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Practice Your Data Analysis Skills!

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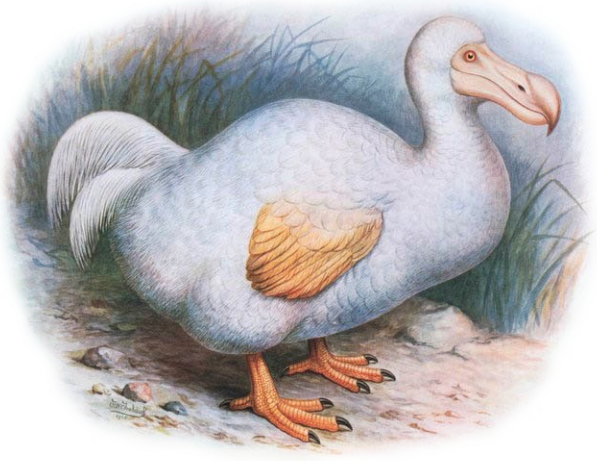

Practice Your Data Analysis Skills!

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ABSTRACT

In this exercise, we present you with a realistic dataset for nest parasitism and a hypothetical analysis performed by a hypothetical student. Using a "rubric" or assessment guide, you will evaluate the analysis, and, where necessary, correct it or improve it. In the process, you will review and reflect on what is required for good data analysis, and you can use that knowledge to improve your own skills.

1. PART 1: DATA

Brown-headed cowbirds (*Molothrus ater*), are North American's most common "brood parasite." These birds parasitize the nests of female birds of another species, laying their eggs in their nests, and leaving the host parents to raise the cowbird chicks (Figure 1). The data in Table 1 are from a study on the effect of brown-headed cowbirds in relation to the position of the nests in the forest. Specifically, the study investigated whether proximity of nests to the forest edge was related to the incidence (or likelihood) of cowbird parasitism. This is an important issue for the conservation of forest birds, because forests are increasingly fragmented by roads—a process that can create new forest edges—and cowbird parasitism can have a strong negative effect on nest success in some cases.

Figure 1. Cowbird chicks. Photo: Kati Fleming [CC BY-SA 3.0]

2. PART 2: DATA ANALYSIS

A student was tasked with analyzing the data recorded in Gaston Forest to decide whether they provide support to a particular hypothesis, and to help make management decisions for the forest about a particular problem. Specifically, the exercise asked:

1. Please describe the pattern found in these data in the form of a graph and an explanatory caption.
2. What do these experimental results tell us? Provide as careful and complete an interpretation of the results as you can, in approximately 1–2 paragraphs.
3. Consider the following hypothesis: *Birds nesting on the edge of the forest will produce fewer offspring than those on the interior*. Do the data support this particular hypothesis? Why? *Explain your answer*.

Now consider the data analysis done by Student X, below.

Name: Student X

1. Please describe the pattern found in these data in the form of a graph (Figure A) and an explanatory caption.

See Figure A.

2. What do these experimental results tell us? Provide as careful and complete an interpretation of the results as you can, in approximately 1–2 paragraphs.

Table 1. Percentage of bird nests parasitized by cowbirds recorded for 24 locations in Gaston Forest (fictitious location). Data based on the information from Brittingham and Temple (1983).

SURVEY LOCATION	DISTANCE FROM THE FOREST EDGE (M)	BIRD NESTS PARASITIZED (%)
1	0	65
2	20	64
3	40	65
4	60	62
5	80	59
6	100	55
7	120	57
8	140	50
9	160	45
10	180	46
11	200	45
12	220	42
13	240	38
14	260	36
15	280	34
16	300	28
17	320	24
18	340	26
19	360	20
20	380	20
21	400	18
22	420	16
23	440	18
24	460	16

Nests closer to the forest edge always have higher parasitism.

3. Consider the following hypothesis: *Birds nesting on the edge of the forest will produce fewer offspring than those on the interior.* Do the data from Gaston Forest support the hypothesis? Why? *Explain your answer.*

No, the data at hand are not sufficient to provide support for that hypothesis.

