus</i>	Rifle Snaketail	S4S5	Scattered distribution; can be locally abundant, but not so everywhere
<i>Ophiogomphus mainensis</i>	Maine Snaketail	S3	Relatively few populations, mostly in Northeast Kingdom
<i>Ophiogomphus rupinsulensis</i>	Rusty Snaketail	S3?	Few sites, all in south and Rutland County; status on Connecticut River not known (specimens to be id'ed)
<i>Stylogomphus albistylus</i>	Least Clubtail	S4	Scattered distribution; can be locally common; may be under-sampled
<i>Stylurus amnicola</i>	Riverine Clubtail	S1	One site
<i>Stylurus scudderii</i>	Zebra Clubtail	S3S4	Was found at many sites in one year; also nymphs are common; considered rare in surrounding states
<i>Stylurus spiniceps</i>	Arrow Clubtail	S3S4	Can be locally abundant; limited to large rivers

Cordulegastridae			
<i>Cordulegaster diastatops</i>	Delta-spotted Spiketail	S5	Widespread
<i>Cordulegaster maculata</i>	Twin-spotted Spiketail	S5	Widespread; hard to assess adult populations (adults patrol streams); nymphs abundant
<i>Cordulegaster obliqua</i>	Arrowhead Spiketail	S1S2	One site; suspected to occur elsewhere; found in seeps, a poorly surveyed habitat
Macromiidae			
<i>Didymops transversa</i>	Stream Cruiser	S5	Widespread, not always abundant
<i>Macromia illinoensis</i>	Illinois River Cruiser	S4	Predictable, though not abundant; big rivers
Corduliidae			
<i>Cordulia shurtleffi</i>	American Emerald	S5	Widespread, locally abundant
<i>Dorocordulia lepida</i>	Petite Emerald	S3	Sparsely scattered, low numbers; a bog specialist
<i>Dorocordulia libera</i>	Racket-tailed Emerald	S5	Widespread, abundant
<i>Epitheca canis</i>	Beaverpond Baskettail	S5	Widespread, abundant
<i>Epitheca cynosura</i>	Common Baskettail	S5	Widespread, locally abundant
<i>Epitheca princeps</i>	Prince Baskettail	S5	Widespread, predictable, common where found (low elevations)
<i>Epitheca spinigera</i>	Spiny Baskettail	S4	Widely scattered, not abundant; not as common as other members of genus
<i>Helocordulia uhleri</i>	Uhler's Sundragon	S3S4	Sparse, scattered populations
<i>Neurocordulia yamaskanensis</i>	Stygian Shadowdragon	S3	Few populations, can be common at particular sites; some difficulty with finding adults
<i>Somatochlora albicincta</i>	Ringed Emerald	S1	One site confirmed, another possible site
<i>Somatochlora cingulata</i>	Lake Emerald	S1S2	Edge of range; habitat very restricted
<i>Somatochlora elongata</i>	Ski-tailed Emerald	S3	Low numbers; Northeast Kingdom and high elevations
<i>Somatochlora forcipata</i>	Forcinate Emerald	S2S3	Very few populations
<i>Somatochlora franklini</i>	Delicate Emerald	S1S2	Very few sites, some of these may be associated together; Northeast Kingdom; may be under-surveyed
<i>Somatochlora kennedyi</i>	Kennedy's Emerald	S1S2	4-5 sites, two being close together; Essex Co.
<i>Somatochlora minor</i>	Ocellated Emerald	S2	Few populations, but more than 5; never abundant
<i>Somatochlora tenebrosa</i>	Clamp-tipped Emerald	S3S4	Not widespread, though locally abundant
<i>Somatochlora walshii</i>	Brush-tipped Emerald	S4	Scattered, predictable, but not abundant
<i>Somatochlora williamsoni</i>	Williamson's Emerald	S3S4	Not well distributed; encountered in low numbers
<i>Williamsonia fletcheri</i>	Ebony Boghaunter	S1S2	Scattered and sparse populations; very few sites
Libellulidae			
<i>Celithemis elisa</i>	Calico Pennant	S5	Well distributed; not abundant, but common (moderate population sizes)
<i>Celithemis eponina</i>	Halloween Pennant	S4	Can be fairly common locally; probably moving in from south of VT
<i>Erythemis simplicicollis</i>	Eastern Pondhawk	S5	Well distributed, except eastern peidmont; abundant; moving in from south of VT

