TESTING A MODEL THAT PREDICTS FUTURE BIRD LIST TOTALS

by Robert W. Ricci

Introduction

One of the more enjoyable features of birding as a hobby is in keeping bird lists. Certainly getting into the habit of carefully recording our own personal birding experiences paves the way to a better understanding of the birds around us and prepares our minds for that chance encounter with a vagrant. In addition to our own field experiences, we advance our understanding of bird life through our reading and fraternization with other birders. One of the most useful ways we can communicate is by sharing our bird lists in Christmas Bird Counts (CBC), breeding bird surveys, and in the monthly compilation of field records as found, for example, in this journal. As important as our personal observation might be, however, it is only in the analysis of the cumulative experiences of many birders that trends emerge that can provide the substance to answer important questions such as the causes of vagrancy in birds (Veit 1989), changes in bird populations (Davis 1991), and bird migration patterns (Roberts 1995).

Most birders, at one time or another, have speculated about what new avian milestones they will overtake in the future. For example, an article in this journal (Forster 1990) recorded the predictions of several birding gurus on which birds might be likely candidates as the next vagrants to add to the Massachusetts Avian Records Committee roster of 451 birds. Just as important as predictions of which birds might appear during your field activities are predictions of the total number of birds that you might expect to encounter.

The "Doubling-Time Rule"

Experiences suggest that finding new species in a birding location does not increase linearly with time but will require a doubling of time to find additional species (Cable and Brock 1991). The doubling sequence will increase as 2^n, where n represents the whole number sequence 1, 2, 3, 4 . . . Take what might be a yearly bird list for a new birder in Massachusetts. During the first year survey, he or she compiles a list of 150 bird species. He or she adds another twenty species during the second year, for a total of 170 species during the second year. According to the above rule, it will take two more years (2^1) to find the next twenty species (fourth-year total of 190 species), four more years (2^2) to find an additional twenty species (eighth-year total of 210 species), eight more years (2^3) to find the next twenty species (sixteen-year total of 230 species), and so on.

Mathematically, the "doubling-time rule" can be written as follows:

total # species seen = # first year + # second year x 3.322 x Log(Y)

The symbol Y represents the year of the survey, and Log is the logarithm to the base 10. As an example application of this formula, we can calculate the total number of species seen at the end of eight years.

total # species seen = 150 + 20 x 3.322 x Log 8 = 210

Of course, the rule applies to any number of years. For the same initial conditions, the doubling-time rule predicts a total list of 226 species at the end of 14 years.

The doubling-time rule is empirical in nature and cannot be derived from more basic biological or ecological principles. Rather it has its roots in the common experience of all birders. We added more birds to our life list during the first year of birding a particular location than in subsequent years.

The rule is based on a variety of assumptions. The area surveyed must be the same. Although the time period need not be in years, it should encompass logical time periods. For example, it would apply in predicting future lists for birding a particular location over several days but would not predict list totals if the days were for different seasons. The number of person-hours spent surveying during a time period should not change nor should the expertise of the birder. No field data are offered in the Cable and Brock paper that might be used to test the doubling-time rule.

Testing the Model

Just as CBC data are more likely to reveal trends from the cumulative efforts of many observers rather than the results of one individual, the doubling-time rule is more likely to be followed when the lists of several people are pooled. From a statistical point of view the precision of field data increases as the square-root of the number of observations. The pooled observations from 100 individuals are likely to be ten times ($\sqrt{100} = 10$) more precise than that of a single individual, all else being equal.

The Forbush Bird Club has been keeping yearly field records of bird species found in Worcester County since 1931. The current practice of displaying field records in an annual publication (*The Chickadee*) was established in 1936. Members send the editor yearly bird lists, which are compiled and listed according to date, number, location, and observer. In the past twenty years, anywhere from thirty to forty members each year have submitted yearly checklists. The field records are a unique resource for anyone interested in birding in Worcester County and contain data spanning almost six decades that can serve as a critical test of the doubling-time rule.

The 1936 edition of *The Chickadee* lists 170 species of birds found that year

in Worcester County. In 1937 the field records listed an additional twenty-one species. Figure 1 shows the total number of bird species seen in Worcester County since 1936 as a function of the year of observation. In compiling the list of new species from the pages of *The Chickadee* I limited myself to those species that are currently on the MARC list. Hybrids were not included. Superimposed on the data is a graph of the total number of species predicted by the doubling-time rule as given above. In 1938 the doubling-time rule predicts that in the year 1994, a total of 293 different species of birds would have been found since 1936. The total number actually found was 310 species. There is less than six percent disagreement between observed and expected. This is a remarkably accurate prediction considering the fifty-nine-year time span involved. In the early years, 1939-1949, the club record lagged behind what would have been anticipated by the doubling-time rule. This might have been due to World War II that undoubtedly curtailed birding activity during these years. The agreement is excellent from 1950-1978, although in 1958 the number of species actually found began to outpace the doubling-time rule as it will undoubtedly continue to do in the future.

