NABA Butterfly Count Column

What can we learn from the 4th of July Counts?

by Leslie Ries

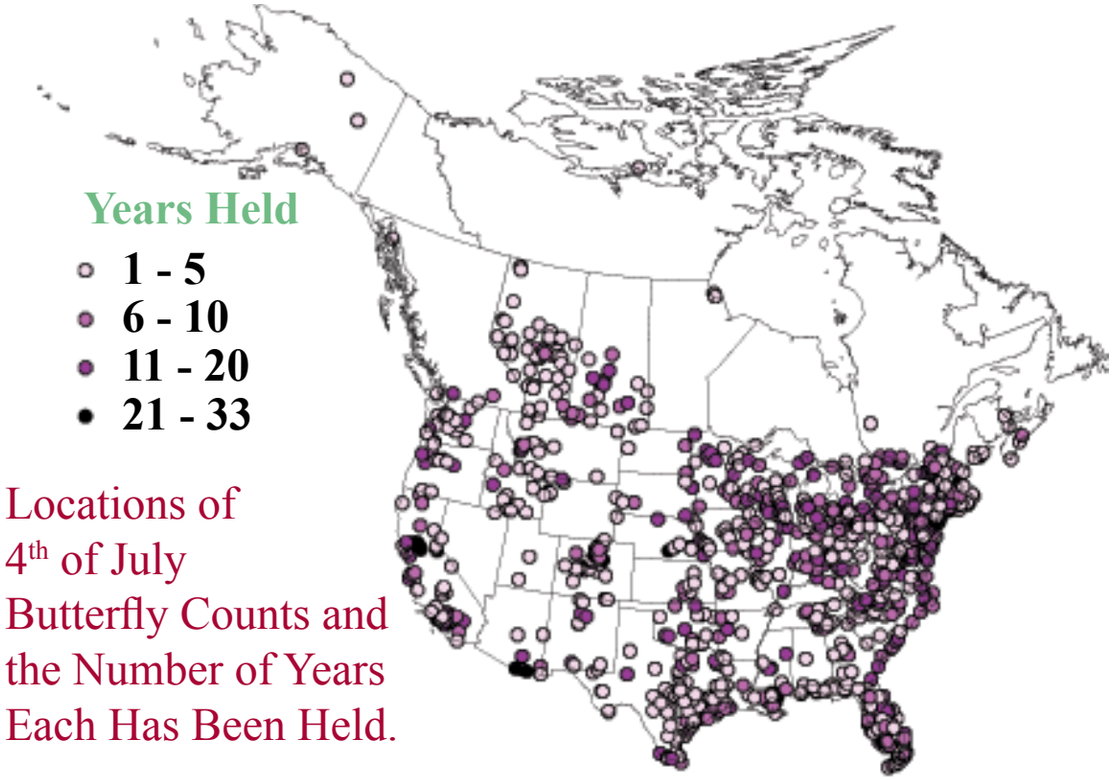
For over 30 years, groups of butterfly enthusiasts all over North America have gone out and counted butterflies during the annual 4th of July Butterfly Counts. These counts often team seasoned naturalists with eager novices for a fun day devoted to seeing as many butterflies as possible. Friendly competitions spur long-time friends to see as many new or interesting species as possible, and the possibility of seeing a species never seen before in an area is motivation to participate year after year. Clearly, one of the greatest benefits of this count program is to get lots of new people watching butterflies.

In addition to the benefits for participants in the over 450 local counts that occur each year, there has been a tremendous amount of information collected since the program began in 1975. Including surveys through 2006, there has been information collected from about 6000 surveys at more than 1000 locations (see map, page 35), with about 200,000 observations of almost 1.5 million individual butterflies. That represents one of the largest natural history databases ever collected! So, a big question is: what can be done with all those data? Although the possibilities may seem endless, there is certainly a need to be cautious. One of my main goals as I've started working with the 4th of July Count data is to use scientific methods to determine the most appropriate ways to extract information from this incredible data source. In this column, I'll share what I've learned so far.

