Achieve

SCIENCE TASK ANNOTATION

ANNOTATION KEY

EQUITY
Supporting a wide range of diverse students.

SCENARIOS
Information provided to elicit performances.

SEPs
Opportunities to demonstrate science and engineering practices.

DCIs
Opportunities to demonstrate understanding of disciplinary core ideas.

CCCs
Opportunities to demonstrate understanding of crosscutting concepts.

SENSE-MAKING
Opportunities for reasoning about phenomena and problems.

ASSESSMENT PURPOSE
Highlights how the task features connect to intended assessment use.

Overall: the task emphasizes sense-making with the SEPs and DCIs in a supported, scaffolded way. The task includes multiple ways (written descriptions, selected response, and numerical predictions) for students to make their thinking visible. While the DCI is required in at least one question, student understanding of the DCI is not extensively probed in this task.

SEPs | DCIs | SENSE-MAKING | EQUITY

GALÁPAGOS GROUND FINCHES

Between 1973 and 1978, the population of ground finches (a type of small bird) on the Galápagos Islands decreased.

This is a specific puzzling observation, which is not immediately explained—this allows for the opportunity for students to make sense of this using SEPs, CCCs, and DCIs. While it is inherently puzzling (why would the population decline), it is not made clear to students why this is something that needs to be explained, which might limit student engagement.

SCENARIOS

Scientists made observations of the population throughout that time period. They recorded and graphed differences in the distribution of traits over time.

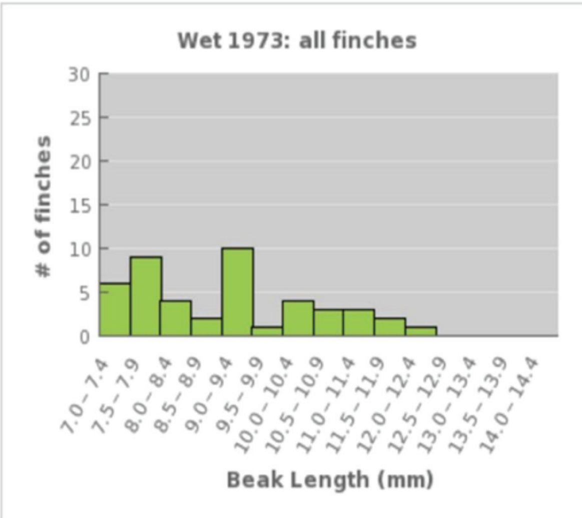
This phrase, in the context of the whole scenario, helps cue students toward which DCIs will be needed to address the scenario.

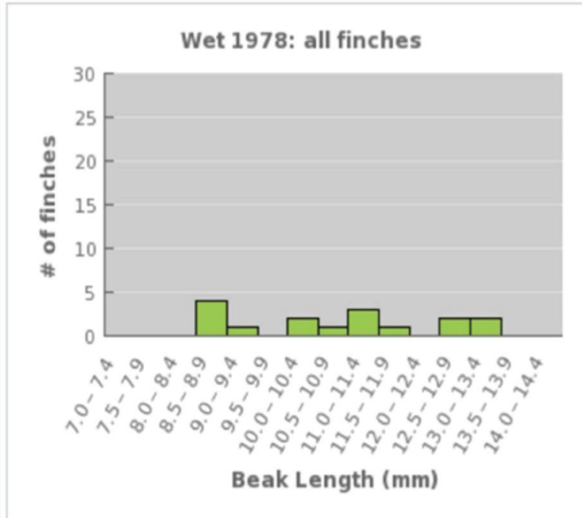
SCENARIOS | EQUITY

GALÁPAGOS GROUND FINCHES (CONTINUED)

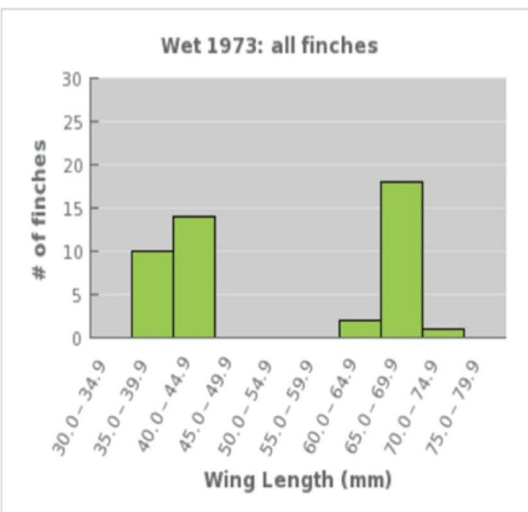
The two sets of graphs below come from the data they collected.

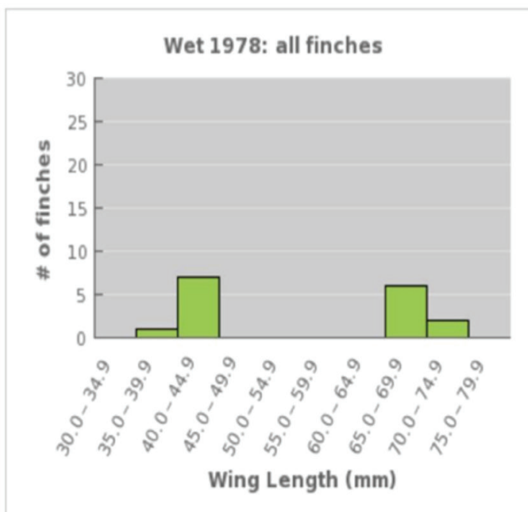
Beak Length for Ground Finches Observed in the Wet Seasons of 1973 and 1978





Wing Length for Ground Finches Observed in the Wet Seasons of 1973 and 1978





GALÁPAGOS GROUND FINCHES (CONTINUED)

Question 1: What patterns do you observe in Beak Length from 1973 to 1978?

