THE DRAGONFLIES AND DAMSELFLIES OF TEAL FARM

Huntington, Vermont
2005

Prepared for
Foundation for a Sustainable Future

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Cover Photo:
Pachydiplax longipennis (Blue Dasher), an uncommon dragonfly at Teal Farm. (Photograph: Gainesville, FL.)

Photograph by Bryan Pfeiffer

1.0 Introduction

Wings Environmental was retained by the Foundation for a Sustainable Future (FSF) to conduct a field inventory of dragonflies and damselflies at Teal Farm in Huntington, Vermont, during the 2005 field season. The study's principal objectives include:

- Obtaining a general baseline knowledge, through simple field investigations, of dragonflies and damselflies at Teal Farm.
- Locating rare, threatened or endangered dragonflies and damselflies at Teal Farm.
- Issuing preliminary land-use and conservation recommendations for dragonflies and damselflies based on the long-term biointegrity of Teal Farm.
- Coordinating survey activities with other investigators (e.g. botanists, zoologists, entomologists etc.) working at Teal Farm.

1.1 Background

In many respects, invertebrates rule the world. Their sheer abundance, diversity and prominence in any ecosystem cannot be overlooked – even at the landscape level. Recognizing that Vermont hosts between 15,000 and 20,000 invertebrate species, we can never expect to fully understand their abundance, distribution and complete role in natural communities. And with that many species inhabiting the state, it may seem odd to focus attention on any single taxon, such as dragonflies and damselflies. Yet while the search for knowledge of invertebrate fauna is seemingly endless, dragonflies and damselflies are now emerging as a taxon warranting — and indeed attracting — serious attention by investigators. In Vermont these investigators range from the Vermont Nongame and Natural Heritage Program to recreational observers. Accordingly, the Foundation for a Sustainable Future, through this basic study, has already contributed to a growing and vital body of investigation into the distribution and abundance of these insects across Vermont.

Dragonflies and damselflies, belonging to the order Odonata (the "toothed" insects), often called simply "odonates"[1] are known as supreme insect predators (with well-developed mandibles) in both their aquatic (larval) and airborne (adult) phases. Although some controversy remains about the phylogeny of today's odonates, it is clear they are among the most ancient insects. The oldest fossil records come from the Upper Carboniferous, about 325 million years ago. (They had wingspans of nearly three meters back then.) What we know today as Odonata first appeared in the Lower Permian, about 250 million years ago, as small early versions of what we see today. They've changed little since then. In North America, the order is divided into two suborders:

Anisoptera (Dragonflies) – Approximately 97 species in Vermont (350 in North America, about 2,900 described). Among adults, dragonflies are generally more robust and larger, up to nearly 10 cm in our fauna (although one species is 2 cm). The hindwings are broader than the forewings; all the wings are held flat at rest; and the eyes are either fused along seam, touching at a point or separate.

1 Taken together, dragonflies and damselflies are commonly lumped under the term "dragonflies" or, to avoid confusion, the English term "odonate." This report will often use the term odonate to refer to both dragonflies (suborder Anisoptera) and damselflies (Zygoptera) as a single group.

Zygoptera (Damselflies) – Approximately 43 species in Vermont (161 in North America, 2,500 described). Damselflies are often 2.5-3.8 cm in total length, although a few are longer. The forewings and hindwings are similar in shape and size, often petiolate. Damselflies hold their wings folded above thorax and abdomen or slightly open at rest; the eyes are separated on the head.

1.2 Odonates as Study Subjects

Odonates offer various advantages as bioindicators: they reproduce in aquatic habitats *and* command the sky as adults; they are relatively easy to locate and identify to species and subspecies; they offer both habitat generalists and specialists; and, for certain species, mark-recapture techniques and larval sampling can be reliable methods of determining population size and distribution.