Although there are seemingly an endless number of questions that could be asked and answered about butterflies using 4th of July data, almost all questions boil down to measuring patterns of abundance, which can usually be thought of in terms of space or time. In any particular location, which species are common and which species are rare? How do those patterns of abundance vary throughout each species' geographic range? Also, how do patterns of abundance change from year to year? Although these are basic questions, these fundamental patterns are at the heart of almost any important question that can be asked. Are butterfly species declining? If so, which ones? Are any shifting their ranges northward in response to global warming? Are any declining in response to drought? Is urbanization shifting the composition of butterfly communities to favor species that do well in disturbed habitats (such as Cabbage Whites)?

Before any of those questions can be explored, it is vitally important to determine how closely the patterns observed in 4th of July Count data reflect reality. Unfortunately, "reality" can be hard to pin down! Luckily, there are several programs that independently monitor butterflies. Although none can claim that they collect the definitive data on patterns of butterfly abundance, when patterns are consistent between all surveys, there is good evidence that the observed patterns are real. I have been fortunate to be given access to butterfly data from two large-scale state monitoring programs that I have used to compare to patterns found in the 4th of July data. These monitoring programs were started independently in Illinois and Ohio and use similar protocols to each other (not the same as the 4th of July program). They have some advantages over the 4th of July program in that surveys at each site are conducted by a single observer over a set transect and done several times per year. The programs have been running for several years (12 in Ohio and 20 in Illinois) and so have a lot of data to compare. In comparing these three independent monitoring programs, I am looking for patterns that are consistent among the three programs.

One of the great things about these two state monitoring programs is that they occur so close to each other and are largely within a similar ecotype (agriculture/grasslands with some forested areas in the south). The geographic and ecological similarity means that Illinois and Ohio share 134 of the 166 butterfly species that have been recorded in both states. In fact, of the 50 most abundant



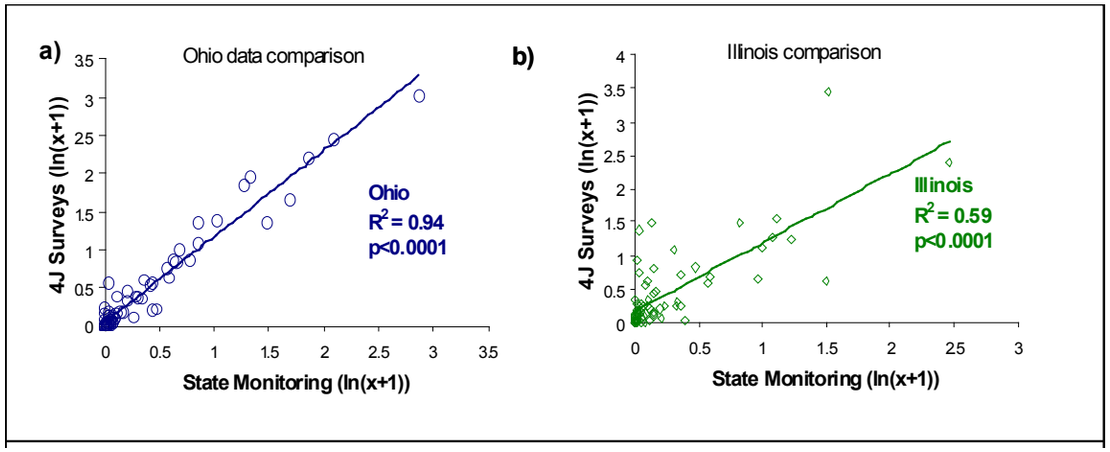
Locations of 4th of July Butterfly Counts and the Number of Years Each Has Been Held.

species (calculated separately for each state), 45 are shared. It is for these 45 shared species that I have done most of my analyses.

