A preliminary survey of the **Butterflies** and adult **Odonata** of the Anderson Properties in Lincoln Township, Addison, Co., Vermont during part of the 2000 field season for the Colby Hill Ecological Project.

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Introduction

This report represents a part-inventory of butterflies and odonata for the second consecutive year for the comprehensive Colby Hill Ecological Project. This project is a biodiversity and monitoring program on three farms (Guthrie/Bancroft, Pierce and Wells), located in northwestern Addison County, in Lincoln and Bristol Townships of Vermont, USA. The farms comprise a total of 680 acres (283.3 ha). All farms are less than one kilometer from each other. The majority of the area of each farm is comprised of second growth, mixed forest. The open fields are mowed once or twice, annually. No livestock grazing is currently permitted. The farms are currently managed on a low-use basis, primarily involving mowing of the open fields. The historical use of the three farms is essentially the same, namely, a combination of dairy and adult forestry.

The biodiversity project began in 1998, the butterfly and odonata inventory started in 1999. The data for 1999 is presented in the MS, entitled, "Colby Hill Ecological Project, 1998-1999". This was compiled and organized by Marc Lapin, Project Coordinator.

I followed essentially the same methods and routes as during the 1999 field season. However, during the 2000 field season, I concentrated relatively more field time at the Pierce farm and much less at the Wells farm. I also focused more on odonata than butterflies, since I had emphasized the latter in 1999. My primary goal was to determine the diversity of butterflies and odonates on the three properties, with an emphasis on identifying the richness of the fauna, the total number of species present.

It was encouraging to be able to compare the results from the inventory of 2000, with that of 1999. That is, the data from 1999 were, in effect, the base line data for the two taxa.

Methods

As in 1999, I continued to use random search techniques. I followed essentially the same routes on each farm as in 1999 (see Appendix I for details). I was on the

project sites during eight dates in 2000: 29 May; 20 June; 6 July; 22, 30 August; 26, 27 September and 3 October. I inventoried over essentially the entire season of flight activity in 2000, as compared to four days in 1999 when I inventoried on 11 June; 5, 31 July; and 27 August. The intensity of sampling was concentrated more or less during the same periods in both years (June through August).

I decided to set-up two blacklights for moths, late in the season, on Sept. 26th. Unfortunately, the night of the 26th was unseasonably cold with an exceedingly heavy killing frost. No moths were collected although several were seen in the headlights of my car while driving in the area on the night of Sept. 26th.

(I was able to borrow the relatively expensive lighting equipment from the science dept. of Lyndon State College where, although retired, I have office and other privileges.

I also made miscellaneous observations on other fauna, including both invertebrates and vertebrates. The available data are reported below.

I completely reworked and reformatted the basic data from 1999 so it could be directly compared with that from 2000. Hopefully, this will be the start of a long series of continuous annual data, allowing the determination of trends in numbers of species for the entire project area, over a period of many years. If this is done, then it would be necessary to follow standardized inventory protocols each year so that the data can be statistically analyzed. The trade-off would be the reduced time available to do random searches over the project area which, in my opinion, would have a higher probability of adding new species to the base line data.

I addressed and treated the classic taxonomic and nomenclatorial problems with northeastern odonata and butterflies in the same manner as I did for the 1999 inventory.

Every individual insect could not be positively identified in the field or netted to verify an identification. In some cases, as with *Polygonia* or *Aeshna*, the genus was apparent, but not the species. That is, clearly a member of the genus was present but the species wasn't verified. Occasionally, I was quite sure I correctly identified an individual in the field, but couldn't verify this in-hand. Specific examples of these two quite distinct problems are indicated in Tables 1-4 with a question mark (?). However, only those species that were positively identified are considered in the final analyses and comparisons (Tables 5 and 6). The questionable cases were included to more accurately indicate the potential total number of species present during any one census, although the kinds were not absolutely confirmed. Tables 1-4 constitute the major data base for the 2000 survey and tables 5 and 6 represent a summary comparison of the 1999 results with the 2000.

There is an interesting problem, and not a trivial consideration, in dealing with the question of whether to list a taxon during a field inventory session. For example, members of the genus *Aeshna,* the darners, could arguably be seen almost everywhere in open areas on many days (just look toward the horizon!), during their flight season. It seems silly to include all such observations since they are essentially meaningless, in terms of relating such observations to the local landscape scale. I listed a species as a question mark, only when individuals were close enough to be clearly seen and recognizable to genus (say, within 20 meters or so, but could not be identified to species). I think it is important to list the presence of any genus,

in a specific habitat, under these guide lines, even if the species cannot be verified. For example, in phenological studies, knowing when the first representative of the genus *Aeshna* appears in the field is valuable information. This is pertinent to a comparison of sites for estimates of species richness or to compare the number of species at various levels in the trophic-dynamic web of an ecosystem. With the latter concept, function is often more important to know than the identification of the species, at a particular trophic level.

I was extremely careful to verify all individuals that were netted. If I had the slightest doubt about a determination, I collected the individual as a voucher specimen for later examination in the laboratory or almost immediately under a small binocular scope, which I set-up on the hood of my car. Often, the latter individuals were released immediately after the identification was confirmed. If the identification in the field was problematic, those specimens were processed later at home and kept as voucher specimens Vouchers were usually taken for all species not previously listed in the inventory or if any specimens were of interest for other reasons, provided those questions could be resolved by having a voucher specimen to study.

I was especially careful in confirming the identification of species only from female specimens . I was ultimately to able to identify all specimens to species. In general, adults of the odonate fauna are far more challenging to deal with, taxonomically, than the butterflies. Larvae of both taxa are much more difficult to identify to species and many simply cannot be verified, except perhaps by specialists. Even they cannot identify all individual larvae to species. (Vouchers are available on loan to any qualified person who might wish to examine any of the specimens)..

My general familiarity with both taxa continues to grow, almost inevitably. I have especially concentrated on the odonata in the past several years and have gone to considerable personal effort to continue to improve my overall competence. In 1999, I attended four professional meetings, all led by various experts, on various aspects of odonate biology. These were: a workshop the Univ. of Conn., the meeting of the northeastern section of the DSA in NYS, the Hine's Emerald workshop in Wisc., and finally, the magnificent experience of attending the national meeting of the DSA in British Columbia, B.C. There is a tremendous increase in interest among professionals, amateurs and, indeed, various management executives, with the odonates. With respect to evaluating total insect biodiversity, both butterflies and odonata are becoming surrogate umbrella taxa for many other insect groups. We have a long ways to go, however, before our knowledge of these taxa even begins to approach that of the vertebrates.

More importantly, a very rich literature is now becoming available for those interested in the general natural history of odonates and even for specialists. In a sense, the literature on odonates, especially for the generalist, has now caught-up or even surpassed that for butterflies. It is truly a fortuitous time to be studying this group. With the use of this new information, almost any field biologist or ecologist can quickly become familiar with the general biology and taxonomy of odonata. In general, with both taxa, there is a very definite expansion of interest from primarily taxonomic issues to an investigation of a broader array of biological topics of each taxa. Dunkle's (2000) field guide is a giant step in this direction. It provides a great deal of information on the ecology of all species of North American odonates, north of Mexico, plus excellent suggestions for identification in the field without requiring the collecting of individuals. However, collecting is clearly not disavowed, under certain circumstances.

Despite the euphoria of progress indicated by these events, there is still an incredible lack of taxonomists, well-curated collections, and detailed studies on the ecology of almost all species of native non-pest invertebrates. One of the most critical problems is the lack of availability, particularly at the state level, of competent taxonomists and well-curated collections, accessible to non-taxonomists. We are still in the listing and mapping stages of studying our fauna, atlas programs, and other important studies of that type. Resources for doing detailed basic and applied ecological studies are almost totally

lacking. This Project is a notable exception, in many ways, both in terms of the broad variety of research that is supported but also in the extremely positive environment and flexibility that exist for the various investigators.

In presenting the data below I have not only compared the inventory from 2000 with the 1999 data but have made a much broader comparison with another similar general inventory of butterflies and odonata that I was engaged in during 2000. This involved about 20 field days at both the West Mt. WMA and the Silvio O. Conte National Wildlife Refuge-Nulhegan Basin division of northeastern Vermont. I ultimately intend to combine the data from this project with all the other work I have done in Vt. on insects, into one or more peer-reviewed papers.

Corrigendum.

I report two errors in the data of 1999. The name *Somatochlora tenebrosa* should be changed to *S. elongata*. Also, *Libellula luctuosa,* The Widow Skimmer, should be added to the list of odonate species for 1999. Therefore, the total list of confirmed odonate species for 1999 should be increased by one, from 24 to 25. This change has been incorporated into the comparison of 1999 with 2000 (Table 6). I apologize for this error and the omission.

Results and Discussion

The inventory for 2000 was conducted on eight dates. The time in the field each day varied over the season on the three farms. In 2000, I concentrated more on odonata, more time at the Pierce farm and less at the Wells farms. (Most of the data presented below on diversity can be verified by consulting Tables 1-6. Therefore, I won't laboriously and continuously refer to these tables in the following narrative). I have written the narrative in a semi-technical style, hoping that this would be of more interest to non-specialists and help to generate more support for the continuation of such studies.

