

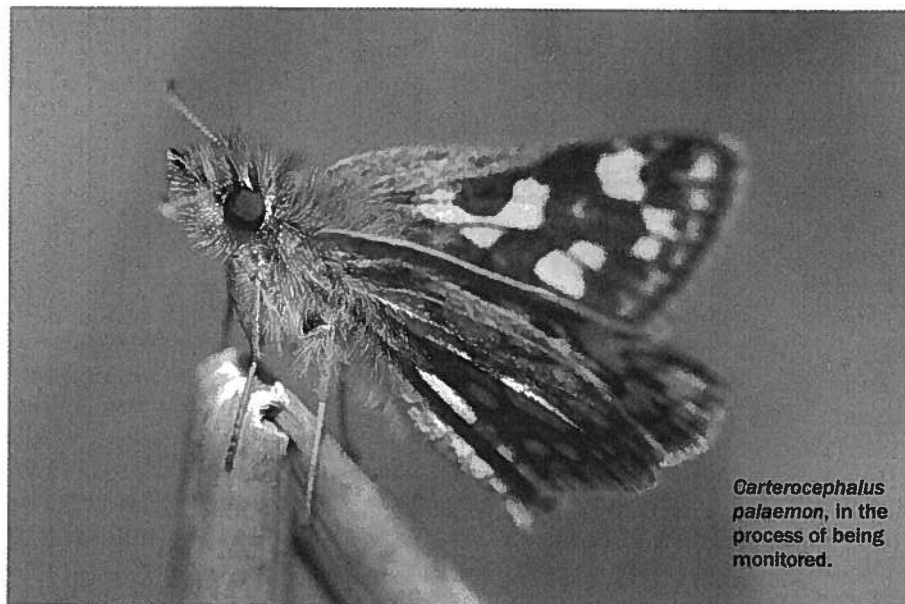
## Monitoring My Monitoring

John Acorn

Insect monitoring is, I suppose, a familiar subject for many readers of this magazine, especially those working on insects of economic or medical importance. There are many standardized means of trapping, sweeping, or visually counting pest insects, and for many entomologists, these sorts of activities are a basic part of the job. I was thinking about mosquito monitoring the other day, and sent an e-mail to Mike Jenkins, who works for the City of Edmonton, asking if he and his colleagues still bare their arms and report "bites per minute" to the press. He informed me, "We used to do bite counts, but because it was a very subjective measure (each person having so many variables in their attractiveness to mosquitoes), we did indeed discontinue the practice when West Nile arrived." Leaving aside whether the West Nile virus "arrived" or just kind of passed on through, I was amused by this, and by Mike's mysterious e-mail signature quote: "Never argue mustelid taxonomy with an angry pedant." How very true.

For those of us with more basic science interests, monitoring is perhaps not quite so familiar. It is, however, a subject that seems to be increasingly important, especially to those interested in conservation. I recently joined the Arthropod Specialist Subcommittee of COSEWIC, the Committee on the Status of Endangered Wildlife in Canada, and my first meeting with this group was fascinating. Some of the very finest naturalists I have ever known were there to discuss one interesting critter after another, in an attempt to decide whether it qualified for conservation attention. It seemed to me that the whole thing boiled down to four questions:

- 1) What sort of biological entity are we concerned with protecting?
- 2) How small is its geographic range, and is that range shrinking?



*Carterocephalus palaemon*, in the process of being monitored.

- 3) How many individuals make up this entity, and is this number declining?
- 4) What threats is the entity facing?

Each question intrigues me, but the most difficult to answer always seemed to be 3), the one about population size—the one that requires monitoring. In case after case, it was very difficult to decide whether the abundance of the bug was increasing, decreasing, or remaining stable.

In everyday speech, monitoring means observing something more or less continually to see if it changes, and for some sorts of things, it is pretty easy to do. Unfortunately, insect populations are rarely very simple to "observe" directly. Some people, however, have done a marvelous job of it, and my favorite example is my friend and mentor John Spence, who has censused the water striders of Experiment Pond, at the George Lake Field Station here in Alberta, every week for some 23 years. I have helped with many of these "bug counts" and the process is simple—put

on chest waders and walk around the pond until you have captured, alive, every last water strider. Then you count them, mark them if they have not already been marked, and let them go.

Most other examples of insect monitoring involve indirect measures of bug numbers. Some folks use mark-release-recapture methods, but the rest of us just count things while searching in some sort of standard fashion. Some of these searches are impressive indeed. One legendary monitoring effort is the light trapping of moths by amateur lepidopterists Vernon and Charlotte Brou of Louisiana. They have operated multiple light and bait traps every night, identifying and recording the moths they catch, and they began doing this since 1969 with only one brief interruption caused by Hurricane Katrina. They passed one million trapping hours a number of years ago, so you can imagine how many moths have passed before them.