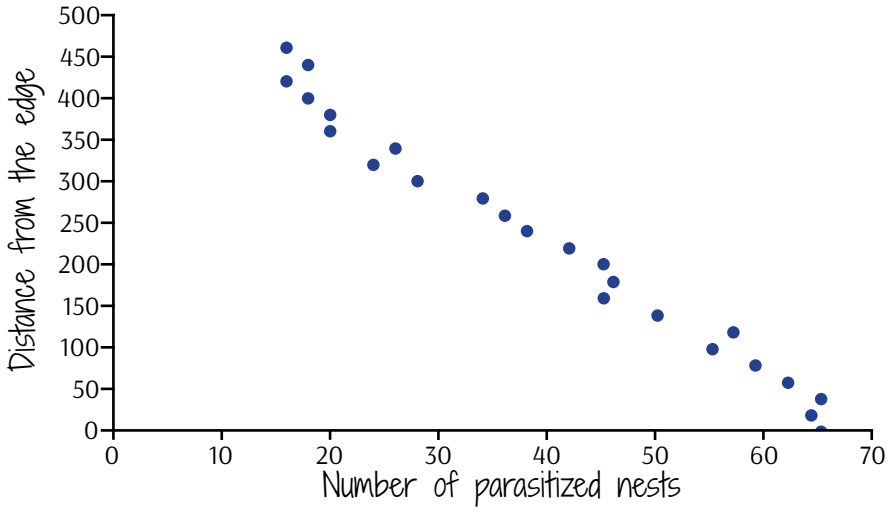
3. PART 3: EVALUATING THE ANALYSIS

Working in groups with your classmates, you will use the rubric (Appendix 1) and the tutorial provided at https://www.esa.org/tiee/vol/v5/research/picone/resources.html ("How to Read a Graph" from Picone et al. 2007) to evaluate the data analysis done by Student X, and improve it where necessary.

The rubric has four criteria, or dimensions, that are considered important parts of data analysis: calculation, representation, interpretation, and drawing conclusions. In this particular case, you will not evaluate calculation.

1. What do you consider is the skill of Student X in these criteria, and why? Write down your answers for the following criteria: representation, interpretation, and drawing conclusions.
2. Using the rubric and the tutorial as your guides, provide an alternative analysis for the data of the exercise that you think reaches or approaches the maximum level of achievement ("Level 4") as

Figure A. Number of parasitized nests and how they decline with distance from the edge.



described in the rubric. You will present your re-analysis to the class.

4. PART 4: REFLECTING ON YOUR OWN DATA ANALYSIS

Finally, after class, you will individually reflect on your own past data analysis performance using the same rubric you used for this exercise. Can you identify specific areas in the rubric where there is room for you to improve?

Please write brief answers to the following questions and submit them to your instructor at the next class meeting:

1. Which of the different aspects of data analysis is the most challenging for you?
2. As you get ready for your next data analysis assignment, what would you use from what you have learned today?

REFERENCES

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APPENDIX 1

Table 1. Data analysis is the ability to make appropriate calculations, convert data to graphical representation, interpret the information presented in graphical or mathematical forms and make judgments or draw conclusions based on the quantitative analysis of data. Levels of achievement (1–4) range from Beginning to Exemplary.

	1	2	3	4
Calculation Ability to identify and use the correct equations and operations to generate a correct answer.	Calculations attempted but unsuccessful.	Most calculations attempted are insufficient to solve the problem.	Most calculations attempted are successful and sufficient to solve the problem.	Calculations attempted are all successful and sufficiently comprehensive to solve the problem.
Data Representation Ability to convert relevant information into various mathematical forms (e.g., graphs, diagrams, tables).	Selects data not relevant to the problem/question/task. Incorrect selection of dependent/independent variable. Inappropriate use of title and labels (e.g., lacks units).	Selects data relevant to problem, but incorrectly selects dependent/independent variables, or incorrectly presents patterns, differences, and/or similarities in data. Inconsistent use of title and/or labels (e.g., lacks units).	Selects data relevant to problem, and correctly selects dependent/independent variable. Presents mostly correct patterns, differences, and/or similarities in data. May have minor errors in the use of title and/or labels (e.g., lacks units).	Selects data relevant to problem, and correctly selects dependent/independent variable. Presents correct patterns, differences, and/or similarities in data. Title and labels are clear and self-explanatory, with the appropriate units.
Interpretation Ability to explain information presented in mathematical forms (e.g. equations, graphs, diagrams, tables), and appropriately characterize results.	Attempts to explain information presented in mathematical forms, but provides an incorrect explanation of what the information means. *For example, attempts to explain the trend data shown in a graph, but misinterprets the nature of that trend (e.g., confusing positive and negative trends.)*	Provides somewhat accurate explanations of information presented in mathematical forms, but explanations are vague, go beyond what is supported by the data, or contain logical errors that detract from the interpretation. *For instance, accurately explains trend data shown in a graph, but overemphasizes the generality or significance of the results.*	Provides mostly accurate explanations of information presented in mathematical forms, and recognizes the limitations of the data. *For instance, provides a correct but basic explanation of the trend data shown in a graph, or has minor errors.*	Provides fully developed and accurate explanations of the information presented in mathematical forms. *For example, accurately and fully explains the trend data shown in a graph, and its limitations.*
Drawing Conclusions Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of the analysis.	Analysis or judgment of the data is incorrect, leading to conclusions that are logically faulty, incorrect, and not supported by the data.	Analysis or judgment of the data is tentative or incomplete, leading to conclusions that are vague, too broad, or not well-supported by the data.	Uses the quantitative analysis of data as the basis for competent judgments. Conclusions are logical and reasonable, but without nuance—no qualifications or explorations of the assumptions or limitations.	Draws detailed, logically structured, carefully qualified conclusions based on a quantitative analysis and judgment of data. Conclusions may extend to novel situations and/or make reference to underlying assumptions.

[2]*Modified from the AAC&U Value Rubric by the Network of Conservation Educators and Practitioners.*