The season of 2000 had relatively normal, if not above, levels of rainfall. 1999, by comparison, was a very dry year (although I don't have specific climatological data for a direct quantitative comparison). I didn't monitor free standing water levels in the farm ponds during 1999. However, I believe all were near or completely dry at the surface (no standing water), except at the Guthrie pond in the open field. The ponded water behind the beaver dam on the Pierce farm (northeast of the house and draining into Isham Brook) was at the top or brink of the dam in 2000. The braided streamlets below the dam were flowing all season, across the meadow. However, in 1999, the pond behind the dam was extremely reduced in size and volume, less than several meters in width and 0.5 meter deep The water in Isham Brook, below the beaver meadow, was reduced to a mere trickle, late in the season. The small isolated pools were crowded with unidentified minnows. Thus, there was a very significant environmental difference between the two seasons, particularly with respect to the availability of free water at most of the inventory sites, with the notable exception of Guthrie Pond. However, I didn't gather much data on possible effects of this difference on the biota,

An unexpected opportunity presented itself in 2000. Many exuviae of *Aeshna*

were observed on emergent vegetation at the small pond on the Pierce farm, just northeast of the homestead. I collected a large sample of these and determined most to species. I sexed all the individual exuviae, using the keys and diagrams of Ken Soltesz (1996), an expert on the identification of odonate larvae. I had several voucher specimens of *Aeshna umbrosa* exuviae available for direct comparison. These had been identified by experts. I also collected one exuvium at the Pierce pond site, adjacent to to a newly eclosed and soft adult female *umbrosa.* That is, I had an identified exuvium from the very pond I was studying, the identity of which was absolutely confirmed.

Little is known about the sex ratio of odonates as represented by exuviae, compared to ratios based on captures of adults. The sex ratio of adult odonates is usually strongly skewed toward males, based on data from free-flying adults. In my own field experience, this is always the situation among the darners. It is uncommon to find females of many species of darners and of other taxa, such as the emeralds, *Somatochlora* spp. (See the discussion below on survivorship of *Aeshna* larvae on the Pierce farm. This is relevant to this issue of survivorship and development of odonates under unusually dry conditions, such as occurred in 1999).

Butterflies.

A total of 34 and 31 species of butterflies were verified in 1999 and 2000, respectively, on all farms. In 2000, three species of butterflies were recorded for the first time: Pearl Crescent, Juvenal's Duskywing, and the Appalachian Brown. Each represented a new record for each of three genera and the second species of record for each genus. This is of interest because it provides the opportunity for elucidating the comparative ecology of conspecific species of three genera, on the project area.

It is a standard technique among ecologists to closely compare two species of the same genus that occupy the same general habitat, so that their general biology and ecology can be more accurately delimited. This approach has been used for years with many diverse taxa to elucidate the fundamental question of the comparative ecological niches of conspecific species, living in what appears to be the same microhabitat (sometimes and incorrectly called the ecological niche). These studies also help in understanding the well-known competitive exclusion principle of Hardin and others: namely, two species of the same genus cannot occupy the same ecological niche or, more often couched, as not occupying the same (micro) habitat.

The Pearl Crescent, *Phyciodes tharos,* is a particularly interesting addition to the butterfly list for the area. I suspected it was present on the area, but never verified it until Aug. 22nd, on the Pierce Farm, at the beaver meadow site. A male speci-men was vouchered and carefully studied. Females of the two species, *P.cocyta* (formerly *P. selenis*) and *P. tharos* are very difficult to identify. Some workers only utilize males specimens to verify the presence of either species. However, this presents the problem that one cannot now assume that all *Phyciodes* seen on the area are *cocyta.*

It would be highly desirable to collect an adequate series of vouchers of *Phyciodes* from all habitats on the farms and over the entire season. This would help in identifying any seasonal differences in phenology and the use of microhabitats, among the two species. For example, how do the two species avoid or ameliorate direct competition? Do the larvae utilize different food plants (*Aster* spp.) and the

adults different nectar sources? What degree of overlap, if any, is there in the period of activity of the adults?

Two individuals of Juvenal's Duskywing were recorded: one in May along the field/meadow upland edge of the Guthrie field and the other, on 20 June, in the lowland marsh/swamp of the Pierce farm (south of the small woodland pond and south of the dirt road by the Pierce homestead). The latter habitat is very unusual for this species and I was most surprised to find it in the swamp. The larvae of *Erynnis juvenalis* are oak feeders, which makes the 20th June record even more puzzling. There is some red oak in the area so perhaps it just flew into the swamp from the nearby upland woods? However, Warren J. Kiel (pers. comm.) told me he once found the species well out in the middle of an extensive fen in Maine. Perhaps certain individuals disperse from their typical breeding habitat over non-breeding habitats. One reason for this would be to move from a source area to a sink area, especially during periods of high population densities. However, that didn't appear to be the situation at the Pierce Farm since only one specimen was observed. Surprisingly, the usually very common *E. icelus* was not recorded in 2000 on any of the properties.

Both individuals of the Appalachian Brown were found on the Pierce Farm and were in the general vicinity of the same lowland marsh/swamp, mentioned above. This species is exceedingly easy to overlook because of its great similarity to *Satryodes eurydice,* the Meadow Brown. I suspected it was present at the site, as inferred in my report for 1999. I had predicted that the small marsh/ swamp complex on the Pierce farm would probably yield some very interesting records. (These two species of *Satryodes* weren't recognized as distinct species until 1970).

I also verified the existence of a resident population of the Mustard White, *Pieris napi*, in the Guthrie woodland, west of the open meadow. Last year I had recorded one individual male of the second brood on 5 July. This year, on 29th May, I counted a minimum of six individuals and five were netted. All were males. Since males usually emerge a day or two before the females, I believe I inventoried, just as the first brood was eclosing. On the 20th of June, in the same area, I saw two individuals and netted one, a worn male of the first brood. Thus, the total period of activity of the first brood was probably recorded, roughly from the end of May through the month of June. Apparently, the second brood emerges about a week after the first, although widely-spaced periods of inventory are not sufficient to detect whether there is any overlap between the two distinct broods. Another interesting question that can only be adequately addressed with more intensive inventorying.

As in 1999, no hairstreaks (Theclinae) were recorded. I suspect this is because of the general lack of oaks as a larval food source, for many species, and the absence of ample, predictable nectar sources. However, not all our native hairstreaks feed on *Quercus*. The dogbane patch on the Guthrie farm, which is! one of the obvious nectar sources, was mowed twice in 2000, generally precluding the opportunity for providing nectar for many species of butterflies and other insectivorous species of insects, such as various hymenoptera, diptera, and diurnal moths. In 1999, I reported many species of insects utilizing this nectar source. There is no question, from my direct observations, that mowing essentially destroys the availability of nectar from dogbane. Dogbane is undoubtedly one of the major nectar sources at Bancroft field for many necti-

vorous species of insects. However, until a careful study is done on the amount, degree of utilization and seasonal availability of **all** nectar sources in the open fields, we can only speculate about the relationship of nectar sources to the adult nectivorous insects. Do other species of nectar producing plants compensate for the loss of one major source, such as dogbane? We should remember that butterflies need three critical things for survival: food for the larvae, food for the adults, and an appropriate place where the chrysalis can be built and is protected until the adult ecloses. The lack of any one of these will generally spell doom for any species.

The European Skipper, an exotic species, and the Prairie or Common Ringlet, relatively recent "immigrants" into the state from the north, were incredibly abundant. The former seems to have a much more restricted flight season than the latter. The skipper was only recorded during the 6 July inventory whereas the ringlet was found essentially all season, after the May inventory. Thus, the skipper is either univoltine or bivoltine at the Lincoln site and the ringlet is clearly multivoltine. The close mowing of the fields apparently provides an ideal environment for these species, both of which feed exclusively on graminoids. The mowing ensures a relatively constant source of succulent stems and leaves that would seem ideal for the developing larvae. In the jargon of ecology, the net primary production of the grasses and forbs in the fields is relatively high, compared to many of the other ecosystems in the area. In fact, it probably is the highest of all the terrestrial ecosystems, on the project area.

Somewhat paradoxically, although the annual mowing does seems to reduce the availability of major nectar sources, 20 of the 23 species of butterflies recorded on the Guthrie/Bancroft farm were found over the fields. Undoubtedly, the extensive amount of woodland/field edge contributed to the species total. However, the precise ecological effect of essentially abandoned but mowed farm fields, on the butterfly fauna, is a very interesting question. Since this land-use practice is now very wide-spread throughout **all** of New England, the question of its potential influence on insect biodiversity is not just a local issue. The Colby Hill Project could very well be a model for further research on this problem. Management, however, would have to consider some changes in the mowing regime so that field experiments could be conducted.

Keeping fields open may be much more than an esthetic consideration.

In less than ten days of inventorying for butterflies on the Colby Hill Project sites, I recorded 31 species. This is three less than the total of 34 that I identified in some 20 days of inventory in Essex Co., Vt., during the same field season. I find this to be somewhat surprising. I would have expected many more species at the two Essex County sites. The most obvious difference between the two study areas was the absence of extensive mowed fields at the Essex County sites. It does suggest that extensive open-but relatively little-used fields do enhance total butterfly biodiversity in a manner that is not totally understood.

Odonata.

A total of 25 and 32 species of odonata were confirmed in 1999 and 2000, respectively, on all farms. This represents a significant increase of seven, in total **number** of species, between the two seasons. Four species, including three relatively common that were reported in 1999, were not recorded in 2000:*Calopteryx maculata*, *Enallagma ebrium*, *E. hageni*, and *Leucorrhinia proxima* (compare in Table

6). The first three species are quite commonly encountered.

Eleven species of odonata were first recorded on the project area in 2000: *Lestes congener, L. rectangularis, Chromagrion conditum, Aeshna canadensis, A. constricta, A. eremita, A. tuberculifera, Cordulegaster maculata, Dorocordulia libera, Epitheca canis*, and *Leucorrhinia intacta*. Four of these were members of the very strong and fast flying darner group, *Aeshna* spp.

