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THE CHRISTMAS BIRD COUNT: CONSTRUCTING AN "IDEAL MODEL"

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ABSTRACT.—In increasing numbers, research studies in early-winter bird abundance and distribution in North America derived from Christmas Bird Count data are being published. It has long been argued that weaknesses and inconsistencies in the method of data collection and reporting cast doubt on the reliability of these data. This paper addresses itself to a 12-point appraisal of existing practices and procedures for assembling and reporting the annual data, and compares their potential for research with a suggested "Ideal Model." The assessment serves both to highlight present weaknesses and to suggest their remedies. The practical problems of implementing steps towards the "Ideal Model" are discussed.

It is now apparent that increasing use in scientific studies is being made of the long-neglected mountains of distributional data provided by the annual Audubon Christmas Bird Count (CBC). This field-work phenomenon is now in its 81st year, and in 1978–79 involved 33,020 named participants in 1320 published counts, of which 1289 were located in continental North America north of Mexico. These studies have proved the general validity of the CBC data in spite of, or in ignorance, of certain weaknesses and flaws in CBC practices both in the field and in the reporting procedure. This paper will explore ways in which both can be improved to provide the researcher not only with more accurate and more reliable raw data, but even afford new areas of analysis.

The refinements suggested will be incorporated in a limited "Ideal Model" for CBC procedures, limited because it recognizes that this proposal must accommodate the real world—with strong traditions of competition, recreation, amateur involvement, and social interaction.

THE IDEAL MODEL

The author is in a unique position to propose changes in CBC practices and procedures. For 10 years he has written the CBC regulations and instructions, and has been editor-in-chief and final court of appeals for 11,200 counts in that time. The proposed "Ideal Model" is therefore not merely theoretical; it can be effectuated, as further refined, perhaps as early as 1981–82.

In this paper I will consider those current problems that may affect the presentation and understanding of raw data. I am not concerned here with censusing *techniques* or their relative effectiveness, or the effectiveness of the human being as a receptor of bird registrations. The problems I consider are intrinsic to the CBC process. Some are presently of minor statistical significance, others of *potential* import, but some are of major importance. Twelve specific areas will be considered.

1. *Count circle adherence.*—I believe from personal knowledge that boundary stretching is widespread; it biases all totals, but until now is ignored. Ideal Model compilers will be required to verify that the count boundary was not violated nor the count circle opportunistically shifted.

2. *Overlapping count circles.*—A 1979–80 study shows that of 576 eastern United States counts 57, or 10%, have overlaps from 5% to 80% of their areas. Researchers have ignored or are unaware of this source of error. Compilers would be required to verify that no overlap occurred, or to segregate overlap and non-overlap totals.

3. *Habitat analysis.*—The data reporting the percentages of various habitat types are not widely used, but if refined have great potential for habitat/population studies. The present error involves the reporting of the actual habitat percentages in an area rather than the actual percentages covered in that area (Table 1). If practical a national or universal habitat classification would be provided each count, to foster uniformity of definitions.

4. *Elevation.*—Only high and low map elevations for the count circle are now required. Compilers will be asked to give altitudinal high, low, and means of the CBC area actually *covered.* Of potential research value only and not presently of frequent use.

5. *Weather.*—The effects of weather on bird presence, detectability, and on observer effort are real and important variables, but difficult to quantify. Long-term, they may average out. However, better information can be furnished than is now published. It would be informative if counts rated Count Day weather on a subjective scale of 1 (worst) to 10 (best) as to its effect on bird finding and observer effort. The "Ideal Model" count would also report, using the same subjective scale, on weather factors for 1) the

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TABLE 1
FICTITIOUS TYPICAL EXAMPLE OF POTENTIAL ERROR IN HABITAT ANALYSIS REPORTING

Habitat type	Reported	Covered	Actual
Woodland	40%	50%	27.8%
Fields	30	80	33.3
Roadsides	10	100	13.9
Residential	20	90	25.0
Totals	100%		100%

week preceding Count Day, and 2) the 3-week period prior to that week.

6. *Party-hours and party-miles.*—Since most studies today are based on the factors birds per 1, 10, or 100 party-hours or party-miles, improved calculating and reporting of these data would be required. The "Ideal Model" accounting would not only assess miles and hours logged by basic parties, but calculate miles and hours added by split parties. Basic parties which divide part-time shall be considered multiple parties for that time, if they are counting different birds. Correcting this badly flawed factor may be the most significant contribution of the Ideal Model. I suggest that many of the papers based on the assumption of accuracy of party-hour and party-mile statistics heretofore published may be in substantial error, on the low side for party-hour totals, high for birds/party-hour.

7. *Observer numbers and effort.*—Total participants listed and total parties afield relate strongly to the adequacy of count-area coverage and the discovery of birds. A wide spectrum exists in CBC participation (Table 2). In 1979–80, participants per count varied from one (10 counts) to 213 (one count).

An analysis of 83 counts taken in California (1979–80) shows an increase in species totals with increases in observers and parties (Tables 3 and 4). However, there is no optimum to the number of parties afield if maximum species (and individual totals) are sought.

TABLE 3
SPECIES TOTALS RELATED TO OBSERVER NUMBERS, CALIFORNIA, 1979–80.

Observers	Counts	Species/Count
1–19	27	76.0
20–49	30	126.7
50–99	21	158.8
100+	5	190.8

While optimum numbers of participants and parties for meaningful data will vary with the type, access and topography of the terrain, except for special situations (ferry transects, pelagic counts, desert areas with oases, etc.), the great majority of present CBCs do not adequately cover their 176.6 mi.^{2} (457.4 km^2) circles.

To qualify, Ideal Model Counts would be required to meet individually specified minima for observer and party coverage. In 1979–80, less than 9.2% of all counts fielded 50 or more observers and 12 or more parties.