Odonates may also serve as useful indications of the potential effects of climate change. There is already evidence, in a study of 37 species of nonmigratory British dragonflies and damselflies, of a northward shift in range margins over the past 40 years, seemingly as a result of climate change (Hickling 2005). This response by an exemplar group of insects associated with fresh water parallels polewards range changes observed in terrestrial invertebrates and other taxa.

It should come as no surprise that Teal Farm is hardly endowed with diverse and extensive wetland communities – places that tend to be best for odonate diversity. And while brooks, streams and rivers host their own suites of odonate species, many of these waters at Teal Farm are of a size and slope presenting limited dragonfly and damselfly diversity. Nevertheless, with the property's two constructed ponds as the principal sites, Teal Farm's odonate fauna came into focus during the course of this brief investigation.

2.0 Methodology

The limited scope of this investigation (budgeted at 16 hours of field work) required selected visits to predicted areas of relatively high odonate diversity. This would include timing visits to coincide with various flight periods of different odonate species.

Teal Farm was surveyed for odonates on four dates from 23 Jun 2005 to 26 Aug 2005, separated by roughly three-week intervals and comprising 12 distinct site visits. Each site visit consisted of the determination of every active adult odonate species and, to a limited extent, the collection of exuvia, which are odonate larval skins (most of the time diagnostic to species).

Survey field technique involved capturing adult dragonflies and damselflies and identifying each to species on the spot. At least one voucher specimen was collected for each species encountered during this study.[1] Each specimen was processed under standard procedures for odonate preservation (immersion in 70% acetone for roughly 24 hours) and stored with voucher data in clear Mylar envelopes.[2]

1 Swift and at times elusive, a few odonate species eluded the investigator's net and are therefore represented as a sight-identification rather than a voucher specimen.

2 Teal Farm odonate specimens are currently segregated and housed with the Wings Environmental odonate collection at 113 Bartlett Road, Plainfield, Vermont 05667.

2.1 Landscape Analysis

A landscape-level review of Teal Farm preceded field investigations. This review, largely via geographic information system (GIS) analysis, was performed in consultation with Marc Lapin of Ecosystem Science and Conservation in Cornwall, Vermont, the principal investigator for the natural community assessment and mapping at Teal Farm. Also consulted during this phase were Nuna Teal, Melissa Hoffman and Amy Seidel of FSF. The following digital and hard-copy resources were employed during the landscape analysis:

- Digital Orthophotography
- U.S. Geological Survey topographic maps (1:24,000)
- Natural community maps prepared by Ecosystem Science and Conservation
- Stream maps (GIS layer)