There was a difference of 44 % (11/25) with respect to the **kinds** of species present, compared to a 28 % (7/25) difference, represented by simply comparing the total **number** of species. It is apparent that simply comparing total number of species would be misleading, in terms of evaluating possible ecological differences of the species assemblages of odonates, between the two years.

I don't think the increase in number of dates of inventory, between the two seasons, can fully account for the 44 % increase in the number of records of **new** species. On 29th May of 2000, for example, no species of odonates were recorded. There appears to be a real biological increase in both the number and kinds of species of odonates on the project area in 2000, as compared to 1999.

There was also a turnover in the kinds of species present. I don't think I could have possibly missed *ebrium ,hageni*, or *Calopteryx maculata* in 2000, if they were present. All are relatively conspicuous and comparatively easy to net. It will be interesting to learn how both the total number of species and the species turnover in 2001 will compare with 1999 and 2000.

The above comparison suggests that the term biodiversity is a very slippery semantic slope and must be defined clearly, since it has several quite different connotations. As Hunter (1996) suggests, many of these ideas are intuitively obvious and perhaps it seems excessively pedantic to belabor them. But, how many people realize that you can get identical Shannon Weaver indices of of biodiversity (perhaps one of the most common measures) with totally different lists of species of the same magnitude, as long as the relative abundance of each species remains the same? In many respects, it is similar to the question of what is an ecologist, or an environmentalist. Therefore, simple counts or lists of species between areas and seasons must be interpreted very cautiously, when making comparative ecological assessments of species assemblages over time and space. All ecologists are patently aware of this, but the term "biodiversity" can be deliberately construed as a "buzz word" to confuse many discussions. The term biodiversity must be clearly defined since there are different kinds and levels, recognized by ecologists.

The change in simple total numbers of species between 1999 and 2000 was much more pronounced with the odonata than the butterflies (28.0% and -8.8 %, respectively). Many odonata are much more vagile (move around more and at greater distances) than most butterflies. The darners, especially, fly great distances at high rates of speed. As many authors have reported, the annual species lists of odonata for a given site shows a great deal of turnover, even though the total number of species may be relatively constant. It is as if many species are transients, homing in on a small pond, say like the Guthrie Pond, for a few days or so, and then moving on. The scale of observation undoubtedly makes a huge difference in the totals. If the scales aren't quite similar then the data from two sites must be interpreted quite cautiously, even if

the method of sampling was very similar at each.

I suspect Guthrie Pond because or its relative permanence and isolation from other similar ponds, acts like an ecological magnet to many species of odonata, especially many of the darners (*Aeshna*). It's almost like taxi-cab drivers in New York City periodically focusing their attention on Grand Central Station, over the course of a day or a week, to get a fare when they are not available elsewhere. The potential "fares" for the darners are probably 1) the increased opportunity to mate, 2) the availability of concentrated food, 3) oviposition sites and 4) possibly a place to take a dip, that is, to cool off! At an elevation of 100 meters or so, Guthrie Pond must shine like a little emerald amid the sea of grasses and forbs in the fields, a beckoning landing light to the intrepid odonate traveler. Whenever I go there, I get a great sense of temporary visitation of individual darners to the Guthrie Pond site. It reminds me of a miniature county airport with single-engined planes constantly coming and going. It is, however, exceedingly difficult to document precisely what is happening, biologically.

The data suggest that there is a considerable turnover in the species of odonates, particularly darners, that are at the pond for unknown reasons. If they could be netted more easily, we could more quickly determine any patterns that exist, either in behavior and/or ecology. It is wonderful to contemplate a greater understanding of what the darners are doing at this little permanent body of water and how Guthrie Pond affects their survival, both as individuals and as populations of one or several species.

Are the darners regularly patrolling back and forth among the various bodies of free water in the area and, if so, what are the outer dimensions of their activity space? Or, except when the females oviposit, are these movements essentially random, with no apparent assembly rules, except perhaps to go where the food is, when not engaged directly in courtship behavior. And when engaged in the latter, how does their behavior change, in terms of movements over the landscape? Do they move over the whole project area, the township or several townships? We simply don't know! A massive marking effort could possible elucidate this problem. However, from my own experience in working with darners, it is not going to be an easy problem to address. Perhaps, miniature transmitters would be the answer? With the current GPS technology we can now quite precisely pin-point the position of individuals on the landscape. I would predict that the varous species of darners utilize the landscape quite differently. We know little to nothing about this.

Although clearly very speculative, darners may have a lek system of mating. This has now been verified in some species of insects. The males certainly seem to fly around at great speeds and seem to temporarily concentrate over the landscape. The latter is one of the characteristics of lek mating systems. Some male odonates, such as the skimmer, *Plathemis lydia*, are known to have preferred perches that they defend. Some authors describe this as a lek. However, Corbet (1999) feels that since a resource is being defended, this example, by definition, cannot be called a lek system. It seems very odd to me that no odonate is known to exhibit this system of breeding?

To manage any species so that it can exist for many generations, we must know the minimal space and other resources required to sustain a minimum population (Ne)

at levels that will permit its survival over many generations. It would be critical to know if male odonates need to concentrate at certain sites to "display" to females. These sites would then become very critical to the species involved; that is, they would be critical habitats, not just structurally or physiologically, but to fulfill the most basic need of the species, namely reproduction and especially choice of mates. Guthrie Pond seems to be such a site.

What constitutes a Mendelian population of any odonate? Perhaps, all the ponds and wetlands on the three project farm properties **and** the adjacent lands comprise the minimum area and habitats required to sustain a breeding population of many the species of darners. The ponds and marshes may essentially constitute the sources and sinks for **metapopulations** of each species. Which are the sources and which the sinks? Clearly, one small pond is not sufficient to maintain the populations of most species of darners and probably not a single one.

Alternatively, it might be more economical to essentially abandon the attempt to solve these kinds of problems with the darners and concentrate efforts on the relatively less active species. We know essentially nothing about the biology of *Enallagma aspersum* and *Lestes congener.* Either of these zygoptera would be excellent possibilities for detailed life history studies. However, I still think darners are a very interesting group to study, despite the difficulties inherent in working with them. I find them to be a real exciting challenge to study albeit, at times, extremely frustrating! They don't reveal their secrets easily. Ultimately, cost and biologically-based priorities will have to be balanced.

The additions of the three species of *Aeshna* to the list exemplifies some of the above discussion with respect to the high probability of these extremely powerful fliers appearing at any potentially suitable site. These were: *constricta*, *eremita*, and *tuberculifera*. I will briefly discuss each.

The *A.constricta* record is interesting to relate. While inventorying insects in the Guthrie woodland marsh/swamp complex, on the 22nd Aug., I swung, almost in self defense, at a darner that was flying rapidly toward me and at about a meter over my head. In most similar situations, the result would be an empty net. To my amazement, I caught a male *constricta,* the Lance-tipped Darner. The first record for the project area. Prior to its capture, I had missed a number of darners at the same site. The *constricta* record was only my second ever for all of Vt. It is reported to be a very wary species, even for a darner, and to frequent more open boggy areas, including those with temporary water. In retrospect, the site of capture very closely resembled the textbook description of Dunkle (2000).

The single record of the Lake Emerald, *A. eremita,* on 30 Aug. was also somewhat surprising. As its name implies, it is primarily a species of large ponds and wooded lakes, although it is occasionally found in bogs and fens. This corresponds to **all** my previous experience with the species in Vt. I simply didn't expect it at Guthrie Pond. On that same date, at Guthrie Pond, I also managed to net two male *Aeshna canadensis.* As usual, several other darners (10-20) evaded my net and were not identified. (Unlike some of my more perspicacious eagle-eyed colleagues, I rarely am confident of the identification of most aeshnids in flight).

However, the most notable new aeshnid record was that of *Aeshna tuber-*

culifera, the Black-tipped Darner, late in the season, on 27 Sept. This is ranked by as a S2 species in the very preliminary list of odonates in Vermont (Carle,1994). It has a very disjunct distribution in the northeastern United States and eastern Canada and the Pacific northwest.

I had checked Guthrie pond between 1600-1610 and 1645-1700 on the 26th Sept. but wasn't able to net any *Aeshna* spp. On the 27th, I was again at the pond between from 1310-1400 hrs. As usual, several darners were cruising over the pond and the nearby field. At 1329, 19 minutes after arriving at the pond, I netted the first darner. It was my second *tuberculifera* of the year in Vt.! At 1341 hrs, I detected another pair of darners that were closely interacting, in flight, just a few meters from the edge of the pond. They eventually assumed the "wheel" reproductive position and, in the process, dropped relatively low, almost at the surface of the ground. I netted both but one escaped before I could examine it closely. The remaining individual was a female *tuberculifera*. The one that escaped almost certainly was a male of the species. At 1348 hrs I netted another darner, in the vicinity of Guthrie Pond, and it was also a *tuberculifera*! Thus, in the space of less than 30 minutes, I had recorded four individuals of a supposedly very uncommon species (S2 rank).

I am more convinced that this species may be much more common than records suggest. In my experience, it seems to be a late fall flying species. Every one that I have ever recorded in Vt. (Jericho, Paul Stream, Bromley Mt., Guthrie Pond) have been complete surprises to me. All, except the individual taken at the Paul Stream location, were in upland clearings, fairly close to a woodland edge, with lentic habitats, apparently permanent water, within at least 50 meters of the capture point. The Paul Stream record was quite different. The male individual was netted low (<20 cms) over the middle of the channel, at a freshly constructed beaver dam across the stream. In fact, I thought it was a *Boyeria* or a gomphid, when I first attempted to net it! I think the Black-tipped Darner is either over-looked or it is more common, later in the season, after the period of **maximum** activity of many other species of darners, is past. One could net an individual of *tuberculifera* and discard it, thinking it is a more common and similar species, such as *umbrosa.* It is extremely important to check the color of the tenth segment before releasing all species of darners. The thoracic stripes are also different and these should be carefully scrutinized to make sure that the specimen in hand is not an *umbrosa* but perhaps a *tuberculifera* or some other similar species.