*(continued on preceding page)*

Another great example is the butterfly work of Art Shapiro at UC Davis. Shapiro got started a few years after the Brous, in 1972, but has amassed an equally impressive data set on the butterflies of central California. His results, which were summarized last year in PNAS, give us a complex, nuanced account of how butterfly numbers and distributions are changing in central California. In general, it seems that diversity is decreasing at low elevations because of habitat destruction, increasing near the treeline as low-altitude species move upslope with climate warming, and decreasing among the high-elevation species as their habitat becomes too warm. For conservation, the message is clear—humans have directly and indirectly made things worse for most butterflies.

For better-known insects, we now have a pretty good idea of what their ranges are, or have been, as well as their seasonality. This leaves the naturalists among us with very few new and exciting things to report, which leads quite naturally to monitoring as the next logical step. The British, perhaps not surprisingly, are leading the way, with atlas projects for butterflies, dragonflies, ladybirds, and moths (and probably other things that I have missed). Here in North America, the trend has been toward such things as bioblitzes and Fourth of July But-

terfly Counts—one-day events rather than long-term projects.

For a long time, I was involved in butterfly counts here in Alberta (where we call them Canada Day Butterfly Counts), but eventually many of us realized that the data was difficult to compare year-to-year, even if the counts happened on the same date. A cool spring and summer gives one set of species, a warm one gives another. So I started doing Pollard Walks, another British invention, on which I walk a standard route, once a week, counting all the butterflies I see and manage to identify. I have been doing one Pollard route for a decade now, and a few others sporadically. It takes me very little time (one lunch break a week, since my main site is near the university), and since I only go out when the weather is nice enough for butterflies, it's an extremely pleasant activity as well.

What have I learned from my butterfly monitoring? Well, to be honest, the clear punchline is that things haven't changed much in the last ten years here in Edmonton, which is presumably a good thing. Mind you, we did have a couple of very dry years (2008 and 2009), and during those summers, two species (both with grass-feeding caterpillars) disappeared from my route. This made perfect sense, since the hillsides I used to see them on were then brown and lifeless. Both species (the Arctic skipper, *Carterocephalus palaemon*, and the common alpine, *Erebia discoidalis*) were also common on the other (north-facing) side of the river valley, reassuring me these particular entities were not in any sort of "decline." Now that we have had two cool, wet summers, both species are "coming back." The most interesting thing about my involvement in butterfly monitoring here, however, is the fact that our fauna is increasing in biodiversity, not decreasing. One introduced species (the European skipper, *Thymelicus lineola*) and two so-called natives (the Hobomok skipper, *Poanes hobomok*, and the northern pearly eye, *Enodia anthedon*) have expanded their ranges over the last two decades, moving in from the east—from Saskatchewan—rather than from the south, as most of us might expect. I'm still a bit worried that pesticides, plant succession, and habitat alteration might be doing bad things to my butterflies, but it's awfully tough to say anything along these lines from a one-hour-per-week survey.

The Pollard Count method is said to give a pretty good measure of the relative number of individuals present from count to count,

so long as the weather is nice enough for butterfly activity, but I do at times wonder what exactly I am monitoring. Is it populations of butterflies, the members of which live where I do my count? Or are many of them moving through my area, and am I measuring dispersal? Perhaps, like many sorts of insect monitoring methods, what I am measuring is activity, not abundance, and many of the individuals present may not be as detectable on some days as opposed to others. Another possibility is that I am monitoring the coming and going of habitat within the local area, not the coming and going of insects within the habitat. The truth is, the whole thing is not really "monitoring" at all, in the sense of watching a particular thing continuously and noting any changes. It's all quite hypothetical, really, even though I do think it is also quite useful and interesting.

So what does it all mean? Well, for one thing, it's clear to me that long-term data sets are great. In a world where most studies last a couple of years at most, and in which environmental change is of interest to almost everyone, what could be better than some believable accounts of what is actually happening as the years roll on by? But there is a personal, psychological benefit as well. I find that my weekly Pollard walk does more than generate butterfly data—it forces me to revisit the same place, in the same way, asking the same question, year in and year out. I like that, and I hope that each of you has some subset of the insect universe that you monitor as well.

#### References

- Foristera, M. L., A. C. McCall, N. J. Sanders, J. A. Fordyce, J. H. Thorne, J. O'Brien, D. P. Waetjen, and A. M. Shapiro. 2010. Compounded effects of climate change and habitat alteration shift patterns of butterfly diversity. PNAS: 0909686107v1-200909686.
- Louisiana State Arthropod Museum. 2011. The Contributions of Vernon Antoine and Charlotte Dozar Brou to the Knowledge of Louisiana Lepidoptera. <http://entomology.lsu.edu/lam/Brou.htm>. Accessed July 31, 2011.
- Spence, John R. 2000. Seasonal aspects of flight in water striders (Hemiptera: Gerridae). Entomological Science 3(2): 399-417.



**John Acorn** lectures at the University of Alberta. He is an entomologist, broadcaster, and writer; and is the author of fifteen books, as well as the host of two television series.

## Connect with Entomologist Online

ESA is now on  
FACEBOOK!

Join the 1,381 Entomologists who are already members of ESA's Facebook Group, and share photos, join or start a discussion, and stay in touch with your peers Online!

Visit [www.entsoc.org/networks](http://www.entsoc.org/networks) to get started