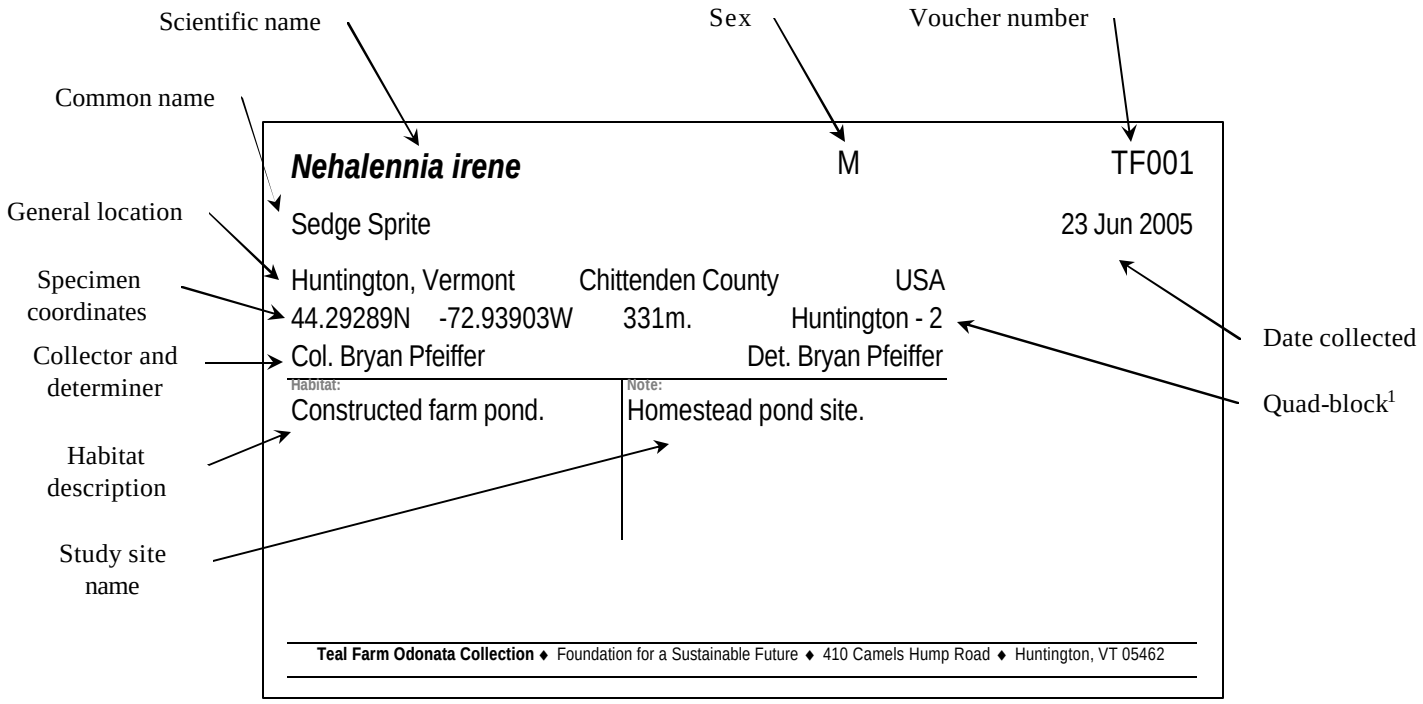
Also preceding formal field investigations was a brief site visit to Teal Farm on 25 April 2005.

2.2 Voucher Evidence

Voucher specimens of nearly every species were collected in order to procure and maintain incontrovertible evidence of the odonate fauna at Teal Farm. In certain cases, voucher specimens are required in order to identify a given odonate specimen to species. These vouchers will also serve as a resources for future odonate investigators at Teal Farm, perhaps including future taxonomic work at the property.

Voucher specimens are maintained with data presented voucher cards (3”x5”) stored with each specimen. A sample voucher card is presented in Figure 1.

Figure 1. Sample Voucher Data Card



[1] The quad-block places Teal Farm within a grid-map system used for the Vermont Breeding Bird Atlas project and the Vermont Butterfly Survey, allowing these taxa to be more easily mapped relative to those atlas projects. A similar grid-map may be used for any Vermont-based Odonata atlas project (now under consideration).

3.0 Study Sites

Survey work was concentrated at the two ponds sites, where Teal Farm's odonate diversity is greatest. No natural ponds occur on the land, but groundwater seeps contribute water to numerous, small, open and forested wetlands; these were investigated only to minimal extent. Streams and brooks constitute Teal Farm's additional odonate habitat. And these as well received limited investigation. The primary sites included:

- **Homestead Pond** – This site includes the constructed pond and associated smaller pond near Teal Farm's housing and related buildings (44.29289 x 72.93903 - Elevation 331m). Approximately 0.85 and 0.05 acres respectively, these ponds include limited emergent plants, including *Typha sp.*, and a small unmowed shoreline vegetated buffer suitable as perching and foraging sites for odonates.
- **Southern Pond and Shrub Swamp** – Formerly an open wetland, this pond was constructed in the 1960s near the meadow toward the property's southern section (44.28132 x 72.93977- Elevation 411m). This site includes a small willow-graminoid swamp at the pond's outlet below the dam.
- **Brush Brook** – Selected sections of the brook at Teal Farm's northern border were surveyed during two visits for Gomphidae and other watercourse species.
- **Cobb Brook** – A small section of this brook was surveyed once for *Ophiogomphus aspersus*.
- **Seeps** – While an exhaustive survey of Teal Farm's seeps were beyond the scope of this project, certain seeps (polygons 19, 67, and 105-107) did receive limited attention for the presence of *Tachopteryx thoreyi* (Gray Petaltail).