A further, unrecognized bias is introduced by compilers who incorrectly report participant totals, adjusting party-miles and party-hours accordingly. Circumstantial evidence strongly suggests that this practice is widespread, and for some counts participants and parties may be understated by 50% or more. This bias can be eliminated if, for Ideal Model Counts, the participant fee is waived.

8. *Observer credibility.*—To improve the credibility of observers' reports, heretofore the single most questioned of CBC data reliability factors, a method for assessing observer reliability must be developed. At present we rely on three review stages and documentary evidence for questionable reports. The Ideal Model would propose to strengthen the process by ad-

TABLE 2
OBSERVERS PER COUNT, 1979–80 CBCs

Observers	Counts	Per Cent
1	10	0.8%
2–4	83	6.3
5–9	222	16.8
10–24	552	41.8
25–49	332	25.2
50–99	102	7.7
100+	19	1.4

TABLE 4
SPECIES TOTALS RELATED TO PARTY NUMBERS, CALIFORNIA, 1979–80

Parties	Counts	Species/ Count	Species/ Party
1–5	19	69.4	19.7
6–11	24	100.4	13.1
12–19	17	134.4	9.5
20–29	14	144.0	5.8
30–39	6	172.0	4.9
59–74	2	180.5	2.7

vancing an observer "Reliability Index" as a rough gauge for measuring observer experience, to help balance party composition.

The following formula, while imperfect, has the advantage of being easy to calculate, applicable to all, and of giving scores which seem to test out surprisingly well. The formula is calculated as follows:

Each observer estimates the number of hours afield birding per year during the last 5 years (a measure of experience) and multiplies this total by the percentage of his state's (or province's) currently accepted living bird list (a measure of expertise) and (for convenience only) divides by 100. Results in the normal range will be between 0.5 and 40. Three examples:

Calculating the Reliability Index

A. *Infrequent birder*
   12 days per year. 6 hours afield each.
   45% of state list.
   $12 \times 6 \times 5 \times .45 \times .01$ = R.I. of 1.62
B. *Average birder*
   26 days per year. 7 hours afield each.
   70% of state list.
   $26 \times 7 \times 5 \times .70 \times .01$ = 6.37 R.I.
C. *Keen, dedicated birder*
   50 days per year. 9 hours afield each.
   86% of state list.
   $50 \times 9 \times 5 \times .86 \times .01$ = 19.35.

Obviously, any arbitrary index of credibility must be evaluated by the compiler, who may waive the rule on low R.I.'s owing to unusual factors. But the Ideal Model proposes *no parties afield* without at least one participant with a 5.0 or better rating. A possibility now under study is the preparation of identification test kits consisting of slides and tapes which CBC groups may use either as educational or evaluational tools.

9. *Numerical estimation.*—The Ideal Model will propose more stringent accuracy in counting and estimating based on expanded training and testing of participants. Parties will be instructed to keep running counts of scatter-type species, instead of end-of-day estimates. For flock counting, training workshops and tests would be programmed. With adequate training and practice, errors in large-numbers estimation can be reduced to 5% or less. Further, observers can discover their own habitual counting bias, and compensate for them. Compilers will be urged to carefully evaluate party routes and bird lists to avoid possible duplication.

10. *Feeding station counts.*—Species totals at feeding stations would be segregated from those afield, removing an ignored biasing factor. Where several feeders are so closely spaced that their patrons circulate between them, averages—not totals—will be presented.

11. *Linear or other transects.*—Carefully *censused* tracts based either on straight transects, point counts, or following topographic features such as streambeds, trails or roads, might be incorporated into the CBC format in certain Ideal Model Counts. These might serve as more accurate sampling yardsticks for comparing year-to-year numbers. But it would be wholly unrealistic to expect any present CBC group to base its statistics solely on transects. The Ideal Model may suggest but will not require counts to experiment with various forms of census sampling techniques.

12. *Summary statistics.*—Ideal Model Counts will expand the information presently given in the summary, to give added dimension to the data presented. The present accounting is: "Total: 135 species, 101,450 individuals." The Ideal Model accounting would be: "Totals: 135 species; 10-yr ave., 128 species, cum. total (26 years) 201 species; 1.61/party-hr, 10-yr ave., 1.52 party-hr; 101,450 individuals, 10-yr ave., 123,456; 1207/party-hr, 10-yr ave., 1469/party-hr."

We propose to test an Ideal Model, refined from this outline, perhaps as early as the 1981–82 season. It would be limited at first to counts fielding statistically significant numbers of observers and basic parties, meeting all other stated conditions, with observers of high R.I.'s and dedicated compilers. We would encourage a sampling from various latitude belts both coastal and inland. We would be pleased to have 25 CBCs run on Ideal Model lines the first year. A long-term goal might be 100 per year. But every count of any size could comply with most of the Ideal Model reporting procedures.

Two problems suggest themselves. An Ideal Model count obviously demands greater effort and care by every participant, especially by compilers. And the editing and publishing of Ideal Model Counts would require more time, effort, and funds.

Two possible solutions to these problems offer themselves. Various direct incentives might be offered Ideal Model Counts: forgiveness of all participant fees, the honorary designation of "Elite Counts," special publicity and awards, such as scrolls or insignias, free reprints, and perhaps even financial assistance. As for the publishing problem, experience will determine whether special funding is required. The incentives of pride in leadership, of pioneering into new frontiers, of acquiring reputations of superiority are powerful motivating forces.

Going one step beyond the limited Ideal Model proposed herewith, study will be given to the

possibility of designing new CBC report forms which can be more easily edited or converted to direct entry into a computer system. This prospect, however, suggested many times in recent years, may run counter to our caveat concerning the CBC and real world possibilities.

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