

# Special Issue of CV Birds: Introduction to Quantitative Data

*John Fulton, 927 Olivewood Drive, Los Banos, CA 93635.*

*Merced\_birding@hotmail.com*

*George Kajrys, PhD, 697 Mockingbird Court, Merced, CA 95340.*

*gkajrys@comcast.com*

*Joe Devine, Modesto, CA. mojoedevine@yahoo.com*

*Rory Fulton, ASA, 931 W. 19<sup>th</sup> St., Unit 10, Costa Mesa, CA 92627.*

*rorysfulton@gmail.com*

Many birders are experts at field identification of birds. Identifying and recording the presence of a species produces qualitative data. Although qualitative data is valuable, quantifying observations adds even more value. Quantitative data consists of counts, numerical estimates, and measurements.

## WHY USE NUMBERS

Why add numbers to bird lists? Quantitative data can be analyzed to ascertain populations, densities, rates of occurrence, and changes over time and space. Such numerical information adds to the value of our contributions to citizen science and to conservation.

By collecting and submitting quantitative data through various forums, birders make their observational data available to others. Although useful, observations that are solely qualitative are not as useful as they could be. Some birders may feel they lack the training, or time to record good quantitative data, or they just have never considered expending the efforts to improve their reported bird data. We believe, however, that many birders are eager to increase the usefulness of their data by investing a little extra effort.

Although some decisions can be made based only on qualitative observations, analyses of changes in populations, species ranges, or uses of different habitat types are possible only with quantitative data. Numbers allow us to prioritize, or to objectively rank choices, such as among management options. Numerical data can provide a way to assess the urgency of actions, to make the best choice and allocate limited resources to do the most good.

Whether day-listers, county listers, eBirders, Christmas Bird Count (CBC) participants, Breeding Bird Atlas compilers, or just doing the “Big Sit,” there

are ways we can make a more meaningful contribution to citizen science data with only a small increase in effort and attention to detail.

## OVERVIEW OF TOPICS ADDRESSED

This special issue of the *Central Valley Birds* includes information about how to improve the quality of data by adding numbers for more measured parameters, and by improving the quality of the numbers submitted. Improving the quality will mean quantifying our data. The following ideas are covered in one or more articles in this issue.

### *Three Components of a Numerical Quantity*

The three parts of a quantity are the significant digits, the order of magnitude, and the units that are measured, such as the birds that are counted. Understanding each of these concepts allows the reporter to provide more consistent and meaningful quantitative data.

### *Significant Figures or Digits*

The digits that represent an actual count are *significant*, while the zeros that are just place holders are not. For example, when you estimate a total of 2,500 geese by counting by groups of 100s, the 2 and 5 are significant digits and the two 0s are placeholders. The placement of zeros preserves the magnitude (ones, tens, hundreds, etc.) of the units of the items counted. The significant digits reflect what quantity of units, or groups of units, were measured. Non-significant zeros show the size of the groups of items counted; these counted groups of units indicate the order of magnitude and the precision, or the amount of uncertainty, that the number demonstrates.

### *Degree of Uncertainty*

The size of the unit groups that were counted, which is shown as zeros used as place holders, indicates the degree of uncertainty in the precision of numerical data. Some call this the margin of error.

### *Performing Mathematical Operations with Significant Figures*

There are rules for how to handle mathematical operations for numbers that have differing significant figures. We review these rules to ensure that addition, subtraction, multiplication, and division operations maintain correct figure significance.

### *Counting Techniques*

We review techniques useful for counting large numbers of birds in various situations.

## *eBird Protocols*

eBird is a tool that enhances the opportunities for birders to contribute to citizen science. The protocols for quantitative data entry are important for ensuring the validity of the data. On CBCs, there are limitations and considerations to how eBird data can interface with CBC data.

### *Examples of When Numbers Counted*

There are many ways the concept of quantitative data can be applied. Anecdotal examples help illustrate how numbers have been collected and used in various situations, and why numbers are so important.

### GOALS

This special edition addresses some opportunities that some of us are missing to be better citizen scientists. We can improve the data that we are collecting. The first step towards improved data is to realize that qualitative is not synonymous with quality.

How do birders move beyond qualitative data to quantitative data? Birders start from a good place. All types of birders can and do make contributions to citizen science. Many birders record and report anomalies when they see a bird outside of its normal range or season. The value of these data increase after they become part of a quantified data set that may show, for example, a rate of range expansion and then that rate is shown to be connected to other quantified data such as climate change, habitat change, or other phenomena.

Many birders already collect numerical or quantitative data. The benefits of their efforts may be increased simply by being consistent in how numbers are used. Be consistent; standardize the use of significant figures; measure units of space, distance, and time; and use standard data collection protocols. Take the time to measure and record additional parameters while birding, such as weather conditions and habitat descriptions. Doing so we will make a much greater contribution to citizen science and to conservation.

### ACKNOWLEDGEMENTS AND AUTHOR CONTRIBUTIONS

Lead author John Fulton, a retired scientist and teacher, initiated the concept of a special CV Birds issue addressing quantification for birders. At about that time, Joe Devine, long-time birder in the Modesto area and Merced County co-editor for eBird, contacted John Fulton with similar ideas. John and Joe identified issues that could be clarified for those wishing to enter quantitative data into data bases, including Christmas Bird Counts (CBCs) and eBird. Rory Fulton is a mathematician and actuary who edited and reviewed early drafts of the manuscripts. Dr. George Kajrys, a retired nuclear physics researcher and teacher, wrote the first draft and provided much of the content for the paper on scientific measurements and significant figures.

As lead author, I, John Fulton, acknowledge all the input from each of the other authors and give them full credit for their contributions, without which this project would not have happened. I am solely responsible for any omissions, errors or other shortcomings in any of the sections, that may have slipped by me and the editorial group.



Flock of mixed geese; Greater White-fronted Goose (*Anser albifrons*) and Snow Goose (*Anser caerulescens*). 21 January 2012. Bruceville Rd., Sacramento Co., California. Photo © Susie Nishio