To a lesser extent, survey work also included brief visits to woodland trails, clearings and brooks. And the results in this report also include incidental encounters with dragonflies away from priority sites, including openings and the property's dirt roads.

4.0 Teal Farm's Odonate Diversity

It would be perilous to characterize Teal Farm's odonate diversity compared to other similar sites, mostly because investigation into Vermont's odonate fauna is only just now growing beyond its infancy. We have much to learn about the distribution and abundance of these insects across the state. Indeed, no odonate species are currently listed as threatened or endangered in Vermont, owing mostly to a lack of knowledge about this insect order in the state.

It is safe to report, however, that with forests dominating the property's landscape, and the wetland and surface water diversity relatively low, the odonate diversity is limited at Teal Farm. And, based on the accumulated knowledge of odonate diversity in Vermont by the state's active investigators, no odonate species warrant immediate conservation status at Teal Farm. But that hardly means Teal Farm is an uninteresting site when it comes to dragonflies and damselflies.

As expected, the majority of Teal Farm's odonate diversity lies in the property's two pond sites. Species encountered at these sites are, in most cases, well-represented in their distributions across Vermont. Many, such as the *Libellua* species found at the ponds, are relative generalists, well distributed across Vermont in similar habitats. Some, such as the *Ophiogomphus* species, are more limited in their distribution (based on current knowledge of Vermont's odonate diversity).

This investigation revealed a total of 11 Zygoptera (damselfly) species and 26 Anisoptera (dragonfly) species. These represent 26 % of the Vermont's known Zygoptera fauna and 27% of its Anisoptera fauna. Table 1 presents the Zygoptera species encountered and Table 2 presents the Anisoptera species.

It should be pointed out that this was a somewhat cursory review of odonate fauna at Teal Farm. Additional species are certainly present on the property. Yet it is safe to assume that the species encountered during this study comprise a large majority (if not the vast majority) of Teal Farm's odonate fauna.

Table 1. Zygoptera Fauna at Teal Farm

Scientific Name	Common Name	Conservation Status [1]	Homestead Pond	Southern Pond
Lestes congener	Spotted Spreadwing	G5	X	X
Lestes disjunctus	Common Spreadwing	G5	X	X
Lestes eurinus	Amber-winged Spreadwing	G4	X	X
Lestes rectangularis	Slender Spreadwing	G5	X	X
Lestes vigilax	Swamp Spreadwing	G5	X	
Chromagrion conditum	Aurora Damsel	G5	X	
Enallagma aspersum	Azure Bluet	G5		X
Enallagma ebrium	Marsh Bluet	G5	X	X
Enallagma hageni	Hagen's Bluet	G5	X	X
Ischnura verticalis	Eastern Forktail	G5	X	X
Nehalennia irene	Sedge Sprite	G5	X	X

[1]
G1 = critically imperiled
G2 = imperiled
G3 = vulnerable to extirpation or extinction
G4 = apparently secure
G5 = demonstrably widespread, abundant, and secure.

