Faunal survey and inventory in Ontario Parks

S.A. Marshall
Department of Environmental Biology, University of Guelph

Abstract

Parks serve an important role as storehouses of biodiversity, but this role is substantially diminished by our ignorance about what is on the storehouse shelves. Although we have taken stock of the bigger items such as vertebrates and vascular plants, the great majority of the items on the shelves is small, like invertebrates, and has never been inventoried. I would like to argue that it is time we tackled the formidable task of all taxon biological inventory work in Ontario's parks. I will discuss some of the problems involved using examples from preliminary survey work in Algonquin Provincial Park and Bruce Peninsula National Park.

The huge majority of species in Ontario parks are insects, but no Ontario park has yet undertaken or sponsored extensive surveys of insects or other arthropods. Several studies have dealt with butterflies and dragonflies, which together make up less than one percent of our insect fauna, and some studies have dealt with biting flies, ground beetles, and a few other relatively small taxa in Ontario parks. Considerably more data are available in the form of properly prepared specimens in the three large Ontario insect collections. For example, over 1,000 insect species from Algonquin Park are represented by pinned, labelled and identified specimens in the University of Guelph Insect Collection. These specimens, and other properly prepared and labelled specimens deposited in major insect collections, form the core of a species-level database which can be checked, corrected, and expanded as it is developed into a thorough inventory of selected Park faunas.

An important role of national and provincial parks is to serve as storehouses of biodiversity. As such, it is a good idea to take stock of what is on the storehouse shelves. It is, in fact, quite remarkable that no park in Ontario can boast adequate inventories of the majority of species they house, despite the fact that parks seem to be the logical place to pursue our commitment to the Biodiversity Convention, which explicitly calls for inventory and monitoring. Such inventories, or species lists, are needed to: establish a baseline fauna; monitor for changes from that baseline; recognize endangered habitats; recognize species of special interest; understand patterns of distribution and relationship; and provide accurate and park-specific interpretive information to feed the increasingly broad public interest in natural history.

Much research in parks has focussed on relatively few species of vertebrate animals, but the invertebrates which make up the overwhelming majority of our wildlife remain poorly known. Even though recent studies have dealt with butterflies and dragonflies of some parks, and several studies have dealt with biting flies in Algonquin Park and elsewhere, these groups together make up less than 1.5% of the arthropod fauna. What about the rest of our conspicuous arthropod diversity, especially the beetles, wasps and flies which dominate the

fauna? If you search the literature for recent insect "biodiversity" studies, you will find that many if not most deal with only one group of insects – the Carabidae or ground beetles. In fact, most of these only cover the small subset of the Carabidae taken in standard pitfall traps. Although documentation of a few dozen ground beetle species in a given park does not really seem like an adequate grasp on our "biodiversity", most current "biodiversity" studies start and finish with the Carabidae. It may be useful to consider why this is the case before going on to look at the problems of broader arthropod inventory.

Ground beetles are relatively inconspicuous insects; generally nocturnal and found in concealed habitats out of the public eye. They are of minor economic importance and most species do not seem to be particularly vulnerable to habitat change. Yet, they are attractive for biodiversity studies for the following reasons:

1. they can be easily sampled with simple pit traps;
2. they can be sorted out of trap samples by unskilled individuals;
3. they are robust and require no special handling;
4. there are good keys to species;
5. there is a huge number of precedent-setting carabid diversity studies done throughout the world; and,
6. there are several good specialists available to assist with difficult identifications. Few other organisms exhibit this auspicious combination of attributes, and carabids are thus the easy choice for every sort of study from undergraduate projects through to major "biodiversity" programs.

Most carabid studies rely on simple pitfall traps or pan traps and only survey a fraction of the local ground beetle fauna. By way of illustration, a recent study of the Carabidae of the Lake Erie islands and adjacent mainland (Will et al., 1995) listed 241 species, of which only 15 were taken in pitfall traps. The balance were taken by light traps, other traps or "hand collecting". More extensive pitfall trapping in that area would probably have taken around 50 species of ground beetle. My own pitfall and pan trap studies done in Bruce Peninsula National Park, along the edge of one lake in Algonquin Park, and in some local peatlands suggest that around 30 species per site is typical, with the number rising towards 50 as different habitats are added.

Many of the remaining 500 species of Carabidae found in southern Ontario require additional collection techniques, although we have a few specialized carabid groups which are easily collected by hand in circumscribed habitats. The diurnal tiger beetles are a good illustration of this, and comprise a very easily identified group which should be on the list of taxa to be inventoried and monitored for every park. With only 13 or 14 Ontario species, including vulnerable and habitat restricted species such as *Cicindela lepida*, the tiger beetles should join the butterflies and dragonflies in getting honorary bird status. Tiger beetles can be as easily monitored annually as butterflies or birds.

Having surveyed the Carabidae – or at least the easily caught species – and added that data to the butterfly, macro-moth, and dragonfly data being assembled by the growing cadre of naturalists diligently working on these groups, the total fauna inventoried and available for monitoring will still be less than 10% of the fauna of a given park. Further attempts at inventory will reveal that few other taxa are easily sampled, easily prepared, and easily identified, and it will be necessary to surmount obstacles in at least one of these areas.

The most obvious, and most serious, of these obstacles is identification, so the first choice might be a relatively easily identified group of beetles, true bugs, biting flies or stinging wasps for which there are good species keys. Perhaps the easiest of all insects to identify are the lady beetles, some of which – like the Coccinellini – are so characteristically coloured that the Canadian Nature Federation (CNF) has been utilizing the general public to survey the lady beetles of Canada. This survey was launched at my suggestion and was made partly because of data in the Guelph insect collection suggesting that two exotic lady beetle species, *Coccinella septumpunctata* and *Harmonia axyridis*, were displacing some native species.