<i>Ladona exusta</i>	White Corporal	SNA	One record, no specimen (i.e., reported, not confirmed); some survey work done since then - unsuccessful
<i>Ladona julia</i>	Chalk-fronted Corporal	S5	Widespread, abundant
<i>Leucorrhinia frigida</i>	Frosted Whiteface	S4S5	Can be locally abundant, but not so widespread; not a habitat specialist
<i>Leucorrhinia glacialis</i>	Crimson-ringed Whiteface	S4	Locally abundant; specialist of high altitude bogs/bog ponds
<i>Leucorrhinia hudsonica</i>	Hudsonian Whiteface	S4S5	More widespread than glacialis, but not so locally abundant
<i>Leucorrhinia intacta</i>	Dot-tailed Whiteface	S5	Widespread, abundant
<i>Leucorrhinia proxima</i>	Red-waisted Whiteface	S4S5	Not widely distributed, but locally abundant; acidic ponds/bogs
<i>Libellula cyanea</i>	Spangled Skimmer	S2	Few records or populations
<i>Libellula incesta</i>	Slaty Skimmer	S5	Abundant in south VT; moving in from south of VT
<i>Libellula luctuosa</i>	Widow Skimmer	S5	Widespread, abundant; probably moving in from south of VT
<i>Libellula pulchella</i>	Twelve-spotted Skimmer	S5	Widespread, abundant
<i>Libellula quadrimaculata</i>	Four-spotted Skimmer	S5	Widespread, abundant
<i>Libellula semifasciata</i>	Painted Skimmer	SU	Very few records (all in south VT), though very common to south of VT; some or all records may be vagrants
<i>Nannothemis bella</i>	Elfin Skimmer	S3	Relatively few populations; found in intermediate/poor fens, but not all of them
<i>Pachydiplax longipennis</i>	Blue Dasher	S5	Abundant in south VT; moving in from south of VT
<i>Pantala flavescens</i>	Wandering Glider	S3S4	Scattered, but no widely so; some records may be migrating individuals, not representing populations
<i>Pantala hymenaea</i>	Spot-winged Glider	S3S4	Scattered, but no widely so; some records may be migrating individuals, not representing populations
<i>Perithemis tenera</i>	Eastern Amberwing	S4S5	Widely distributed in southern VT, Champlain Valley; can be locally abundant
<i>Plathemis lydia</i>	Common Whitetail	S5	Widespread, abundant
<i>Sympetrum internum/janeae</i>	Cherry-faced/Jane's Meadowhawk	S5	Widespread, abundant; taxonomic issue, call it internum
<i>Sympetrum costiferum</i>	Saffron-winged Meadowhawk	S3	Relatively few populations, limited to north VT
<i>Sympetrum danae</i>	Black Meadowhawk	S1S2	3 records
<i>Sympetrum obtrusum</i>	White-faced Meadowhawk	S5	Fairly common, well distributed
<i>Sympetrum semicinctorum</i>	Band-winged Meadowhawk	S4S5	Fairly well distributed, abundant where found; not so predictable
<i>Sympetrum vicinum</i>	Yellow-legged Meadowhawk	S5	Widespread, abundant
<i>Tachopteryx thoreyi</i>	Grey Petaltail	SNA	One sight record, but no documentation (i.e., reported, not confirmed)
<i>Tramea lacerata</i>	Black Saddlebags	S4	Widely scattered, locally common; low elevations

Compiled by Bryan Pfeiffer, Michael Blust and Mark Ferguson – 21 April 2008



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