Table 2. Anisoptera Fauna at Teal Farm

Scientific Name	Common Name	Conservation Status [1]	Homestead Pond	Southern Pond	Brook/River Site	Other
Aeshna canadensis	Canada Darner	G5	X	X		
Aeshna constricta	Lance-tipped Darner	G5				X
Aeshna eremita	Lake Darner	G5		X		
Aeshna interrupta	Variable Darner	G5	X	X		
Anax junius	Common Green Darner	G5	X	X		
Gomphus exilis	Lancet Clubtail	G5	X	X		
Gomphus spicatus	Dusky Clubtail	G5	X	X		
Lanthus parvulus	Northern Pygmy Clubtail	G4	X			
Ophiogomphus species	Snaketail species	-		X		
Ophiogomphus carolus	Riffle Snaketail	G5				X
Epitheca canis	Beaverpond Baskettail	G5	X			
Epitheca spinigera	Spiny Baskettail	G5	X			
Somatochlora sp.	Emerald species	-		X		X
Celithemis elisa	Calico Pennant	G5		X		
Erythemis simplicicollis	Eastern Pondhawk	G5	X			
Ladona julia	Chalk-fronted Corporal	G5	X			
Leucorrhinia intacta	Dot-tailed Whiteface	G5	X			
Leucorrhinia proxima	Belted Whiteface	G5				
Libellula incesta	Slaty Skimmer	G5	X	X		
Libellula luctuosa	Widow Skimmer	G5	X			
Libellula pulchella	Twelve-spotted Skimmer	G5	X	X		
Pachydiplax longipennis	Blue Dasher	G5	X			
Plathemis lydia	Common Whitetail	G5		X		X
Sympetrum costiferum	Saffron-winged Meadowhawk	G5		X		
Sympetrum internum	Cherry-faced Meadowhawk	G5		X		X
Sympetrum obtrusum	White-faced Meadowhawk	G5		X		
Sympetrum vicinum	Yellow-legged Meadowhawk	G5	X	X		

[1] G1 = critically imperiled; G2 = imperiled; G3 = vulnerable to extirpation or extinction; G4 = apparently secure; G5 = demonstrably widespread, abundant, and secure.

4.1 Notable Species

It is usually difficult to find odonate species warranting conservation attention at constructed farm ponds. The species encountered at the pond sites appear to be stable across their range and not demanding management or conservation measures.

Nevertheless, depending on Teal Farm's "Odonata goals," most any dragonfly species encountered at the ponds can be considered notable species. Along with butterflies, dragonflies are assuming a growing role in exposing the public to the joys and benefits of insects. As a result, the two ponds would make for accessible sites for public education on biodiversity.

Beyond the ponds, of potentially heightened interest at Teal farm would be species associated with rivers and brooks. This investigation permitted limited inquiry into these habitats. But the three notable dragonflies encountered during the study are associated with watercourses:

- ***Lanthus parvulus*** (Northern Pygmy Clubtail) — The habitat of this small Gomphidae (Clubtail) species is clear streams and brooks with strong current over clean gravel, cobbles or bedrock. At Teal Farm, it was located in the small brook approximately 15 meters east of the homestead pond. Its range is northeastern North America. Its conservation status is G4 — apparently secure, S3 in New York and unranked in Vermont. Potential threats include the impoundment of running waters by human activities, such as poorly drained roads, damming, and also natural activities such as beaver damming; channelization leading to scour of microhabitats; toxic or organic pollution; and introduction of exotic species (NatureServe 2006).
- ***Ophiogomphus carolus*** (Riffle Snaketail) — Another Gomphid species, this striking green dragonfly prefers swiftly flowing, sandy or rocky streams and rivers (Nikula 2003). Its global conservation ranking is G5 (widespread, abundant and secure). It is ranked S4 (apparently secure) in New York and Quebec, and unranked in Vermont. This species was located along the wood road (44.29709 x 72.92984) in Teal Farm's northeastern corner (toward the inholding lot). It is likely to be breeding in nearby Brush Brook. While this species is probably secure in Vermont, its distribution (and that of its three other known congeners in the state) is attracting attention from various investigators.
- One additional *Ophiogomphus* species, a female, was collected at the South Pond site. The exact identity of this specimen is subject to some debate.[1] Females of this genus are notoriously difficult to identify (as is the case with this particular specimen) and members of the genus are known to hybridize. An attempt to locate additional specimens near this site was unsuccessful. It is possible that this individual is a hybrid between *Ophiogomphus carolus* and *O. mainensis*. There is also remote possibility that this individual represents a species not yet described. Newly described *Ophiogomphus* species are not uncommon along mountain ranges to Vermont's south. Resolving this dilemma would require the location of males in the same area or rearing larvae. In any event, this individual is reported here as *Ophiogomphus species*.