The lady beetle survey has been a great public relations exercise for CNF, but some conflicts between the maps recently published by CNF and my inventory data serve to illustrate some important points. First of all, we have no real baseline data on the native species, and old specimens in collections like the University of Guelph's provide our only data on where these species occurred in the past. Fortunately, there are a few specimens of the native species *Coccinella novemnotata* and *Coccinella transversoguttata* taken in Algonquin and Bruce Peninsula in the 1970s. Since neither of these species have shown up in survey work on the Bruce or in Algonquin over the past few years, and neither species has been collected anywhere in Ontario in many years, my data suggest that we should consider *Coccinella novemnotata* and *Coccinella transversoguttata* to be imperilled or even extirpated from the province.

The CNF, however, has recently published maps showing many observations of both species by southern Ontario participants in the lady beetle survey, suggesting that these species are secure. The CNF data are not vouchered by specimens or photographs, and could be based on misidentifications. The important points illustrated by this example are the need for voucher specimens to check records, the lamentable lack of historical baseline data on park insects, and the problem of misidentifications even in an easy group like coccinellines. Once we establish a baseline species lists for park sites, lady beetles will be an easy and profitable group to monitor, with appropriate deposition of voucher specimens.

Misidentifications are by no means confined to amateurs, but the problem of misidentification is a particularly serious one for inventory or survey work which is not linked to a major insect collection. Most identification work requires experience, appropriate literature, and access to a reference collection to check names. Even for relatively well-known groups, error rates are surprisingly high for identifications done without access to a reference collection. My experience suggests that non-systematists working on groups other than butterflies, moths and dragonflies are likely to have error rates of close to 40% at the generic level if they are working without reference collections. These claims are hard to quantify, but I have taught a fourth year course in insect taxonomy for 16 years, and students in that course find it a challenge to beat a 40% error rate keying insects to family during the first half of the course, and by the end of the course very few of them could do that well at the generic level without a really good reference collection.

Even systematists have a significant error rate using most keys, and accuracy is attained only by reference to an authoritatively identified collection. You might well ask, then, what is the error rate of existing surveys? For surveys done without a major reference collection it is probably very high, but unless the specimens from those surveys are permanently housed in a major reference collection we have no way of checking and the data are consequently of very little value.

One way to beat the identification problem is to work with taxa which have been recently revised and thoroughly illustrated to the species level. One such taxon is the family Sphaeroceridae, a group of small flies which are roughly equivalent to the Carabidae in species diversity, are invariably more abundant than Carabidae, show a considerable range of habitat specificity, and have virtually all been described and keyed in the past twenty years. Species determinations in this group do not require a reference collection since male genitalia are complex, species specific, and well illustrated in recent publications. Despite these advantages, few people are working with Sphaeroceridae since they lack the immediate appeal of shiny beetles, are not as easy to recognize in trap samples as big beetles, and are expensive to properly prepare. While one merely whacks a pin through a ground beetle, small flies need to be properly dried in an expensive critical-point drier and glued to paper points. I mention the Sphaeroceridae because they are my taxonomic specialty, but they are only one of more than a dozen fly families which exceed Carabidae in diversity in most survey projects. Diverse parks like Algonquin probably house around 2,000 species of flies in total, although many of those species are difficult to identify at this time. One small ecotone study in Algonquin Park, for example, has so far yielded around 650 species of flies in the suborder Brachycera alone, including 400 species in the higher dipteran families Empidae, Dolichopodidae, Phoridae, Syrphidae, Chloropidae, Sphaeroceridae, Ephydridae, and Muscidae.

Although most of these flies were taken using simple trapping techniques, working on them has involved tremendous problems of sample processing, specimen handling, and identification. Many could not be identified at the University of Guelph despite the active dipterology program and the good reference collection there. Many had to be identified by specialists in Ottawa, Montreal, Washington and elsewhere. Despite these problems, the identified Scott Lake specimens we have accumulated at the University of Guelph represent real progress towards a full survey of Algonquin's most diverse group of insects. The physical collection of properly prepared and housed specimens at the University of Guelph constitutes a permanent, verifiable, and growing database on a significant part of Algonquin's biodiversity.

The examples I have briefly discussed should serve to illustrate the following major points about the importance of linking survey and inventory work to major insect collections:

1. Identifications made with the benefit of a large reference collection, such as those of the University of Guelph, the Royal Ontario Museum or the Canadian National Collection are more reliable. Most insects have to be keyed out or identified using a vast literature of variable quality. Inexperienced identifiers, such as summer students, are likely to have a high error rate at the family level and an enormous error rate at the genus and

species level. Confirmation by specialists or checking against a reference collection is usually required.

2. Specimens housed in park collections tend to have a short shelf life, and often end up destroyed by museum pests in the absence of adequate curatorial care. Not only is that wasteful, but the loss of voucher material throws previous identifications into doubt.

3. Permanent deposition in a museum collection makes specimens available for future identification or re-identification, and also makes the specimens available for future studies on taxonomy and distribution.

Even though current resources may restrict biodiversity and inventory work to quick assessments of “easy” groups, placement of properly prepared and labelled specimens in permanent insect collections contributes to a continuously expanding, improving and verifiable database on species diversity in Ontario parks. I strongly recommend that long-term arrangements be made between those parks interested in species inventory and one or more insect collections able to house their material.

Reference:

Will, K.W., F.F. Purrington, and D.J. Horn. 1995. Ground beetles of islands in the western basin of Lake Erie and the adjacent mainland (Coleoptera: Carabidae, including Cicindelini). *The Great Lakes Entomologist* 28: 55-70.