Dunkle (2000) reports that this species, although uncommon at the landscape level, is found "commonly" at ponds "edged with cattails..." This is essentially a description of Guthrie Pond, except that many ponds with cattail edges are semi-permanent. Ponds with cattails are essentially ubiquitous in the northeastern United States, certainly *tuberculifera* is not! Some other variable must be critical I suspect the existence of permanent standing water may be very important. All my previous captures have been at lentic sites and appeared to have open water present, during dry seasons. Only one record was from a lotic environment and this stream is one that flows all year, even during very dry periods.

In 1999, I did recall seeing a darner oviposit in a cattail at 1758 hrs on 31 July 1999, the Guthrie pond site. The unidentified female was ovipositing (endophytically) into the cattail stem, about 20 cm **above** ground level. The plant was about one meter

from the edge of the water, on the land side. *A. tuberculifera* is one of the few species of native darners known to regularly oviposit high in emergent vegetation, well above the surface of the water. I am virtually certain the individual was not an *umbrosa,* although I had netted six darners at the same general time and they were all female *umbrosa*. (The latter species commonly oviposits at or very near the water surface and even partially submerges at times, to oviposit). At the time, I remembered wondering if I had seen a female *tuberculifera* but discarded the conjecture almost immediately as wishful thinking and essentially ignored the observation. Could it be that this relatively rare darner, *Aeshna tuberculifera*, is breeding at Guthrie Pond? I think the answer is a guarded, yes! If so, it would present an extremely unique opportunity for a more detailed study of the species.

I shudder to contemplate that one large-sized dump truck could probably fill in that pond in an afternoon. Also, the undisputed fact that purple loosestrife is now displacing *Typha* throughout most of the northeast, gives more pause for concern about this species and others that seem to require cattails as a critical part of their ecological niche.

I returned again to the project area on 3rd Oct., as soon as the weather was suitable to see if *tuberculifera* was still at Guthrie Pond. The weather seemed ideal (relatively clear skies and a temp. at 73 F. at 1516 hrs in the shade at my car). I was at the site from 1515 to 1605 hrs. I saw at least ten darners and managed to net two: a wing-worn male *interrupta* and a female *umbrosa* that was completely missing all its terminal appendages. Both these records suggest that the season of activity for adult darners was drawing to a rapid close. Unfortunately, no Black-tipped darners were recorded. Where were they? Were they there and I simply failed to net any or had they left the area entirely? Did the adults die, did they migrate, did they move to Bristol Pond? To my knowledge, migration has not been reported in this species of aeshnid. We simply don't know the answers to **any** of these questions.

To more clearly elucidate the overall ecology of darners at Guthrie Pond, collections of well-curated larvae should be made. This would assist in determining which species breed and which are transients (don't breed there). However, the identification and collection of a satisfactory sample of the larvae of *Aeshna* spp. would be fairly challenging. The larvae of the shadow darner, *umbrosa,* is quite easy to distinguish but the larvae of other species of *Aeshna* are much more difficult to identify.

Notes on the ecology of *Aeshna umbrosa* larvae.

While walking around the small pond, northeast of the Pierce homestead, on 6 July, I noticed a very recently eclosed adult female *umbrosa*. This was my first observation of any darner on the entire area for the season. Twice, I returned to the pond in Aug. Each time I noticed exuviae (the shed exoskeleton of the ultimate larva) clinging to the emergent vegetation. This presented a fairly unique and unexpected opportunity to check the species and sex ratio of the darner population, as represented by exuviae. (In nature, the sex ratio of essentially all adult flying odonates, based on captures in nets, is strongly biased toward the male sex. In fact, with some species, such as *Somatochlora* and even some *Aeshna*, it is a red-letter day to find a female).

I collected 21 exuviae: 6 on 22 Aug. and 15 on 30 Aug. All except two, which I could not verify to species, were *umbrosa*. One of these was a male with the labium missing, the other looked slightly different enough that I decided to omit it from

the data base, although it did resemble an *umbrosa*.

Fifteen (71.4 %) of the 21 were females. Thus, the sex ratio was 2.5 females to 1 male, a ratio very heavily skewed toward females. Since it is relatively unusual to record females in free-flying populations of darners, this presents the problem of why was the sex ratio at the pond so skewed toward females? Assuming a 50:50 sex ratio at oviposition, which is universally assumed to be the normal situation in essentially all sexually reproducing insects, the skewed ratio toward females, in last-stage larvae, is unexplained. I can't provide the answer.

I'm quite confident that I didn't introduce any bias by my method of collecting the exuviae. I certainly didn't distinguish any sexual differences between individual exuviae. I also collected more or less randomly throughout the entire area of emergent vegetation. If males were present in equal numbers to the females, among the larvae in the pond, why wasn't this reflected in the analysis of the exuviae? There must have been greater selection against larval males than females, by some unidentified factor(s).

The data from the exuvial counts strongly suggests that there was a higher proportion of females emerging from the Pierce pond in 2000. The last stage larvae survived the very dry conditions of 1999, presumably in the pond. After eclosion and the nuptial flight, there apparently is a greatly increased mortality of females. The adult sex ratio then shifts back to a preponderance of males. It would be extremely interesting to see what the situation will be next year. The Pierce pond seems ideal for this type of study.

Another potential problem was suggested by the mere fact of the collection of the exuviae. Why were any there at all? Presumably, last season (1999) the Pierce pond, northeast of the homestead, completely or very nearly dried up. It certainly had very little free water in it when I last visited the site in 1999. How did the larvae survive at the pond?

Most, if not all, species of *Aeshna* at this latitude take more than one year to mature **as larvae**. Corbet (1999) clearly shows this. He reported that of 24 species of aeshnidae (as compared to just the genus), from primarily temperate regions, only two have one generation per year. He didn't explicitly mention *umbrosa*, however. Walker (1912) stated unequivocally (p. 49) that "...three years is the normal length of *Ae. canadensis and Ae. umbrosa*, if not all species..." Hence, there is little doubt that *umbrosa* needs more than one year to mature as a larva and probably requires three. How did the larvae of *umbrosa* survive in the Pierce Pond, if it was near or totally devoid of free water? Could they have possibly moved down from the nearby seep area? Or, did they go into some type of dry period aestivation?

In view of the above, I certainly would not have predicted the relatively **large number** of ultimate larvae that survived at the pond. The sample of 21 certainly didn't include all the exuviae that were present in the pond during 2000. Exuviae are very fragile and can easily be damaged by various environmental vicissitudes. Even if there had been a very small amount of free water in the pond in 1999, the density of the larvae must have been extremely high. I would think that competition for food would have been intense and most potential ultimate stage larvae would have starved. And, in addition, assuming cannibalism, which has been reported many times in

odonates, one might predict, under these apparently very crowded conditions of 1999, that most, if not all, the earlier stage larvae would have been eaten. Thus, at the next year (2000) there should be few if **any** exuviae of *umbrosa* at the pond. Alternatively, predation by birds or even amphibia, such as larval salamanders or adult ranids, might have reduced the degree of competition among the odonate larvae. With any of these sources of potential mortality, however, the predation might have been greater on the male larvae than the females. In summary, was the differential sex ratio of the emerging larvae a function of physical or biological factors?

It would also be equally interesting to sample larvae and exuviae from the Pierce pond in 2001.

How many adult individuals of *umbrosa* eclosed from the little Pierce pond in 2000? All would be avid feeders on flying insects, among which mosquitoes would presumably be the primary targets. At least 21 and probably many more adult darners, regardless of species or sex, successfully eclosed. I saw well over 20 exuviae on the 22nd of Aug. that I never collected. The Pierce farm pond is apparently a major Shadow Darner nursery. And I hesitate to add, a producer of predators of flying insects. It is extremely interesting to contemplate how important these comparatively very small ponds (well under 1/20 ha) are for some species of odonata of the area. Do the ponds produce enough darners to significantly decrease the numbers of biting insect pests, in the human community of the area.

Although I don't recall seeing a quantitative comparison, the diurnal darners, in many ways, seem to play the same role in possibly controlling insects, as the nocturnal bats. It would be extremely interesting to quantify both. We know quite a bit about the feeding ecology of bats but much less so about darners.

E. aspersum continued to be found only at Guthrie pond. At the beaver meadow area, on the Pierce pond, I recorded an apparent total of 14 species of odonata, of which 11 were definitely confirmed to species. At the Guthrie Pond, a much smaller area, there was a potential maximum of 22 species, of which 18 were confirmed. Behind and over the beaver dam and over the adjacent meadow, there were many individuals of both darners and emeralds, flying back and forth. *Somatochlora elongata* seemed to be the most prevalent emerald although a smaller unidentified emerald was seen, definitely not *elongata* and probably *minor* or *walshii.*

The beaver pond and adjacent meadow complex, with its rete of braided streams and all of Isham Brook need more work on odonata and other biota, as some of the other researchers on this project have already asserted.