1 Digital images, taken through a stereoscope, of this individual's sub-genital plate, occipital crest and other distinguishing characteristics were presented to three of continent's leading odonatists. Each of them came back with a different species—*Ophiogomphus mainensis*, *O. carolus* , and *O. rupinsulensis*.

4.2 Additional Notable Sites

One additional site, for which the scope of this study did not allow survey work, is a small peatland (polygon 29) in the Montane Yellow Birch - Red Spruce forest community near the property's eastern boundary (44.28838 x 72.92358 - Elev. 259 m). This site may be worthy of future investigation for bog/fen odonate species, including *Williamsonia lintneri* (Ringed Boghaunter), a globally ranked species (G3) not known from Vermont.[1] The site was discovered during Wings Environmental's point-count bird survey work at Teal Farm on 19 Jun 2005, a date too late for the predicted flight of *W. lintneri.*

Finally, during the initial planning phases of this investigation, seeps on the property were considered as possible sites for *Tachopteryx thoreyi* (Gray Petaltail), a primitive dragonfly with a global status of G4 and locally imperiled or vulnerable across much of its range in the southeastern United States. Vermont has one record of this species (Carle 1994), from the southern Green Mountain Plateau.[2]

This study includes a limited investigation of two seep sites. Additional seeps were not yet completely mapped in time for the flight period of *T. thoreyi*. Even had they been mapped, Wings Environmental determined that the most efficient and effective use of the time allocated for this project was to obtain a more general inventory of sites with high odonate diversity. Investigation for *T. thoreyi*[1] may be a consideration for future odonate work at Teal Farm.

5.0 Basic Planning Recommendations

Planning considerations for Odonata at Teal Farm obviously cannot be considered apart from broader land-use and conservation goals for the property. Although no odonate species encountered at Teal Farm warrants immediate conservation attention, many options for future odonate investigation can be considered at the property. The research options are varied — and obviously dependent on the overall planning and conservation priorities of the Foundation for a Sustainable Future.

At the very least, this investigation has offered new insights into odonate diversity in Vermont, producing a number of new records for Chittenden County. These will greatly assist a separate, on-going effort to document the distribution and relative abundance of dragonflies and damselflies across Vermont.[3]

Other general recommendations include:

- Further investigate watercourses for *Ophiogomphus* species and other lotic species.
- Further investigate seeps for *Tachopteryx thoreyi*.
- Study newly constructed waterbodies, such as the pond for micro-hydroelectric generation, for odonate immigration, colonization and diversity.
- Protect existing watercourses from stream alteration or geomorphological damage, such as sedimentation and riparian impairment, resulting from development or land-use practices (including forestry) at Teal Farm.

1 Its presence is admittedly remote.

2 An unconfirmed report of this species, from Caledonia County, is currently being investigated.

3 Bryan Pfeiffer and Michael Blust of Green Mountain College intend to publish on the odonate fauna of Vermont.

6.0 Conclusion

The Foundation for a Sustainable Future is to be congratulated for its interest in dragonflies and damselflies. These insects present great possibilities for researchers and recreational wildlife watchers alike. For years, and with good reason, ecologists have defined natural communities, despite their great complexities, largely through their botanical composition. The inclusion of birds and insects in the ecological assessment of Teal Farm is not only a step forward for the farm itself, but a leap with statewide significance. We cannot truly know a place without knowing what's growing there. But we must also know what sitting, slithering, crawling, walking and flying there as well. As the Foundation for a Sustainable Future's research and conservation goals come into sharper focus, dragonflies would be among the many worthy and willing subjects for future inquiry.

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