In my opinion, this divergence is due to increased birding activity, increased experience and expertise of the current members of the club, and to some extent changes in bird population and habitat. None of these factors are accounted for in the simple doubling-time rule. As an indicator of the increased birding activity and expertise of the club members, I have plotted in Figure 2 the total number of different species sighted and reported in *The Chickadee* in a

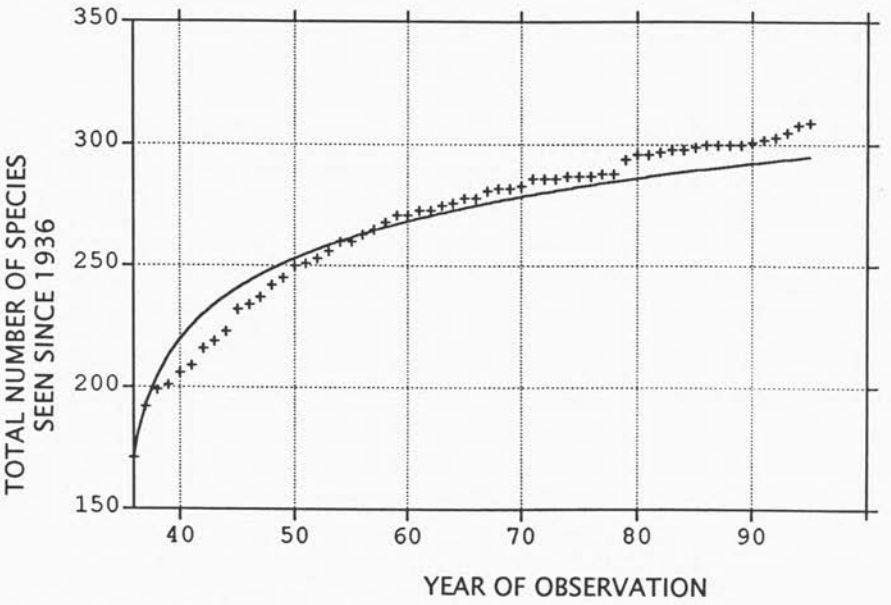

Figure 1. Forbush Bird Club List Totals, 1936-1994

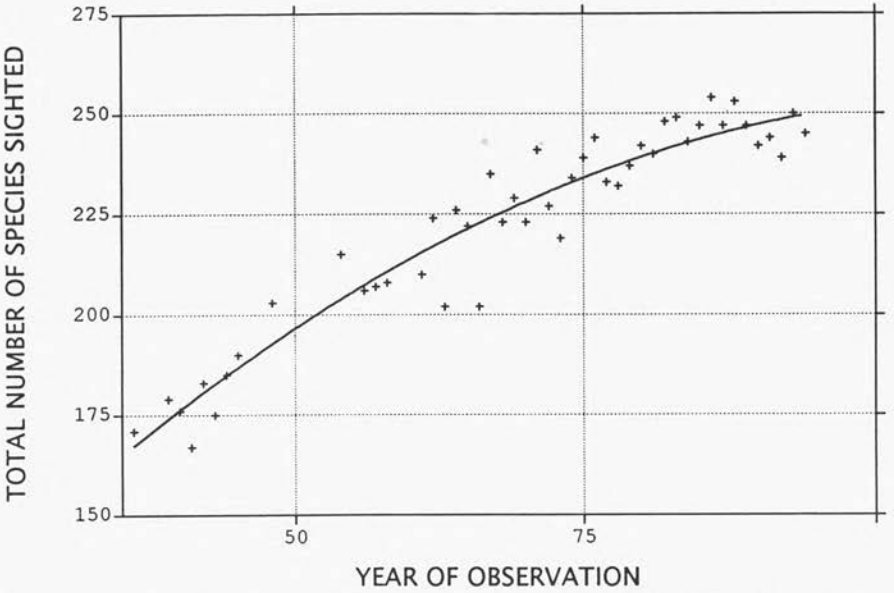

Figure 2. Number of Bird Species Seen in a Given Year by Forbush Bird Club Members, 1936-1994

given year versus the year since 1936. Almost year by year, in a very consistent trend, the number of different species found per year has increased. About fifty percent more different species were found each year in the 1990s as in the 1930s. There is some evidence in the data that the total number of species reported in beginning to level off at the 250 mark.

The doubling-time rule would appear to have validity in the above application and should apply to the birding lists of individuals as long as we understand its limitations. It can provide birders with an approximate tally of how many birds they can expect to see in a given area over a given time interval after the first two surveys. This could provide useful information in helping to plan a birding trip to a new location or simply as a guide to future birding list totals.

References

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BOOK REVIEWS: *Last of the Curlews* and *The Flight of the Red Knot*

by Wayne R. Petersen

Last of the Curlews by Fred Bodsworth. Counterpoint Press, Washington, D.C., 1995, illustrations throughout, 174 pages, $15.00.