The combined total of 32 species of odonata on all farms in 2000 is probably well below the potential total. By comparison, I verified 56 species of odonata during the summer from the Essex Co. site. Much more inventory work remains to be accomplished with the odonate fauna on the entire Colby Hill Project area. I am less confident that a similar effort will reveal a corresponding increase in the number of species of butterflies. Certainly, other species of butterflies will be found but I think the odonate fauna will eventually prove to be the most speciose of the two major taxa, by a considerable margin. I have yet to inventory along Baldwin Brook or some of the small streamlets that flow northeast on the north end of the Bancroft property. There is no question that various species of gomphids will eventually be found at those sites.

There is a remote-but real possibility that a very rare species of odonate will be found in the woodland seeps in the same general area. I won't speculate on which at this time for a variety of reasons.

Further butterfly observations late in the season.

While at the Guthrie Pond on 3rd Oct., I saw a single monarch flying on a general southwestern heading over the field at 1538 hrs. Also, the common ringlet and several "alba" form individuals of *Colias* were flying over the adjacent meadow. In my experience, the "alba" form (all females) are much more common, later in the season of flight of the resident pierids: *Colias philodice* and *C.eurytheme.* I don't know if it is understood why this is so. "Alba" females can be quite difficult to identify to species. From a thermodynamic perspective, the increased prevalence of white-colored individuals later in the season seems counter-intuitive. I would expect just the opposite, based on the expected need to absorb more radiation. Male individuals, especially of *philodice*, are darker in the late fall as expected, although I don't know if this has been proven to be a thermodynamic advantage.

Other invertebrates.

I collected several series of carabids but have not been able to have them identified (together with those of 1999). However, the tiger beetle, *Cicindela duodecimguttata*, the 12-spotted beetle, seems to be the only species of tiger beetle along the upper part of Isham Brook. I would eventually expect *repanda* to be found there. I have frequently found both species along quite similar streams in other parts of the state, but usually at lower elevations.

On 3 Oct. I collected a large female adult orb-weaver spider that was floating on Isham Brook. Dr. Ross T. Bell kindly verified that it was *Araneus diadema*, the Garden or Cross Spider, a common introduced species. However, Ross indicated that the individual represented the more uncommon of two possible color forms. In fact, he had never seen that particular morph before. I donated the specimen to the UVM collection, under Dr. Bell's supervision. Collins and colleagues had not recorded this species from the project area, during their pitfall trapping. The arachnid fauna of the area clearly is in need of much more work. This is essentially the situation anywhere in the world for any arachnid except those of medical interest.

I noticed several individuals of one small species of spider that was apparently using the empty exuviae of *umbrosa* as a domicile. I have made similar observations in other areas on what appears to be the same species of spider. I know of absolutely no work on the details of the possible biological relationship between this spider and the exuviae of odonates. Is this spider dependent on odonata exuviae for its successful reproduction? The ecological web of life can be, as Darwin once indicated, a very tangled bank, indeed. Not all of the complex symbiotic relationships reside in the tropical rain forests. Some of the most interesting problems reside under our very noses, right here in Vt.

Essentially all the major insect taxa need to be inventoried if a primary goal of the project is to ascertain the diversity of invertebrates. I would suggest that priority should be given to the study of the aquatic macro-invertebrate fauna of all the brooks and other aquatic habitats on the area. The macro-invertebrate fauna of brooks are usually sensitive indicators of landscape changes.

Vertebrates.

I made no systematic surveys of vertebrates but did see three two-lined salamanders, *Eurycea bislineata*, under rocks in the upper Isham Brook on 27th Sept.

I found a road-killed male White-winged Crossbill on the direct road, just east of the Pierce homestead, on 22nd Aug. I heard this species singing several times in the area during the field season. I scanned Mr. King's 1999 lists and don't believe he recorded this species in 1999. Also, unless I missed the record, he doesn't list the Golden-crowned Kinglet in 1999. I have regularly encountered this latter species in both 1999 and 2000, at the Guthrie farm.

I have seen brook trout of least five to six inches in length in Isham Brook, along with many unidentified minnows. The latter, especially, would be extremely interesting to study. They are, in many respects, the "canaries" of the brooks.

I think all of Isham Brook and its immediate riparian zone would be an ideal subject for more careful biological inventories. It is an absolutely marvelous stream for potential detailed limnological studies of all types.

Recommendations for management.

Some of my recommendations for management are essentially the same as last year. I reiterate the three major suggestions from 1999 and add others.

1. change the timing and duration of the mowing of the fields to see if it would have any long-term affects on the biodiversity of butterflies
    a. Avoid mowing the dogbane patch in Bancroft field until after it has fully bloomed
2. Consider making more ponds on the area and/or deepening some of the existing ones
    a. Allow for a wider buffer ecotone around the Guthrie and the Pierce ponds
3. Plan for long-term monitoring of keystone taxa
4. Plan to expand the breadth of taxa and ecosystems that are included in the general plan. I especially recommend more detailed studies of the macro-invertebrates of the streams in the area.
5. Continue the excellent practice of consolidating the reports of all investigators each year
    a. All the investigators, might formally communicate, once a year and/or assist each other with their individual goals, to the extent that this contributes positively to the entire Project and is not inhibiting to the work of individual investigators
    b. Each investigator might briefly suggest, in writing, what he/she would like others to possibly contribute in the way of his/her field observations and/or collections, on a strictly voluntary basis
    c. A first step would be for the names, addresses (esp. emails) of all investigators to be circulated and included in the annual reports. That is, let's keep each other periodically informed of what we are doing and attempt to freely share information, discuss problems, ask questions and share skills so each of us can accomplish our individual goals with more dispatch and rigor, within the context of enhancing the general goals of the Project

6. An empirical real-world computer model could be developed whereby data could be inserted and retrieved so that legitimate parties would have access to it in a readily available, convenient, and flexible electronic format. This multi-disciplinary model should be useful to other similar projects, based on biodiversity studies of old New England farms. I believe that various federal and state entities have similar models. Many of these, in my relatively uninformed view, seem far more complex than I contemplate here, but a study of the best of these should yield some excellent ideas for scaled-down models for this project.

I am more interested in the utility of the models for inputting and retrieving various classes of data in the most expeditious manner possible, while still having a model that permits a long-range response to important basic and applied questions, from summarizing empirical data (species lists, etc.) to applications of these data to social and economic issues at different scales.

The use of the model should not require excessively expensive and/or extensive computer requirements. Hopefully, individual investigators should be able to interact with the program from their own computer platforms.

Direct consultation with qualified investigators involved with the New Hampshire Hubbard Brook facility would be an excellent place to seek such advice. I believe the models from that well-known and highly respected program, have already been developed and, more importantly- tested and used over a period of years. Furthermore, I think much of that information is part of the public domain.

Individual investigators, however, in my opinion should retain the right to publish their data, within some reasonable time frame. That is, the empirical data should be made available to the model but investigators should have the academic freedom to publish their own analyses, rather than just being mere conduits of information to a model. The latter does not make for a very stimulating experience for any investigator, whatever the discipline. This does not preclude multi-authorship of a general synthesis of the data from several investigators, as already illustrated in the 1999 compendium, a most useful publication.

Summary

In 1999, eight field days were spent to inventory both butterflies and odonata. The combined data from 2000 was compared with that from 1999 (spread sheets of Tables 5 and 6) and these data were briefly compared with other unpublished data from Essex Co., Vt., collected in 2000.

Thirty-one species of butterflies were confirmed in 2000, compared to 34 in 1999. There were three species recorded for the first time in 2000. Most of the species of butterflies were taken at the open fields of the Guthrie farm or at the beaver meadow area of the Pierce farm.

Thirty-two species of odonata were confirmed in 2000, compared to 25 in 1999. Eleven species were recorded for the first time in 2000. Among these were four species of darner, *Aeshna* spp., including four individual records of the rare (S2 rank) Black-tipped, *Aeshna tuberculifera*. Three of these new species records of *Aeshna* were at the Guthrie pond.

A collection of exuviae of the Shadow Darner was made at one of the Pierce farm ponds. The sex ratio was heavily skewed toward females: 2.5:1, quite different from the usual male-skewed ratio found in flying adults. The collection of female-biased exuviae also prompted several other questions for later investigation.

Guthrie Pond, the Pierce Ponds, and the various wetlands on all farms continue to be sites with a high relative biodiversity of odonata.

For reasons that are not clear, the majority of butterflies, especially on the Guthrie/Bancroft farms are recorded from the fields, which are periodically mowed. There is a definite need to research the question of the relationship between the butterfly biodiversity and the extent of mowed old fields. Abandoned, but mowed fields, may be most important as sources of nectar for the adults of many species of butterflies. Dogbane is a very important source of nectar for many adult insects. Mowing seems to reduce its potential as a source of nectar.

Various individual species and assemblages are discussed in more detail.

Suggestions for further research and management are presented throughout and summarized at the end of the manuscript.

The literature cited and the bibliography, together with that in 1999 report, constitute an excellent introduction to the literature on butterflies and odonates for both interested amateurs and specialists.

Codes for Tables 1-4 showing date equivalents of letters for the 2000 field season

A=29 May, B=20 June, C= 6 July, D=22 August, E= 30 August, F= 26 September, G=27 September, and H= 3 October.

A question mark (?) after a species nomen indicates that a species is potentially present. One associated with a genus nomen by itself indicates that an unidentified member of that genus was definitely present.

Species deemed to be expected from the Colby Hill Project area but not recorded to date are included.

Table 1. Butterflies of Guthrie (G) and Bancroft (B) Farms, Lincoln Twp., Addison Co., Vt.-2000.

