Bird-Eating Centipedes of Phillip Island: Data Play

Instructor Background

From *The Conversation*'s article *Giant bird-eating centipedes exist — and they're surprisingly important for their ecosystem,* we learn about the centipede (*Cormocephalus coynei*) on tiny Phillip Island. On Phillip Island, part of the South Pacific's Norfolk Island group, the centipede (*Cormocephalus coynei*) population can kill and eat up to 3,700 seabird chicks each year. As large marine predators, seabirds usually sit at the top of the food chain. But according to the new study, published in The American Naturalist, this isn't always the case. The study shows how large, predatory arthropods can play an important role in the food webs of island ecosystems.

The data tables below have been excerpted from the article *Arthropod Predation of Vertebrates Structures Trophic Dynamics in Island Ecosystems* in the journal *The American Naturalist.* The data tables show both proportions of prey strikes, successful strikes, and feeding events by the centipedes and what proportion of their diet comes from each prey.

In this activity, students are asked to use the employ the I^2 strategy for analyzing data from BSCS to both figures. Students will then answer scientific connection questions using the data tables.

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Student Worksheet

Part 1: Initial Data Analysis of Table 1

Directions: Use the I^2 strategy to analyze "Table 1. Proportion of prey strikes, successful strikes, and feeding events by Phillip Island centipedes"

- **Identify**: What do you see? Annotate what you see in the figure/data set. Mark and describe at least three observations.
- **Interpret**: What does the data mean or what "could" the data mean? Annotate the trends you see occurring or compare/contrast data points to explain similarities and differences.
- **Caption**: Use all your observations and interpretations to write your own caption for the figure.

Table 1: Proportion of prey strikes, successful strikes, and feeding events by Phillip Island centipedes

Prey class, species	Strikes (%)	Successful strikes (%)	Feeding (%)
Insecta:			
Ant sp.	6.3	100	9.5
Crickets (*Dictyonemobius pacificus, Dictyonemobius lateralis, Nesitathra phillipensis*)	65.6	19	28.6
Beetle sp.	0	0	4.8
Moth sp.	0	0	4.8
Arachnida:			
Spider sp.	0	0	4.8
Diplopoda:			
Oxidus gracilis	3.1	100	9.5
Chilopoda:			
Cormocephalus coynei	3.1	0	4.8
Osteichthyes:			
Engraulis australis, fish sp.	0	0	19
Reptilia:			
Christinus guentheri	15.6	0	4.8
Aves:			
Anous minutus	0	0	4.8
Pterodroma nigripennis	6.3	50	0

Note: Strikes are defined as the percentage of the total number ($n = 32$) of strikes accounted for by strikes at that prey taxon. Successful strikes are the percentage of those strikes that resulted in successful capture. Feeding is the percentage of the total number of feeding observations ($n = 21$) where a centipede was observed consuming a given prey taxon. Fish are deceased and discarded from tree-nesting seabirds.

Part 2: Scientific Connections of Table 1

Directions: Use Table 1 to answer the questions below.

1. Why do you think the Ant sp. and *Oxidus gracilis (greenhouse millipede)* have 100% successful strikes?
2. Explain why some food sources (prey, species) have 0 strikes but do contribute to the feeding (%).
3. The *pterodroma nigripennis* (black-winged petrel) is cited with 6.3 strikes and 50% successful strike. Centipedes hunt on the forest floor, how do you think they are successfully striking any members of this bird species?

Part 3: Initial Data Analysis of Figure 4

Directions: Use the I^2 strategy to analyze Figure 4

- **Identify**: What do you see? Annotate what you see in the figure/data set. Mark and describe at least three observations.
- **Interpret**: What does the data mean or what "could" the data mean? Annotate the trends you see occurring or compare/contrast data points to explain similarities and differences.
- **Caption**: Use all your observations and interpretations to write your own caption for the figure.