The Flight of the Red Knot by Brian Harrington (with Charles Flowers). W.W. Norton & Co., New York, 1996, 50 color photographs, 192 pages, $29.95.

During the past two centuries shorebirds have variously captured the attention and admiration of sportsmen, market hunters, naturalists, bird carvers, artists, photographers, ornithologists, and birders. And to this long list should now be added conservation biologists.

For some folks, restless parties of animated shorebirds are as symbolic of summer clam flats and sandy beaches as are volleyballs and beer. To others, it is perhaps the epic annual migrations of shorebirds or their spectacular seasonal concentrations at widely separated coastal localities that captures our fancy. But regardless of the appeal, be it aesthetic or intellectual, gaining an understanding of shorebird history and developing a concern for their future should clearly be most deserving of our attention.

The titles, *Last of the Curlews* by Canadian nature writer Fred Bodsworth and *The Flight of the Red Knot* by Manomet Observatory ornithologist Brian Harrington, each poignantly address the past, present, and future existence of shorebirds with an eloquence and a directness all too seldom encountered in natural history writing. Each book, the first a recently republished fictional classic about the Eskimo Curlew, the second a cutting-edge monograph pertaining to the Red Knot, provides readers with graphic and moving accounts of the plight of shorebirds in the twentieth century.

Bodsworth's curlew novel first appeared in 1955, when it enjoyed tremendous success by ultimately selling three million copies in eight different languages. In brief, the book gives an account of a year in the life of two (the last?) Eskimo Curlews. Beginning with a magnificent chronicle of the practically unimaginable nonstop over-Atlantic autumn flight of the Eskimo Curlew as it departs from Labrador, bound for its distant wintering quarters a hemisphere away in wind-swept Patagonia, the story concludes with the agonizing sadness of its return flight to arctic Canada. Bodsworth's narrative brings the reader face to face with the harsh realities facing a species at the doorstep of extinction. Factually meticulous and movingly (but not sentimentally) written, *Last of the Curlews* provides intimate details about one of North America's rarest vertebrates.

The 1995 edition includes attractive line drawings by Abigail Rorer, along with a stage-setting foreword by Pulitzer prize author W.S. Merwin. Especially

insightful is a thoughtful afterword by Nobel Prize physicist, Murray Gell-Mann, who cogently discusses the Eskimo Curlew in the context of global extinction and growing threats to the integrity of our planet's biodiversity. Counterpoint Press and all who contributed to the revival of Fred Bodsworth's original classic are to be congratulated for recognizing the worth of this superb piece of nature writing and for reminding us how tenuous a species' tenure on earth really is.

In contrast to Bodsworth's fictional account, Brian Harrington's narrative uses contemporary research to round out a picture of another arctic-breeding shorebird, the Red Knot. For Massachusetts readers with a passion for shorebirds, there is a lot to identify with in *The Flight of the Red Knot*, not the least being fifty spectacular color photographs, many by David Twichell. Harrington specifically describes how the autumn migration strategy of the knot is closely tied to the southern shores of Massachusetts Bay and Cape Cod, where large numbers routinely stop to replenish resources lost on their nonstop flight from James Bay in northern Ontario, the first leg of a migration that eventually terminates in Argentina.

From Canada, Massachusetts, and the Middle Atlantic states all the way to the broad, shelf-like, sediment-packed beaches—the *restingas*—that comprise the species' Patagonian winter habitat, the author has tracked the "Robin Snipe." Beginning in late fall on the austral calendar, he has carefully chronicled how the knots initiate their northward migration, a migration that eventually brings most of the New World population of the species to a pinpoint on the map, the shores of Delaware Bay in New Jersey. Here, at one of the greatest shorebird concentrations to be found on the continent, the knots arrive precisely in mid-May, along with myriads of Ruddy Turnstones, Sanderlings, and Semipalmated Sandpipers, to harvest a munificence of horseshoe crab eggs, a protein-rich food source generated in synchrony with the flood tides of late spring. After only a few short days of gluttony in Delaware Bay, the tireless knots depart for their arctic breeding grounds, where they remain but a few short weeks, before once again initiating their southward journey.

By color-marking, banding, and observing thousands of knots throughout the western hemisphere during the past twenty-five years, Harrington and his colleagues have been able to accurately profile a long-distance migratory bird species with a detailed understanding available for very few other bird species. But more importantly, Brian Harrington has placed the Red Knot in a modern context, a context threatened by a growing human population, sweeping environmental changes, large-scale habitat alterations, and increasing competition for living space that is placing growing demands on all living things, not just shorebirds like the Red Knot. *The Flight of the Red Knot* is a case study, indeed, a blueprint, for both species preservation and ecosystem conservation.

In summary, these two shorebird volumes afford the reader, each in a refreshingly unique format, both information and pleasure, as well as underscoring the growing importance of implementing effective international conservation strategies. Even if shorebirds are not your thing, read these books. You will not be disappointed.

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