SPECIES (names after Layberry et al, 1998)	COMMON NAME	STATE RANK (S)*	G open fields	G corner marsh	G woodland swamp/ marsh	G wood-land	G totals sites	B field	Grand Totals sites G & B	Species Present
Battus canadensis (=Papilio)	Canadian T. Swallowtail	5	B			B	2		2	X
Pieris napi	Mustard White	5	A			AB	2		2	X
Pieris rapae	Cabbage White	5	D	D	D		3		3	X
Colias eurytheme	Orange Sulphur	5	B?DH	D			2	BD	3	X
Colias interior	Pink-edged Sulphur	5								
Colias philodice	Clouded Sulphur	5	DH	D	D		3	D	4	X
Lycaena phlaeas	American Copper	5								
Callophrys augustinus	Brown Elfin	4								
Feniscea tarquinius	Harvester	5								
Celastrina ladon or neglecta	Celastrina "Complex"	5	AB				1		1	X
Everes comyntas	E. Tailed Blue	5			D		1		1	X
Glaucopsyche lygdamus	Silvery Blue	5	B				1		1	X
Speyeria sp.?	Fritillaries		D	D			2		2	?
Speyeria atlantis	Atlantis Fritillary	5	D		D		2		2	X
Speyeria cybele	Great Spangled F.	5			D?		1?		1?	?
Boloria bellona	Meadow F.	5	C				1		1	X
Boloria selene	Silver-bordered F.	5	BDE				1		1	X
Phyciodes sp.?	Crescents		C			B	2		2	?
Phyciodes cocyta	Northern Crescent	5								
Phyciodes tharos	Pearl Crescent	5								
Euphydryas phaeton	Baltimore Checkerspot	5								
Chlosyne harrisi	Harris' Checkerspot	5								
Polygonia sp.?	Anglewings									
Polygonia faunus	Green Comma	5								
Polygonia interrogationis	Question Mark	5								
Polygonia progne	Grey Comma	5								
Nymphalis antiopa	Mourning Cloak	5								
Nymphalis milberti	Milbert's Tortoiseshell	5	A?				1?		1?	?
Vanessa sp.?	"ladies"									
Vanessa atalanta	Red Admiral	5	A		D		2		2	X
Vanessa virginiensis	American Lady	5								
Limenitis arthemis arthemis	White Admiral	5			C	B	2		2	X
Limenitis archippus	Viceroy	5								
Enodia anthedon	N. Pearly Eye	5				D	1		1	X

Table 1. Butterflies of Guthrie (G) and Bancroft (B) Farms, Lincoln Twp., Addison Co., Vt.-2000.

Satryodes appalachia	Appalachian Brown	5								
Satryodes eurydice	Eyed Brown	5			C		1		1	X
Cercyonis pegala	Common Wood-Nymph	5	DE	D			2	D	3	X
Megisto cymela	Little Wood Satyr	5	B				1		1	X
Coenonympha tullia	Common Ringlet	5	BCH			A	2	BC	3	X
Danaus p. plexippus	Monarch	5	BCH		D		2	BC	3	X
SKIPPERS										
Erynnis icelus	Dreamy Duskywing	5			B?		1?		1?	?
Erynnis juvenalis	Juvenal's Duskywing	5	A				1		1	X
Ancyloxpha numitor	Least Skipper	5								
Thymelicus lineola	European Skipper	5	C	C	C	C	4	C	5	X
Carterocephalus palaemon	Arctic Skipper	5								
Polites mystic	Long Dash	5								
Polites themistocles	Tawny-edged Skipper	5								
Euphyes bimacula	Two-spotted Skipper	5								
Poanes hobomok	Hobomok Skipper	5			B	B	2		2	X
Amblyscirtes hegon	Pepper and Salt Skipper	5								
Amblyscirtes vialis	Common Roadside S.	5								
Euphyes vestris metacomet	Dun	5	D		D		2		2	X
Total species verified +?			20+1?	6	11+2?	8		6		23+5?
*fm. Grehan & Sabourin, 95	% species verified (23)		86.9	26.1	47.8	34.8		26.1		

Table 2. Butterflies of Pierce and Wells Farms, Lincoln Twp., Addison Co., Vt.-2000.

SPECIES (names after Layberry et al, 1998)	COMMON NAME	STATE RANK (S)*	Pierce fields	Pierce Woods	Pierce Beaver Meadow and Swamp	Pierce-lowland wooded marsh/ swamp	Pierce Totals Sites	Wells-field & adjacent swamps	Grand Totals Sites Pierce & Wells	Species Present
Battus canadensis	Canadian T. Swallowtail	5		B			1		1	X
Pieris napi	Mustard White	5								
Pieris rapae	Cabbage White	5	G		DG	E	3	E	4	X
Colias eurytheme	Orange Sulphur	5	EGH		DG		2		2	X
Colias philodice	Clouded Sulphur	5	EGH		GH	E	3	AE	4	X
Colias interior	Pink-edged Sulphur	5								
Lycaena phlaeas	American Copper	5								
Callophrys augustinus	Brown Elfin	4								
Feniscea tarquinius	Harvester	5								
Celastrina ladon or neglecta	Celastrina "Complex"	5		C	D		2		2	X
Everes comyntas	E. Tailed Blue	5								
Glaucopsyche lygdamus	Silvery Blue	5								
Speyeria atlantis	Atlantis Fritillary	5				E	1	E	2	X
Boloria selene	Silver-bordered F.	5								
Phyciodes sp.	Crescents									
Phyciodes cocyta	Northern Crescent	5	B		C	C	3		3	X
Phyciodes tharos	Pearl Crescent	5			D		1		1	X
Euphydryas phaeton	Baltimore Checkerspot	5								
Chlosyne harrisi	Harris' Checkerspot	5								
Polygonia sp.	Anglewings				C	E	2		2	X
Polygonia faunus	Green Comma	5								
Polygonia interrogationis	Question Mark	5								
Polygonia progne	Grey Comma	5								
Nymphalis antiopa	Mourning Cloak	5		E			1		1	X
Nymphalis milberti	Milbert's Tortoiseshell	5				E	1		1	X
Vanessa sp.	"ladies"									
Vanessa atalanta	Red Admiral	5			D	E	2	E	3	X
Vanessa virginiensis	American Lady	5						A	1	X
Limenitis arthemis arthemis	White Admiral	5								
Limenitis archippus	Viceroy	5				E	1	E	2	X

Table 2. Butterflies of Pierce and Wells Farms, Lincoln Twp., Addison Co., Vt.-2000.

Enodia anthedon	N. Pearly Eye	5	E				1		1	X
Satryodes appalachia	Appalachian Brown	5		E		C	2		2	X
Satryodes eurydice	Eyed Brown	5		C	C		2		2	X
Cercyonis pegala	Common Wood-Nymph	5			D		1	E	2	X
Megisto cymela	Little Wood Satyr	5	BC	C		BC	3		3	X
Coenonympha tullia	Common Ringlet	5	ABCEGH	C	G		3	E	4	X
Danaus p. plexippus	Monarch	5				E	1		1	X
SKIPPERS										
Erynnis icelus	Dreamy Duskywing	5								
Erynnis juvenalis	Junvenal's D.	5				B	1		1	X
Ancyloxpha numitor	Least Skipper	5			C		1		1	X
Thymelicus lineola	European Skipper	5	C	C	C	C	4		4	X
Carterocephalus palaemon	Arctic Skipper	5								
Polites mystic	Long Dash	5				C	1		1	X
Polites themistocles	Tawny-edged Skipper	5								
Euphyes bimacula	Two-spotted Skipper	5								
Poanes hobomok	Hobomok Skipper	5	B?	B	C	B	3 +1?		3+1?	X
Amblyscirtes hegon	Pepper and Salt Skipper	5								
Amblyscirtes vialis	Common Roadside S.	5								
Euphyes vestris metacomet	Dun	5	E		E	E	3	E?	3+1?	X
Total species verified +?			9+1?	9	15	16		8+1?		27
*fm. Grehan & Sabourin, 1995	% of total verified (27)		33.3	33.3	55.6	59.2		29.6		

Table 3. Odonata of Guthrie and Bancroft Farms, Lincoln, Twp., Addison Co., Vt. 2000.

SPECIES	COMMON NAME	STATE RANK (S)*	Guthrie-pond & immedi-ate environs	Guthrie -open fields	Guthrie - corner marsh to sw	Guthrie-woodland swamp/ marsh	Guthrie woodland	Guthrie totals sites	Ban. field	Grand Totals sites B & G	Species Present 2000
Calopteryx aequabilis	River Jewelwing	4									
C. maculata	Ebony Jewelwing	5									
Lestes sp.	Spreadwings										
Lestes congener	Spotted Spreadwing	3	DEGH					1		1	X
L.disjunctus	Common Spreadwing	5	B?DE					1		1	X
Lestes dryas	Emerald Spreadwing	5									
Lestes rectangularis	Slender Spreadwing	5									
Lesets vigilax	Swamp Spreadwing	5									
Argia moesta	Powdered Dancer	5									
Argia f. violacea	Variable Dancer	5									
Chromagrion conditum	Aurora Damsel	5									
Coenagrion resolutum	Taiga Bluet	5									
Enallagma sp.	Bluets		H					1		1	?
Enallagma aspersum	Azure Bluet	5	DE					1		1	X
Enallagma boreale	Boreal Bluet	5									
Enallagma cyathigerum	Northern Bluet	5	BC					1		1	X
E. ebrium	Marsh Bluet	5									
E. hageni	Hagen's Bluet	5									
Ishnura posita	Fragile Forktail	5									
Ishnura verticalis	Eastern Forktail	5	BCDE					1		1	X
Nehalennia irene	Sedge Sprite	5	BD					1		1	X
Aeshna sp.	Darners		FG					1	B?	1+ 1?	?
Aeshna canadensis	Canada Darner	5	DE					1		1	X
Aeshna constricta	Lance-tipped D.	5				D		1		1	X
A. eremita	Lake Darner	4	E					1		1	X
A. i. interrupta	Variable Darner	4	DGH			D		2		2	X
A. tuberculifera	Black-tipped Darner	2	G					1		1	X
A. umbrosa	Shadow Darner	5	H					1		1	X
Anax junius	Common Green Darner	5		CD		D?		1+1?	D	2 +1?	X
Basiaeschna janata	Springtime Darner	5									

Table 3. Odonata of Guthrie and Bancroft Farms, Lincoln, Twp., Addison Co., Vt. 2000.