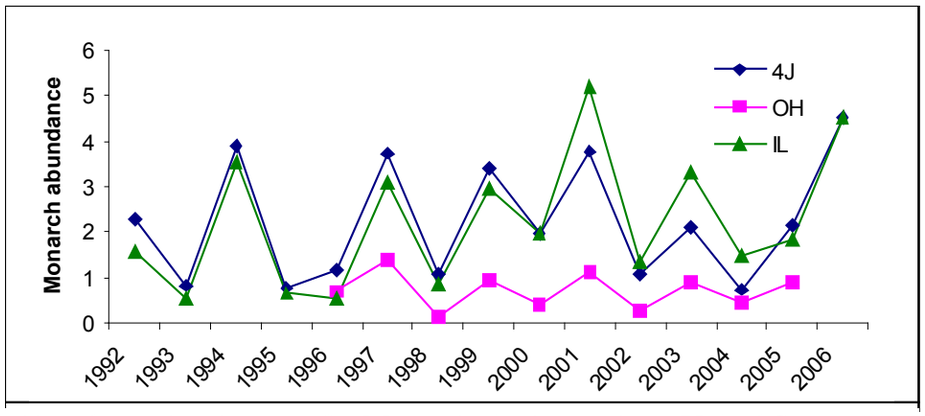
The first question I address is whether the relative abundances of these species show similar patterns among the three surveys (4th of July, Illinois and Ohio). As the graph at the top of page 36 shows, they definitely do. The 45 points in each graph indicate the mean abundances over the years for the 45 most common species. When the points line up along the diagonal of the graph, that indicates that abundance patterns are very similar. For instance, when you see a high abundance score in the Ohio or Illinois counts, you are also likely to see a high abundance score in the 4th of July surveys. Similarly, low abundance scores for one survey find low abundances in the others. Although the Ohio fit is better than the Illinois fit, you really don't see very abundant species in one set of surveys show up as rare in another set of surveys. This means that the 4th of July surveys do a good job of indicating which species are relatively abundant and which ones are rare. This information is useful for lots of reasons, and can be used to address lots of interesting ecological and evolutionary questions or to help novice observers narrow down their choices of which species they are most likely to have observed in the field.

The second question is much trickier. How well can we track year to year trends in the 4th of July data? This question is complicated by the fact that effort and participation varies from year to year. If we see an increase in observations from one year to another, is that because numbers are going up or because more and more people are participating (and participants may become better at finding and identifying butterflies)? Although effort is quantified in each count, analysis of Christmas Bird Counts (the program after which the 4th of July Counts were modeled) shows that the relationship between effort and counts is not linear. I am continuing to refine my analytical methods to take effort and experience into account. But my initial analyses at least shows that year-to-year trends show similar patterns for some, but not all, species when comparing 4th of July data to Illinois and Ohio monitoring programs. An example is shown for one species, Monarch, in the graph in the middle of page 36.

Of the 45 species analyzed for year-to-year trends, 17 showed similar patterns among the three surveys. Although this may seem like a low



Comparisons for relative abundances of 45 of the most common species between the 4th of July data and independent monitoring surveys in Ohio (a) and Illinois (b).



Abundance data by year for Monarchs in the northern United States are shown for the 4th of July, Illinois and Ohio surveys from 1992 through 2006 (Ohio surveys began in 1996).

number, it indicates that sophisticated analyses are possible for up to 1/3 of all commonly observed species in a particular geographic area. This is better than I had hoped for! Taking a closer look at the data reveals that the 17 species that performed well were similar in several ways. For instance, large, easy-to-identify butterflies tended to perform better in analysis, which makes sense considering the wide range of skill level in the 4th of July observers. In addition, the most abundant species did the best, which also makes sense because higher numbers tend to lead to easier to detect statistical patterns. All these common-sense results are evident in one of our best performing species, Monarch, which is certainly one of the largest, most abundant, widespread and easy to identify butterfly species. In fact, we have also compared Monarch numbers to a monitoring program that counts Monarch eggs and caterpillars throughout the eastern United States and have also found similar patterns that have allowed us to track the progress of Monarchs throughout their journey northward each year.

These results clearly indicate that analyses for the most common, easy-to-identify butterflies are well-supported. On the other hand, explorations of patterns of rare or cryptic species should be undertaken with caution. I'll be back in future columns to describe some patterns of increases and declines for some of our most common, widespread species and also share other, interesting results that we are finding with this valuable data set.