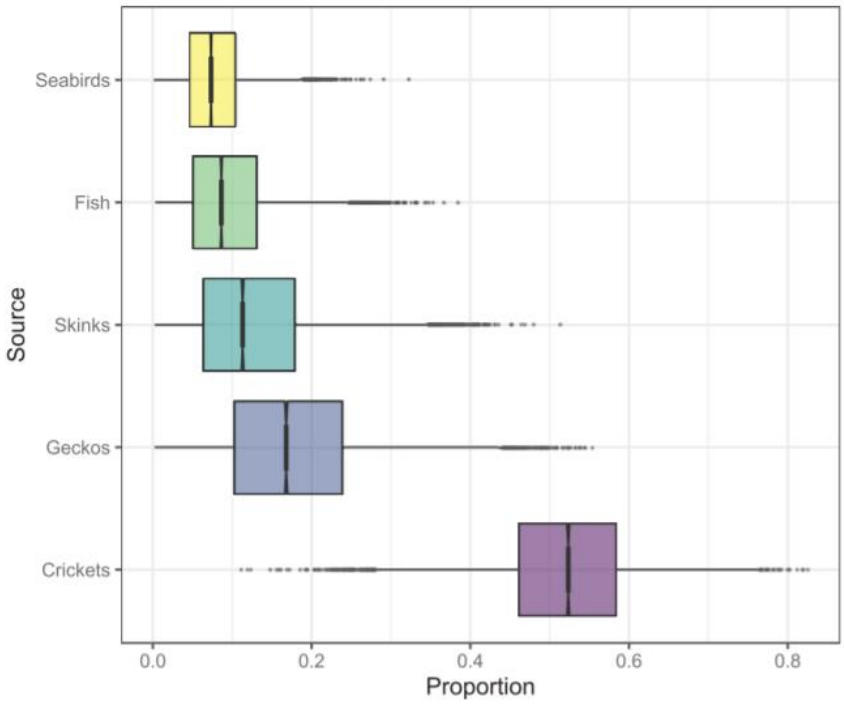

Figure 4: Estimated contribution of prey items in the diet of Phillip Island centipedes. Results present the relative proportions of dietary source contributions to centipede tissue predicted by the Bayesian dietary source mixing model (median, interquartile range, and maximum/minimum values of the posterior probability distribution).

Part 4: Scientific Connections of Figure 4

Directions: Use Table 1 to answer the questions below.

1. Which of these food source proportions surprises you the most? Why?
2. Centipedes hunt on the forest floor. How do you think they obtain fish as a food source?
3. Centipedes are a natural predator of the seabirds. Without the centipedes there could be an overpopulation of seabirds. What could that overpopulation do to the ecosystem? What populations might increase or decrease and how could that have a lasting impact on the island's biodiversity?

Part 5: Exploring the Ecological Niche

Directions: Read the excerpt from *The Conversation*'s article *Giant bird-eating centipedes exist — and they're surprisingly important for their ecosystem* to answer the questions below.

From the rates of predation we observed, we calculated that the Phillip Island centipede population can kill and eat between 2,109 and 3,724 petrel chicks each year. The black-winged petrels — of which there are up to 19,000 breeding pairs on the island — appear to be resilient to this level of predation.

And the predation of black-winged petrels by Phillip Island centipedes is an entirely natural predator-prey relationship. By preying on vertebrates, the centipedes trap nutrients brought from the ocean by seabirds and distribute them around the island.

In some sense, they've taken the place (or ecological niche) of predatory mammals, which are absent from the island.

1. As large marine predators, sea birds, like the black-winged petrel, are usually at the top of a food chain; but on Phillip Island the centipede is consuming their chicks. Despite this unusual food chain, the black-winged petrel has survived this level of predation. Explain why this change still maintains a healthy ecosystem.
2. In some situations, humans have introduced non-native species to an island in order to fill a niche. What do you think might be the consequences of introducing a species that is not native to the island?
3. Imagine if the centipedes did not fill this niche, do you support the idea of humans intervening to maintain this population? What might be the benefits and consequences of human impact on this island?