Boyeria grafiana	Ocellated Darner	4									
B. vinosa	Fawn Darner	5									
Cordulegaster diastatops	Delta-spotted C.	5									
C maculata	Twin-spotted C.	5									
Cordulia shurtleffi	American Emerald	5	BC?					1+1?		1 +1?	X
Dorocordulia libera	Racket-tailed E.	4			B	B		2		2	X
Epitheca sp.	Baskettails										
Epitheca canis	Beaverpond B.	5									
Somatochlora sp.	Emeralds										
S. elongata	Ski-tailed Emerald	3									
S. minor	Ocellated Emerald	2									
S. walshii	Brush-tipped E.	3									
Ladona julia	Chalk-fronted C.	5	BC		B			2		2	X
Leucorrhinia frigida	Frosted Whiteface	5	C					1		1	?
L. glacialis	Crimson-ringed W.	3	BC					1		1	X
L. hudsonica	Hudsonian Whiteface	5									
L. intacta	Dot-tailed Whiteface	5	B		B			2		2	X
L. proxima	Red-waisted W.	3									
Libellula sp.	Skimmers										
Libellula luctuosa	Widow Skimmer	5		C		C		2	C	3	X
Libellula pulchella	12-Spotted Skimmer	5		C		C		2	C	3	X
Libellula quadrimaculata	Four-spotted S.	5				B		1		1	X
Plathemis lydia	Common Whitetail	5	C					1		1	X
Sympetrum sp.	Meadowhawks		DEH			CD	D	3		3	?
Sympetrum costiferum	Saffron-winged M.	?									
S. danae	Black Meadowhawk	3									
S. internum or janae	Cherry-faced or Jane's	5	D			D	D	3		3	X
S. obtrusum	White-faced M.	5									
S. semicinctum	Band-winged M.	3									
S. vicinum	Yellow-legged M.	5	G					1		1	X
Total species +?			18+4?	3	3	7+2?	2		3+1?		24+4?
Carle,FL 1994	% species verified(24)		75	12.5	12.5	29.2	8.3		12.5		

Table 4. Odonata of Pierce and Wells Farms, Lincoln, Twp., Addison Co., Vt. 2000.

SPECIES	COMMON NAME	STATE RANK (S)*	Pierce Fields	Pierce Ponds-woods (w) open area (o)	Pierce Beaver Marsh Area-Upper Isham Brook	Pierce Lowland Wooded marsh-swamp	Pierce Site Totals	Wells Pond Open Fields	Wells brushy areas adjacent to fields	Wells Site Totals	Grand Totals Pierce & Wells	Species Present Pierce and Wells
Calopteryx aequabilis	River Jewelwing	4										
C. maculata	Ebony Jewelwing	5										
Lestes sp.	Spreadwings											
Lestes congener	Spotted Spreadwing	3		DoEo			1				1	X
L.disjunctus	Common Spreadwing	5		DoEw	D		2				2	X
Lestes dryas	Emerald Spreadwing	5										
Lestes rectangularis	Slender Spreadwing	5				DE	1				1	X
Lesets vigilax	Swamp Spreadwing	5										
Argia moesta	Powdered Dancer	5										
Argia f. violacea	Variable Dancer	5										
Chromagrion conditum	Aurora Damsel	5		Bw			1				1	X
Coenagrion resolutum	Taiga Bluet	5										
Enallagma sp.	Bluets				E		1				1	?
Enallagma aspersum	Azure Bluet	5										
Enallagma boreale	Boreal Bluet	5										
Enallagma cyathigerum	Northern Bluet	5										
E. ebrium	Marsh Bluet	5										
E. hageni	Hagen's Bluet	5										
Ishnura posita	Fragile Forktail	5		Bo			1				1	X
Ishnura verticalis	Eastern Forktail	5		BwEow	CE		2				2	X
Nehalennia irene	Sedge Sprite	5			C	C	2				2	X
Aeshna sp.	Darners							E		1	1	?
Aeshna canadensis	Canada Darner	5			G		1				1	X
Aeshna constricta	Lance-tipped D.	5										
A. eremita	Lake Darner	4										
A. i. interrupta	Variable Darner	4										
A. tuberculifera	Black-tipped Darner	2										
A. umbrosa	Shadow Darner	5		CoDo Ew	DEG		2				2	X

Table 4. Odonata of Pierce and Wells Farms, Lincoln, Twp., Addison Co., Vt. 2000.

Anax junius	Common Green Darner	5										
Basiaeschna janata	Springtime Darner	5										
Boyeria grafiana	Ocellated Darner	4										
B. vinosa	Fawn Darner	5										
Cordulegaster diastatops	Delta-spotted C.	5										
C maculata	Twin-spotted C.	5			C		1				1	X
Cordulia shurtleffi	American Emerald	5		Co			1				1	X
Dorocordulia libera	Racket-tailed E.	4										
Epitheca sp.	Baskettails											
Epitheca canis	Beaverpond B.	5	B		C		2				2	X
Somatochlora sp.	Emeralds				E	E	2				2	?
S. elongata	Ski-tailed Emerald	3			DE		1				1	X
S. minor	Ocellated Emerald	2										
S. walshii	Brush-tipped E.	3										
Ladona julia	Chalk-fronted C.	5		Bo			1				1	X
Leucorrhinia frigida	Frosted Whiteface	5										
L. glacialis	Crimson-ringed W.	3										
L. hudsonica	Hudsonian Whiteface	5										
L. intacta	Dot-tailed Whiteface	5										
L. proxima	Red-waisted W.	3										
Libellula sp.	Skimmers											
Libellula luctuosa	Widow Skimmer	5										
Libellula pulchella	12-Spotted Skimmer	5				B	1				1	X
Libellula quadrimaculata	Four-spotted S.	5										
Plathemis lydia	Common Whitetail	5										
Sympetrum sp.	Meadowhawks		E	DoEw	E	E	4	E		1	5	?
Sympetrum costiferum	Saffron-winged M.	?										
S. danae	Black Meadowhawk	3										
S. internum or janae	Cherry-faced or Jane's	5		Do	G		2				2	X
S. obtrusum	White-faced M.	5		D			1				1	X
S. semicinctum	Band-winged M.	3			G		1				1	X
S. vicinum	Yellow-legged M.	5	Ew	D	G		3				3	X
Total species + ?			1	12	11+3?	3+2?		1				19 +2?
Carle,FL 1994	% species verified(19)		5.2	63.2	57.9	15.8		5.2				

Table 5. Butterflies of Guthrie/Bancroft, Pierce and Wells Farms, Addison Co., Vt. (running totals).

SPECIES (names after Layberry et al, 1998)	COMMON NAME	STATE RANK (S)*	Gut-Ban 1999	Gut-Ban 2000	Gut-Ban Totals 99 & 20	Pierce 1999	Pierce 2000	Pierce Totals 99 & 20	Wells 1999	Wells 2000	Wells Totals 99 & 20	Grand Totals 1999	Grand Totals 2000	Grand Totals 99-20
Battus canadensis	Canadian T. Swallowtail	5	X	X	S		X	S				T	T	TT
Pieris napi	Mustard White	5	X	X	S							T	T	TT
Pieris rapae	Cabbage White	5	X	X	S	X	X	S		X	S	T	T	TT
Colias eurytheme	Orange Sulphur	5	X	X	S	X	X	S	X		S	T	T	TT
Colias interior	Pink-edged Sulphur	5												
Colias philodice	Clouded Sulphur	5	X	X	S	X	X	S	X	X	S	T	T	TT
Lycaena phlaeas	American Copper	5	X		S							T		T
Callophrys augustinus	Brown Elfin	4												
Feniscea tarquinius	Harvester	5												
Celastrina complex	Celastrina "Complex"	5	X	X	S		X	S	X		S	T	T	TT
Everes comyntas	E. Tailed Blue	5		X	S	X		S				T	T	TT
Glaucopsyche lygdamus	Silvery Blue	5	X	X	S							T	T	TT
Speyeria aphrodite	Aphrodite	5												
Speyeria atlantis	Atlantis Fritillary	5	X	X	S	X	X	S	X	X	S	T	T	TT
Speyeria cybele	Great Spangled F.	5	X		S	X		S				T		T
Boloria bellona	Meadow F.	5	X	X	S							T	T	TT
Boloria selene	Silver-bordered F.	5	X	X	S							T	T	TT
Phyciodes cocyta	Northern Crescent	5	X	X	S	X	X	S				T	T	TT
Phyciodes tharos	Pearl Crescent	5		X	S								T	T
Euphydryas phaeton	Baltimore Checkerspot	5												
Chlosyne harrisi	Harris' Checkerspot	5	X		S							T		T
Polygonia faunus	Green Comma	5												
Polygonia interrogationis	Question Mark	5	X		S							T		T
Polygonia progne	Grey Comma	5	X		S							T		T
Nymphalis antiopa	Mourning Cloak	5					X	S	X		S	T	T	TT
Nymphalis milberti	Milbert's Tortoiseshell	5	X		S		X	S				T	T	TT
Vanessa atalanta	Red Admiral	5		X	S		X	S		X	S	T	T	TT
Vanessa cardui	Painted Lady	5												
Vanessa virginiensis	American Lady	5								X	S		T	T
Limenitis a. arthemis	White Admiral	5		X	S							T		T
Limenitis archippus	Viceroy	5	X		S	X	X	S		X	S	T	T	TT

Table 5. Butterflies of Guthrie/Bancroft, Pierce and Wells Farms, Addison Co., Vt. (running totals).