To successfully answer questions 1 and 2, students have to consider two graphs that depict patterns that are not immediately straightforward (e.g., not just a dramatic visual increase or decrease). These questions help make sense of the data provided and scaffold the remainder of the task. Both questions ask students to "use graphical displays...to identify temporal relationships" (part of the 6-8 SEP #4 element).

Because students are explicitly told to look for patterns in the data, student responses are an ***example*** of "graphs...can be used to identify patterns in data" (6-8 CCC element), but because students didn't need to bring that understanding to the table to answer this question, this is not an assessment of the CCC.

SEPs | CCCs | SENSE-MAKING

Question 2: What patterns to you observe in Wing Length from 1973 to 1978?

Question 3: In the bottom pair of graphs about wing lengths, what is true about the total number of finches with shorter (35-45 mm) and longer (60-75 mm) wings over time?

(circle the correct answer)

A. Both shorter- and longer-winged finches decreased in number.

B. Longer-winged finches decreased in number.

C. Shorter-winged finches decreased in number.

D. The number of both kinds of finches stayed about the same.

This question overlaps with question 2— it might help students who were struggling with the open ended questions by providing an example of the kinds of patterns, and claims based on those patterns. It should be clear to those interpreting student responses that this question requires :

- different sense-making (since students could answer this by matching the choices to the graphs) and
- less sophisticated understanding of analyzing and interpreting data (reduced to graph reading rather than requiring analysis and interpretation).

In this question, it is difficult to make the case that the CCC is meaningfully present, as students do not need to understand patterns beyond increases and decreases.

SEPs | CCCs | SENSE-MAKING

GALÁPAGOS GROUND FINCHES (CONTINUED)

Question 4: Now look at all the graphs. Which trait, beak length or wing length, has changed the most in the population over time? Support your answer by describing the change in proportion of the trait over time.

Answering this question is more involved than simply comparing across charts, as students need to take into account not only absolute numbers but proportions of trait presence within the total population at both points in time. This is further evidence that students can analyze and interpret data using simple concepts related to statistics and probability. This is closer to the middle school elements of the SEPs than the high school elements because the mathematical thinking is quite simple, and students are still using their analysis to make sense of the data, rather than connecting it back to a scientific question or problem. However, this is clearly a progress-point toward HS-level SEPs.

This question elicits student understanding that patterns—relative similarities and differences in the observed data—can be used to communicate simple rates of change for natural phenomena (3-5 CCC element) and used as evidence (3-5 CCC element). While "patterns" language was not used in this question, this question appears to require simple understanding of how patterns can be used more effectively than questions 1–3.

SEPs CCCs SENSE-MAKING

Finch Habitat: Ground finches get their name because they get their food by gathering it from the ground. They eat small insects and the fruit and seeds of plants.

This additional information (both text and image) supports the driving phenomenon. It is introduced later in the task when relevant to student work, providing some additional support to students.

EQUITY

GALÁPAGOS GROUND FINCHES (CONTINUED)

Question 5: One of the changes that happened during the study period was that there was less food available for the finches. Using evidence from the study and your understanding of how traits change in finch populations over many generations, develop an explanation for how having less food may have caused beak length to change in the population between 1973 and 1978.

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This is the first question that requires DCI understanding in order to respond. Here, students have to use patterns in the data with their understanding of how environmental changes influence trait changes over generations, to provide an explanation.

It should be noted that it would be a stronger task if students were given information about both the amount of food available AND the types of food available—while less food would lead to a decline in the finch population overall, it wouldn't necessarily lead to a shift in beak population unless the decreased availability of food was accompanied by a change in the type of food that was most available (i.e., food that smaller beaks could easily access was most impacted, etc).

With simple modifications, this task requires that students use their data interpretation along with reasoning grounded in an understanding of adaptation (part of MS.LS.4C) to make sense of how having less food may have caused beak length to change.

SEPs | DCIs | SENSE-MAKING

GALÁPAGOS GROUND FINCHES (CONTINUED)

Question 6: What do you predict will be the proportion of birds with beaks that are 11mm or longer in another five years, if the environmental conditions stayed the same?

Use mathematics to support your answer by first calculating the rate at which the proportions are changing.

With the rest of the task, this question is rather straightforward—it asks students to use their understanding of the rate at which the populations changed to extrapolate from the 2 given data points.

This builds on high MS-level SEP expectations toward HS-level expectations of mathematics and computational thinking. When students make this predictions, they must make use (implicitly) of a linear function to extrapolate the population of birds with long beaks —which builds on "Apply mathematical concepts and/or processes (such as ratio, rate, percent, basic operations, and simple algebra) to scientific and engineering questions and problems." (MS) toward applying "techniques of algebra and functions to represent and solve scientific and engineering problems." (HS).

SEPs

This requires math—not just mathematical thinking—to successfully respond. Interpretation of student responses should take this into account.

CONNECTION TO ASSESSMENT PURPOSE