

dependent variable in a regression equation with three independent variables, enabling the prediction of the 2002 count for each species. Regression analysis attempts to determine the degree to which variation in one variable, for example, the annual count of a species, is determined by variation in so-called independent variables, for example, changing weather conditions. The three independent variables were: year, average daily temperature in Chicago during November, and average daily temperature in Chicago during December. The use of a time variable recognizes any particular time trend that exists. This trend would be captured by the use of a time variable, in this case YEAR. By including the temperatures for November and December, I controlled for changes in temperature over the twenty-year period.

The regression analysis provides coefficients for each of the three independent variables as well as an intercept term. These coefficients yield a quantitative measure of the relative importance of each independent variable in determining the variation in the count. For example, the estimated regression line for

crows yielded the following results:

$$\text{Count} = -897.086 + 0.457(\text{YEAR}) - 0.123(\text{NOV}) + .081(\text{DEC})$$

This should be interpreted to mean that if we held November and December temperatures constant, each year the crow count would rise by 0.457 per party hour. There is therefore a positive trend in the crow count over time. Using this equation I was able to forecast the count for 2002 by substituting 2002 for YEAR, and 37.3° Fahrenheit for NOV and 30.1° Fahrenheit for DEC. This produced a forecast of 15.16 crows per party hour for the 2002/03 CBC. Finally, I calculated confidence intervals around this forecasted average number of birds. A confidence interval provides the estimated range of counts that will include the forecast and all other counts that are not statistically significantly different from the forecast.

### Results

In the Chicago region, the 2002 count for Blue Jays, American Crows, and Black-capped Chicka-

dees declined significantly, while for the other five species, there was no statistically significant change in their numbers in 2002 relative to the 1982-2001 average (Table 1). This means that in the case of jays and chickadees, the 2002 counts were significantly less than the historical average at the .05 level. That is, there is no more than 1 chance in 20 that the results occurred randomly. Crows were significantly less than their historical average at the .001 level; there is less than 1 chance in 1000 that this result occurred randomly.

### Discussion

There are several possible explanations for the decline in the number of birds found on the winter counts in 2002. One is the standard explanation that the decline represents nothing more than a natural variation in populations. Birds and other animal organisms experience short-term swings in their numbers resulting from such factors as fluctuations in food supply, the appearance of intolerable (or superb) weather, or the presence of an unusually high number of predators, among others.

**Table 1.** Variation in Counts in Eight Chicago Area CBCs, Individuals Per Party Hour

	MODO	DOWP	BLJA	AMCR	BCCH	WBNH	NOCA	AMGO
Average 1982-2001	3.67	1.11	0.82	9.20	4.20	0.57	2.46	2.23
Predicted Value-2002	5.03	1.52	1.02	15.16	4.20	0.72	2.91	3.25
Confidence Interval								
Lower Bound	3.55	1.27	0.44	6.57	3.52	-1.68	2.42	2.40
Upper Bound	6.51	1.78	1.60	23.75	4.89	3.11	3.41	4.09
Actual Value-2002	5.04	1.44	0.34*	2.26***	2.64*	0.68	2.85	3.35
Source: BirdSource	MODO = Mourning Dove,		DOWP = Downy Woodpecker,		BLJA = Blue Jay,			
	AMCR = American Crow,		BCCH = Black-capped Chickadee,		WBNH = White-breasted Nuthatch,			
	NOCA = Northern Cardinal,		AMGO = American Goldfinch					
	*P<0.05, ***P<0.001							