SPECIES (names after Layberry et al, 1998)	COMMON NAME	STATE RANK (S)*	Gut-Ban 1999	Gut-Ban 2000	Gut-Ban Totals 99 & 20	Pierce 1999	Pierce 2000	Pierce Totals 99 & 20	Wells 1999	Wells 2000	Wells Totals 99 & 20	Grand Totals 1999	Grand Totals 2000	Grand Totals 99-20
Enodia anthedon	N. Pearly Eye	5	X	X	S	X	X	S	X		S	T	T	TT
Satryodes appalachia	Appalachian Brown	5					X	S					T	T
Satryodes eurydice	Eyed Brown	5	X	X	S		X	S				T	T	TT
Cercyonis pegala	Common Wood-Nymph	5	X	X	S	X	X	S		X	S	T	T	TT
Megisto cymela	Little Wood Satyr	5	X	X	S		X	S				T	T	TT
Coenonympha tullia	Common Ringlet	5	X	X	S	X	X	S	X	X	S	T	T	TT
Danaus p. plexippus	Monarch	5	X	X	S	X	X	S	X		S	T	T	TT
SKIPPERS														
Erynnis icelus	Dreamy Duskywing	5	X		S							T		T
Erynnis juvenalis	Junvenal's D.	5		X	S		X	S					T	T
Ancyloxpha numitor	Least Skipper	5				X	X	S				T	T	TT
Thymelicus lineola	European Skipper	5	X	X	S		X	S	X		S	T	T	T
Carterocephalus palaemon	Arctic Skipper	5	X		S							T		T
Polites mystic	Long Dash	5	X		S		X	S	X		S	T	T	TT
Polites themistocles	Tawny-edged Skipper	5	X		S				X		S	T		T
Euphyes bimacula	Two-spotted Skipper	5												
Poanes hobomok	Hobomok Skipper	5	X	X	S		X	S				T	T	TT
Amblyscirtes hegon	Pepper and Salt Skipper	5												
Amblyscirtes vialis	Common Roadside S.	5												
Euphyes vestris metacome	Dun	5	X	X	S		X	S				T	T	TT
	Total Species Verified		31	25	36	13	24	26	11	8	16	34	31	40
*Grehan & Sabourin, '95	% Grand Total (40)				90			65			40			

Table 6. Odonata of Guthrie and Bancroft Farms, Lincoln, Twp., Addison Co., Vt. (running totals).2000.

SPECIES	COMMON NAME	STATE RANK (S)*	Gut-Ban 1999	Gut-Ban 2000	Gut-Ban Totals 99 & 20	Pierce 1999	Pierce 2000	Pierce Totals 99 & 20	Wells 1999	Wells 2000	Wells totals 99 & 20	Grand Totals 1999	Grand Totals 2000	Grand Totals 1999-2000
Calopteryx aequabilis	River Jewelwing	4												
C. maculata	Ebony Jewelwing	5				X		S				T		T
Lestes congener	Spotted Spreadwing	3		X	S		X	S					T	T
L.disjunctus	Common Spreadwing	5	X	X	S	X	X	S				T	T	TT
Lestes dryas	Emerald Spreadwing													
Lestes rectangularis	Slender Spreadwing						X	S					T	T
Lesets vigilax	Swamp Spreadwing													
Argia moesta	Powdered Dancer	5												
Argia f. violacea	Variable Dancer	5												
Chromagrion conditum	Aurora Damsel	5					X	S					T	T
Coenagrion resolutum	Taiga Bluet	5												
Enallagma aspersum	Azure Bluet	5	X	X	S	X		S				T	T	TT
Enallagma boreale	Boreal Bluet													
Enallagma cyathigerum	Northern Bluet	5	X	X	S							T	T	TT
E. ebrium	Marsh Bluet	5				X		S				T		T
E. hageni	Hagen's Bluet	5	X		S	X		S				T		T
Ishnura posita	Fragile Forktail	5				X	X	S				T	T	TT
Ishnura verticalis	Eastern Forktail	5	X	X	S	X	X	S				T	T	TT
Nehalennia irene	Sedge Sprite	5	X	X	S		X	S				T	T	TT
Aeshna canadensis	Canada Darner	5		X	S		X	S					T	T
Aeshna constricta	Lance-tipped D.	5		X	S								T	T
A. eremita	Lake Darner	4		X	S								T	T
A. i. interrupta	Variable Darner	4	X	X	S							T	T	TT
A. tuberculifera	Black-tipped Darner	2		X	S								T	T
A. umbrosa	Shadow Darner	5	X	X	S		X	S				T	T	TT
Anax junius	Common Green Darner	5	X	X	S							T	T	TT
Basiaeschna janata	Springtime Darner	5												
Boyeria grafiana	Ocellated Darner	4												
B. vinosa	Fawn Darner	5												
Cordulegaster diastatops	Delta-spotted C.	5												

Table 6. Odonata of Guthrie and Bancroft Farms, Lincoln, Twp., Addison Co., Vt. (running totals).2000.

SPECIES	COMMON NAME	STATE RANK (S)*	Gut-Ban 1999	Gut-Ban 2000	Gut-Ban Totals 99 & 20	Pierce 1999	Pierce 2000	Pierce Totals 99 & 20	Wells 1999	Wells 2000	Wells totals 99 & 20	Grand Totals 1999	Grand Totals 2000	Grand Totals 1999-2000
C maculata	Twin-spotted C.	5					X	S					T	T
Cordulia shurtleffi	American Emerald	5	X	X	S		X	S				T	T	T
Dorocordulia libera	Racket-tailed E.	4		X	S								T	TT
Epitheca canis	Beaverpond B.	5					X	S					T	T
S. elongata	Ski-tailed Emerald	3	X		S		X	S				T	T	TT
S. minor	Ocellated Emerald	2												
S. walshii	Brush-tipped E.	3												
Ladona julia	Chalk-fronted C.	5	X	X	S		X	S				T	T	TT
Leucorrhinia frigida	Frosted Whiteface	5												
L. glacialis	Crimson-ringed W.	3	X	X	S							T	T	TT
L. hudsonica	Hudsonian Whiteface	5												
L. intacta	Dot-tailed Whiteface	5		X	S								T	T
L. proxima	Red-waisted W.	3	X		S							T		T
Libellula luctuosa	Widow Skimmer	5	X	X	S							T	T	TT
Libellula pulchella	12-Spotted Skimmer	5		X	S	X	X	S				T	T	TT
Libellula quadrimaculata	Four-spotted S.	5	X	X	S							T	T	TT
Plathemis lydia	Common Whitetail	5		X	S	X		S				T	T	TT
Sympetrum costiferum	Saffron-winged M.	?												
S. danae	Black Meadowhawk	3												
S. internum or janae	Cherry-faced or Jane's	5	X	X	S		X	S				T	T	TT
S. obtrusum	White-faced M.	5	X		S	X	X	S				T	T	TT
S. semicinctum	Band-winged M.	3				X	X	S				T	T	TT
S. vicinum	Yellow-legged M.	5	X		S		X	S				T	T	TT
Total species verified			19	24	28	11	19	24	0	0	0	25	32	36
*Carle,FL 1994	% Grand total (36)				77.8			66.7			0.0			

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* The above, together with the extensive bibliography provided in my 1999 report, brings the general reader essentially up-to-date with the current textbook literature on odonata and butterflies.

Appendix I: Generalized description of site visits during 2000 by dates

Please refer to the 1999 report for detailed maps. In 2000, I generally followed the same routes as in 1999 and I will refer to those 1999 maps .by letters (D &E), whenever this was the case. I will also briefly describe how and when my routes deviated from the 1999 routine at each farm, on certain dates.
Codes: G-B=Guthrie/Bancroft Farm, P=Pierce Farm, W=Wells Farm.

Dates (2000)	Farm(s) Visited and General Routes
29 May	G/B-typical route (map D) P-checked both ponds (the one ne of house and the woodland pond s. of house) and the woodland swamp, s. of the latter W-east across fields up and over crest of wooded hill to the east, looped back, westward, and across field to nw corner swamp
20 June	G/B-typical route (map D) P-long route down to Isham Br. and hemlocks, checked both ponds, woodland swamp, and open field to s. of road (map E), but did not go to beaver dam and meadow of upper Isham Br
6 July	G/B-typical route (map D) P-checked both ponds, woodland swamp and then upper Isham Brook, beaver meadow and pond
22 Aug	G/B-typical route (map D) P-pond ne of house and beaver dam and meadow and upper Isham Brook
30 Aug.	G/B-at pond in field only, which I name Guthrie Pond in text P-same route as 20 June (map E) W-open field, pond in field, and bushy swamp s. of buildings and swamp in nw corner of field
26 Sept.	G/B-Guthrie Pond, Guthrie field, and woodland marsh/meadow but not in Bancroft field (very like map D) P-ponds and woodland marsh s. of wooded pond
27 Sept.	G/B-pond only P-upper Isham Brook and beaver meadow and dam; pond ne of house
3 Oct.	G/B-pond only P-same as 27th of Sept.