BASIC DATA INTERPRETATION FOR BEGINNERS

By Mary Heimerdinger Clench

Many people, including banders, have an aversion for mathematics. This attitude may be understandible when it comes to figuring out the "new, simplified" income tax forms, the price per ounce of a 13 lbs., 7-9/11 oz. box of detergent, or the sophisticated statistics in bird population studies. Yet banders accumulate a great deal of information about birds, and much of it is in the form of numbers: wing measurements, weights, dates, number of birds, etc. All too often these important data lie fallow in banding notebooks because banders think they have to be accomplished mathematicians to analyze them. It just isn't true! Of course if you know statistics you can get a lot more information out of your banding, but with simple techniques (that you probably learned in grade school) plus a modicum of common sense, you can get some results from your figures. These results may be interesting enough to publish directly, or they could lead you to future, even more rewarding, studies.

What birds to analyze? Some people try to work only on "rare" birds, even though they may not band more than a few of them per year. Leave that sort of thing to the statisticians who know how to deal with small samples. Concentrate instead on birds you've banded good numbers of. Note that I don't say precisely how many you must have; the numbers that constitute an "adequate" sample depend on what sort of analysis you're doing. Don't make the common mistake of ignoring common birds. Some of the least understood birds biologically are ones you band in numbers; they have been consistently neglected just because they were under everybody else's nose too. Swainson's thrushes can be just as interesting as swainson's warblers!

What to analyze? Again, almost anything you have good numbers on, such as wing measurements, weights, times of migration. Make comparisons within or among species whenever possible--males vs. females, HY's vs. AHY's, resident species vs. migrants. The list can be as long as your ingenuity. You will probably spend a fair amount of time and paper experimenting with different kinds of comparisons, but at worst it will give you experience in handling data, and eventually you are bound to turn up something interesting.

When you're working with numbers, don't forget your common sense. You know, for instance, that feathers wear; therefore don't lump measurements of worn wings (spring-summer) with freshly-molted fall birds to come up with the "average" wing length of a species. You also know that the amount of fat a bird is carrying will have a strong effect on its weight. So weight analyses must be done on comparably fat birds. This is not to say you can't contrast fall with spring measurements to demonstrate feather wear, or the various fat indexes to show the effect of fat on weight. Just be sure your groups of figures are internally comparable. And, in migration analyses, be sure the time periods and numbers of birds on the graphs are chosen to reflect the birds' activities rather than yours; for instance, if you band irregularly (perhaps only on weekends, with varying numbers of nets) express the number of birds as the number caught per 100 net hours, or lump the time periods so each will represent approximately equivalent banding effort. One any one graph however, all the units should be consistent, such as the time spaced evenly into 10-day periods. This principle of uniformity, in fact, goes all the way through data analysis. When you compare two groups of numbers (such as males vs. females) the sample sizes should be about the same. If they are not there are statistical ways to get around the problem (usually by expressing one group as a percentage of the other) but a novice would do well to stay with samples that are naturally comparable. If you really want to compare a group of 35 birds with another of 200, go ahead and try, but don't forget that you have eight times as many birds in the second sample, and that the first group will probably show the "vagaries" of a small sample--look for differences (or similarities) only in the most general patterns.

How to analyze? The first step is usually to gather your numbers into long columns such as "weights of HY Yellowthroats with a fat index of 0 banded between 1 September and 1 October, 1970". But looking at long columns of figures is not usually very enlightening. The next step may be to take the average of the numbers. Averages alone, however, can be misleading because they give no indication of how much variation is within the sample. Fifty birds that "average" 20 grams each may vary only from 16 to 25 grams, or they might run from 11 to 31 grams. Statisticians can show variation by computing "standard deviations". You can show it by graphing your results.

In fact, graphs are by far the most useful, as well as the simplest, way of understanding data. You make a picture of your numbers so you can see what they're doing. A column of figures gives you only one aspect of your data; a simple line graph or bar graph enables you to relate two aspects to each other; and a scatter diagram permits relating of three different aspects.

Take this (obviously hypothetical) example:
100 female Cerulean Robins* (a species easily sexed by plumage) are banded

* a ficticious species

between 1 September and 19 November. The average wing length is 117.6 mm. Yet if you graph the results (fig. 1) with the number of individuals on the left side and the wing lengths across the bottom, you can see that it's not the smooth 'normal' or bell-shaped curve you might expect; instead, there's a suspicious large number of 20mm. females. What about the males? Graph the male sample taken during the same period of time (conveniently, also 100 birds) for comparison (fig. 2). You find the males show a "normal" curve. If you had simply computed the female average, 117.6, and the male average, 118.0, the two numbers would not appear very different. But by making a picture of the wing lengths of the two sexes, something interesting has cropped up: a group of "big" females. What might be the explanation? Are they missexed, perhaps young, males? Are they AHY females, longer-winged than HY (or vice versa)? Are they from a different population, perhaps a different subspecies, than the shorter-winged females? Or is it something else, unsuspected? A statistician could go on to more rigorous tests to prove or disprove the hypotheses. You can go on to further analysis through more graphs--and perhaps more field work next year.

