Numbers Count: Personal Examples When Counts Mattered

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Certain times in our lives are formative. The following anecdotes describe situations when numbers mattered to me. Although these events did not happen in the Central Valley, the processes involved are universal in the sense that they can be applied anywhere.

OVER 700,000 WARBLERS PASS OVER QUEBEC IN A DAY

On 28 May 2018, Grandmont et al. (2018) observed a huge wave of migrating birds at Tadoussac, on the St Lawrence River in Quebec, Canada. Davies reported the event on eBird that day, stating, "Today was the greatest birding day of my life." He reported that over their nine hours of observation, "Total number of warblers: 721,620. To our knowledge, the previous warbler high for a single day in the region was around 200,000, which was the highest tally anywhere in the world. Other observers in the area today had multiple hundreds of thousands, so there were likely more than a million warblers moving through the region on 28 May 2018. There's no place like Tadoussac."

Once posted on eBird, the report was forwarded and announced on multiple California birding list-serves over the ensuing week. Luckily, somebody was there in Quebec to see this amazing event. More importantly, the numbers and the methodology to derive those numbers was also well-documented. The post included how the seven observers took timed observations repeatedly to calculate how many birds of each species per second were moving through each flight path or field of view. These were tabulated and then multiplied by the duration of each of 20 timed intervals to arrive at the grand total. See the Quebec 28 May 2018 web posting (Grandmont et al. 2018) for more, including photos, videos, maps and the numbers of each species.

The extrapolation that over a million birds may have arrived in that wave was plausible only because the methodology was explained. Absent such an explanation, the report could be questioned, or ignored as hyperbole, or even deleted by an eBird editor and the data lost to future generations of interested birders and scientists.

GULF SPRING MIGRANT FALLOUTS

When northward migrating birds depart from the Yucatan peninsula on their trans-Gulf migration flight, it is usually sunset. They reach land again 10 to 20 hours later, depending upon weather and wind conditions.

My years living in the southeastern U.S. in the 1980s gave me several chances to see incredible concentrations of migrating birds. I had many opportunities to count large flocks of migrants: 1,500 accipiters, 1,000 American Robins (*Turdus migratorius)*, 400 Indigo Buntings (*Passerina cyanea)*, 200,000 ducks, and 1,000 Broad-winged Hawks (*Buteo platypterus)*. Some of the winter roosts were impressive too: 1,200 Double-crested Cormorants (*Phalacrocorax auritus)*, 400 Turkey Vultures (*Cathartes aura)*, and 1.2 million blackbirds spent the winter near Mobile Bay.

I also heard many old-timers' stories from the 19th and early 20th Century about "fallouts"—huge waves of migrating spring warblers and other species along the US Gulf Coast—when there would have been hundreds of warblers resting from exhaustion on the beach at the edge of the surf, and hundreds more in the beach grass on the nearby dunes. The exhausted warblers land on the sandy shores of the Gulf of Mexico to rest a minute or two, after fighting squalls of bad weather during the long flight from the Yucatan Peninsula. The historical reports from the early 20th century stated that some birds would be too tired to fly any more, even to attempt escape when a person picked them up. I had doubts about waves of hundreds of birds. Judith Toups and Jerome Jackson (1987) mention these fallouts decades later, as warblers would arrive on the coast in waves, but with numbers in the dozens rather than hundreds, with as many as 20 species in mixed flocks. Despite diminished numbers, it is still impressive, especially when you think about the birds scattered the full length of the Gulf of Mexico.

In the 1980s, I counted "only" up to 20 birds per 100 meters that had landed upon the beach during a spring fallout event at Gulf Shores, Alabama. While warblers predominated, there were thrushes, tanagers, and vireos in the mix. Due to this relative paucity of birds in my limited experience on the Gulf Coast compared to 50 or 100 years earlier, I wondered if the historical reports had been exaggerations or if populations of birds had declined by at least an order of magnitude. The 28 May 2018 eBird account from Quebec of 700,000 migrants, with supporting count methodology, substantiates the magnitude of numbers reported in those recent historic records. It also makes us wistfully aware of the decline that avian populations have experienced in the past century.