In scatter diagrams, each individual is represented by a point. This technique allows you to diagram such triplets as the number of individuals per wing length per date of capture, and significance is seen in clusters or bands of points. To continue the example of the Cerulean Robins, the scatter diagram might turn out to look like fig. 3. If the large females are clustered at a particular point of time in migration (as here) that might give you a good hint of the explanation. If they are not clustered, you might suspect other explanations--such as the HY vs. AHY theory. Additional bar graphs or scatter diagrams, comparing as many aspects of Cerulean Robins as you can think of, may offer other clues. Whatever the explanation turns out to be, you may not be able to prove any hypothesis until you've done further field work--carefully examining all the Cerulean Robins you catch the following fall, perhaps recording additional data (length of bill, length of tarsus, searching for incoming feathers, etc.), and certainly by enlarging your total sample.

A great many fascinating problems lie hidden in numbers: subtle differences in migration timing, measurements, or weights that can only be spotted clearly by some sort of data analysis. So it is well worth the time spent in graphing one thing after another, in a variety of combinations. Eventually you will turn up an interesting bit of information. It's very satisfying to find a problem of your own, and track down a new aspect of a bird's biology that was not suspected until you found a funny bump in your graph.

In this workshop summary, I've tried to present a sort of "primer" for data interpretation. It's almost impossible to do justice to the subject in a few pages, however, so for those who would like to pursue statistics further (and, for example, to study the Chi Square test discussed in several workshop sessions) I recommend Facts from Figures by M.J. Moroney (a paperback Pelican Book #A236 /Penguin Books Inc., New York/ $1.95). This excellent introduction to statistics is written for laymen--it's a real gem.

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Figure 1. Bar graph of wing lengths of 100 female Cerulean Robins.

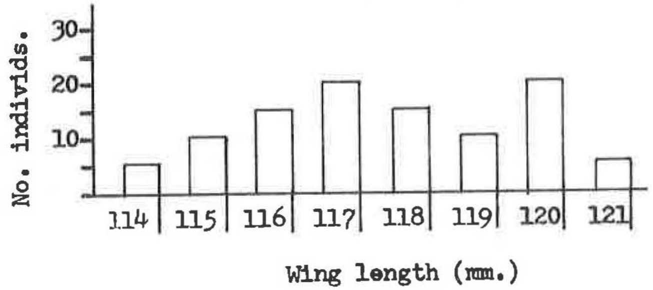
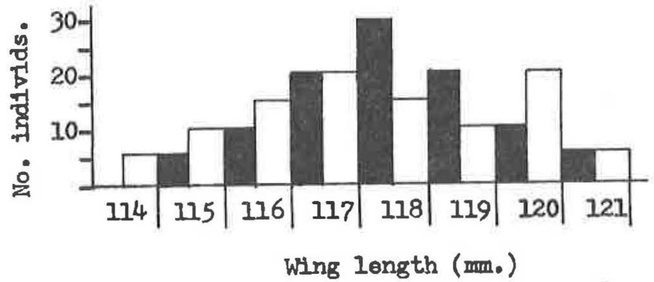
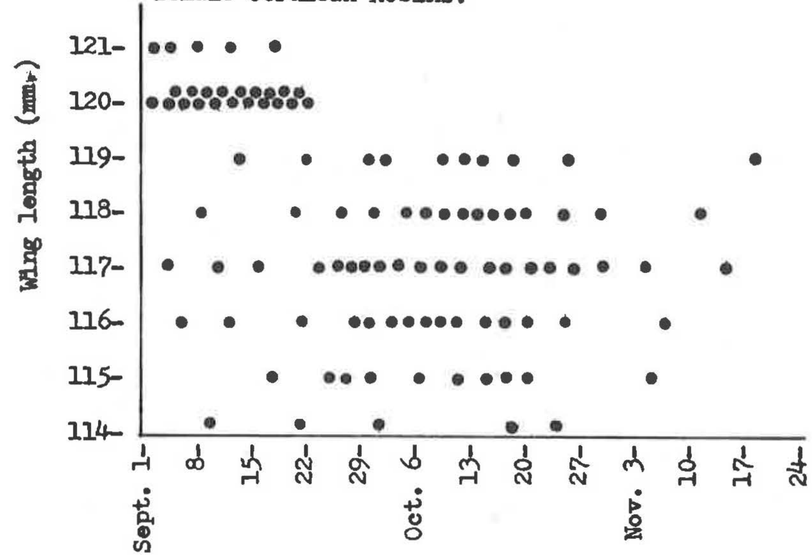


Figure 2. Bar graph of wing lengths of male and female Cerulean Robins.



Open bars = females; solid bars = males.

Figure 3. Scatter diagram of wing lengths and dates of capture of 100 female Cerulean Robins.



THE PINE SISKIN WING STRIPE AND ITS RELATION TO AGE AND SEX

By Robert P. Yunick

The Pine Siskin (Spinus pinus) invasion of 1964 was my first encounter with this species in the hand. Early in the encounter, the differences in the amount of intensity of yellow in the wing stripe sent me to the literature to determine what significance, if any, these criteria contributed toward determining age and sex. Texts like Forbush (sexes alike or similar, female smaller than male), Roberts (yellow on wings and tail of female is restricted) and Chapman (no comment on age and sex difference) provided insufficient information, so I sought the answer from inspection of the skin collection at the American Museum of Natural History (AMNH) in New York in June 1964. Because I was not able to examine the wing stripe of the specimens without risking undue damage to the skins, I was not able to compare wing stripe characteristics and wing chord data of these specimens of known sex with similar data gathered from birds I had banded during the previous winter. However, a comparison of data I did have gave an indication of an indirect relationship between wing stripe characteristics and age and sex.