NUISANCE BIRD ROOST ASSESSMENT

While working for the US Department of the Interior in northern Georgia in late fall 1982, my supervisor dispatched me to respond to a hazardous animal call. A person complained that millions of blackbirds were causing a serious health concern near Gainesville, Georgia. I found the flock roosting in a bamboo thicket and counted the bird numbers present. As the birds swirled overhead in the light of the setting sun, I used progressive visualizations (Fulton and Kajrys 2019) to get my best estimate of the numbers. The swirling flight did make it a bit more challenging. They were not blackbirds, and there were not millions of them. The roost supported <15,000 European Starlings (*Sturnus vulgaris*). As a result, the Animal Damage Control team was told to focus their limited resources on another roost two orders of magnitude larger in another part of the state.

COUNTING NIGHT-MIGRANT FLOCKS

In April 1990, Bill Evans, a young researcher, met me at my office at Bon Secour National Wildlife Refuge in Gulf Shores, Alabama with an idea on how to document bird migration waves along the Gulf Coast. The refuge often hosted avian researchers studying migration with mist nets. Bill wanted to do something different and was on the cutting edge of acoustic birding—using flight calls to count night migrants. He was literally working in the dark without a net.

He recorded hundreds of thrushes per hour flying overhead along the Fort Morgan Peninsula of Alabama all night long. Identifying birds by their flight calls was new then. He was confirming his hypothesis that night-migrating mixed-species-flocks of thrushes can be identified to species by their flight calls alone, even when they are flying 300-700 m (1,000-2,000 ft) overhead in complete darkness (Evans 2009).

Bill went on to quantify the minimum bird numbers involved by measuring the detection-cone angles for various types of equipment, and detection distances for each species' flight-call, which is directly related to volume. Thrushes' calls, for example, can be recorded and identified at over 600 meters distance.

Bill's array of microphones could detect birds only within about 600 m (1,800 ft). Birds farther away would not be identifiable because the strength of the signal is inversely proportional to the square of the distance. The array could be used to follow the source of a call note from mic to mic to avoid duplicate counting of birds, but it could not tell whether the source was one bird or multiple birds in close proximity. Therefore, his methodology could only give a minimum number, but that does not diminish the significance of the data; in fact, it makes it all the more impressive. Bill quantified the angle

and distance of the microphone detection cone; he quantified the numbers and the density of the birds flying at different heights. Bill identified the calls of the different thrush species and then established a minimum number for each species. He quantified the ratios and minimum magnitudes of the migration waves (Evans 2005). Without careful and detailed quantitative methods, all he would have learned was that some thrushes migrate at night.

In presenting his data, Bill described his equipment and his techniques. He carefully described his count methods so other researchers could interpret the data. He explained his data analysis process and admitted the limitations of his methods. Careful description of count methods and results allowed others to use the same methods to try to replicate the results and collect comparable data elsewhere.

ROOST COUNTING

While working on National Wildlife Refuges, my duties included documenting the numbers of birds using the refuge each month. We did separate monthly counts for various bird groups. Our counts focused on waterfowl, raptors, shorebirds, colonial waders and endangered species. Each group was broken down into species-specific tallies. Newly established refuges needed to have procedures established so that these counts could be used to track population trends and habitat use over time. Counting birds in daylight and apportioning the numbers to several species can be done in more than one way. Roost counts may be one of the easiest. It is relatively easy to count wading birds coming into a roost. Experienced observers can distinguish distant silhouettes of each species of white wader: Cattle Egret (*Bubulcus ibis)*, Great Egret (*Ardea alba)*, Snowy Egret (*Egretta thula)*, White Ibis (*Eudocimus albus*), immature Little Blue Heron (*Egretta caerulea*), white morphs of Great Blue Heron (*Ardea herodias*) Reddish Egret (*Egretta rufescens)*, and Wood Stork (*Mycteria americana*). It is trickier with a flock of mixed blackbirds, grackles, starlings, and cowbirds because they are smaller and usually are in greater numbers and at greater distances than waders.

When counting several thousand ducks on a pond, I would visually discriminate the identity of the species that are closest, in order to get percentages of each, and then multiply the percentages by the total number of birds to derive total numbers for each species. (This method is well-explained by Grandmont et al. [2018] who used the technique to determine the numbers of warblers of each species in a mixed flock.) Alternatively, I would identify duck species by flight behavior or silhouette as they took to the air if disturbed. Disturbance may flush ducks that were unidentifiable before because they were too distant or partially hidden in vegetation. Ducks are easier to identify to species than mixed blackbirds or mixed white waders. Counting the total number is very similar. I would use a grid to calculate the

area and multiply that by the density for a stationary flock. If the birds were flying, I would take sample counts. Every time the flock density changed I would record the time and take a new sample count. That way I would know the length of time by which to multiply by the birds per unit time, to yield the number of birds passing during each time interval for each swath of the habitat or each flight path. For more details see Fulton and Kajrys (2019).

Alternatively, I would tally different species individually. This can be difficult if the distance involved makes detection or identification difficult for those birds that are most distant. I have seen some biologists successfully use a tally sheet and mark down bird numbers as they flew by. Doing counts alone, I found that it was easy to mark a number in the wrong column and to not notice. I found it easier to use an audio recorder to record counts as they happened. Looking down at the data sheet was time that I could not observe the birds' flights, while the audio record could be transcribed later.

COUNTING GREEN HERONS AT A BREEDING COLONY

I was censusing nests of Green Herons (*Butorides virescens*) in Mississippi at Yazoo NWR in 1984 (White et al. 1988) when a revelation came to me. I had previously assumed that they were solitary nesters until I surveyed a swamp with scattered buttonbush (*Cephalanthus occidentalis)* surrounded by a 100-acre green-tree reservoir. There, on one of the monthly heron counts, I counted a dozen Green Herons among the thousands of larger herons in the roost. I assumed that there could have been as many as six nests in close proximity. Over the next few days, researcher Keren Ensor and I were surprised to find that there were about two dozen nests there, and that the adults were much less conspicuous than I had expected. We flagged and numbered individual nests and watched them progress from egg-laying through fledging. We documented that as the young began leaving the nests and "branching", the nests' twigs were recycled by other adults to build other nests, often within a few feet of the previous nest. Over the 10-week breeding season, we documented over 50 successful Green Heron nests in the reservoir, without detecting any re-use of the same nests.

In this instance, counting individual nests during one or a few visits was not sufficient to understand the size of the colony. Conducting a full census of breeding efforts required marking, labeling, and counting each nest as it was built, and then following its success through the season. Such methods have been independently developed to quantify nesting at a Sacramento colony (Kopp 2018). Careful counting efforts make a difference.

LESSONS LEARNED

My experiences taught me several important lessons about counting under complicated or difficult conditions.

Be prepared to adapt to unexpected conditions. You may need to "wing it" and adjust "on the fly." Encountering large flocks unexpectedly may provide your only chance to document an unusual event. Get the best data you can when you can.

Bad weather can be good for birding. Rain squalls can cause migrating warblers to become concentrated in space and time. This can result in impressive concentrations if you are prepared to brave the elements. Being in the right place at the right time, however, is more a result of good planning than mere good luck.

Old technology can be used for new applications. Bill Evans used five-gallon paint buckets to improve the sensitivity of microphones. He used the concept of birding by ear, to develop the new field of study that identified and counted birds in the dark.

Do not let generally accepted assumptions cause you to jump to conclusions before you gather the data. The secretive lives of Green Herons may cause some to think that they are solitary and that they may re-nest in the same season. Our study showed Green Herons sometimes nest in sizeable colonial rookeries and we detected no nest re-use.

Making careful observations and taking detailed notes is the best way to maximize our contributions to citizen science.

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