The Evolution and Survival of the Galápagos Medium Ground Finch

A Carolina Essentials™ Activity

Student Worksheet

Overview

Evolution is a scientific theory that includes the processes of adaptation and natural selection. You may have heard the phrase "survival of the fittest." How do scientists determine what individuals are the fittest?

This activity is a data-driven analysis lesson that uses information collected in the late 1970s by Peter and Rosemary Grant of Princeton University. The Grants collected data on medium ground finches, *Geospiza fortis*, on Daphne Major, one of the Galápagos Islands. During 1977, a drought on Daphne Major resulted in a higher than normal mortality rate for the finches. The Grants investigated finch characteristics that may have contributed to the survival of the remaining birds.

You will use this data to construct frequency distribution graphs as evidence of the process of evolution, identifying those birds and the traits that make them better able to survive and reproduce during a drought period. A frequency distribution graph is usually a bar graph or histogram that displays the number of occurrences for a particular characteristic. In this case you will look at finch survival after the drought and finch beak depth and a second variable that you think may impact a finch's ability to survive drought.

Since you are testing the hypothesis that survival depends on beak depth, beak depth is the x-axis and frequency of survivors is on the y-axis. The same will apply to the variable of your choosing. Your data analysis will be used as evidence to explain the process of evolution.

Phenomenon

Below is a stamp commemorating Darwin and the Galápagos finches he observed. How does this represent and explain the theory of evolution?

SAFETY REQUIREMENTS

No PPE is required for the activity.

MATERIALS

Data Tables

Graphing supplies if you are graphing by hand (graph paper, colored pencils, ruler)

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Essential Question

What kind of evidence is necessary to explain the process of evolution?

Activity Objectives

1. Create frequency distribution graphs of finch survival after drought.
2. Use distribution graphs as evidence to explain which finches are better able to survive and reproduce during drought conditions and how this relates to the process of evolution.

Data and Observations

Individual Finch Survival and Mortality Measurements

Bird ID	Death Year	Beak Depth (mm)	Weight (g)	Wing (mm)	Beak Length (mm)
1	1977	8.30	14.50	67.00	9.20
2	1977	7.50	13.50	66.00	9.50
3	1977	8.00	16.44	64.19	9.93
4	1977	10.60	18.54	67.19	11.13
5	1977	11.20	17.44	70.19	12.13
6	1977	9.10	16.34	71.19	10.63
7	1977	9.50	15.74	67.19	9.93
8	1977	10.50	16.84	68.19	11.33
9	1977	8.40	15.54	68.19	9.93
10	1977	8.60	17.50	70.00	11.10
11	1977	9.20	15.00	67.00	10.80
12	1977	8.80	17.00	70.00	9.70
13	1977	8.50	15.00	66.00	10.60
14	1977	8.00	15.00	66.00	9.60
15	1977	9.70	15.00	67.00	10.50
16	1977	8.40	16.50	67.00	9.90
17	1977	7.90	13.00	64.00	9.60
18	1977	9.30	16.00	71.00	10.70
19	1977	7.70	13.50	65.00	9.30
20	1977	8.50	16.00	69.00	10.10
21	1977	8.20	14.00	65.00	9.70
22	1977	9.70	15.00	65.00	11.00
23	1977	10.30	19.00	70.00	11.00
24	1977	10.20	17.00	72.00	11.60
25	1977	8.90	15.00	68.00	10.50
26	1977	9.60	16.50	68.90	10.20
27	1977	7.85	14.75	64.20	9.70

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Data and Observations (continued)

Individual Finch Survival and Mortality Measurements (continued)

Bird ID	Death Year	Beak Depth (mm)	Weight (g)	Wing (mm)	Beak Length (mm)
28	1977	9.60	16.00	73.00	11.10
29	1977	9.80	17.00	68.00	11.10
30	1977	8.80	15.00	68.00	10.20
31	1977	9.00	16.00	68.00	10.80
32	1977	9.10	14.50	65.00	10.00
33	1977	9.20	17.00	69.00	11.10
34	1977	8.80	16.00	70.00	10.30
35	1977	9.20	17.00	70.00	11.10
36	1977	8.80	14.50	66.00	10.50
37	1977	9.40	15.50	67.00	11.00
38	1977	8.30	14.50	67.00	10.00
39	1977	8.40	15.50	66.00	10.30
40	1977	10.20	16.50	70.00	11.70
41	1977	9.30	14.00	66.00	10.20
42	1977	10.20	15.50	71.00	10.90
43	1977	10.50	16.50	69.00	11.90
44	1977	9.00	14.00	66.00	10.20
45	1977	9.80	16.00	66.00	10.50
46	1977	9.30	14.00	65.00	10.50
47	1977	7.60	15.50	67.00	9.80
48	1977	10.50	18.50	70.00	11.80
49	1977	9.70	17.00	72.00	11.00
50	1977	8.60	14.00	66.00	10.30
51	1978	9.80	18.00	71.00	11.50
52	1978	8.50	14.00	67.00	10.20
53	1978	10.30	18.00	70.00	12.10
54	1978	9.90	17.50	68.00	11.60
55	1978	8.80	15.00	67.00	10.30
56	1978	10.10	18.00	72.00	11.40
57	1978	8.20	14.50	67.00	8.70
58	1978	8.00	15.00	65.00	9.90
59	1978	8.90	14.50	65.00	10.20
60	1978	9.10	15.00	66.00	10.30
61	1978	9.80	16.24	68.19	11.43

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Data and Observations (continued)

Individual Finch Survival and Mortality Measurements (continued)

Bird ID	Death Year	Beak Depth (mm)	Weight (g)	Wing (mm)	Beak Length (mm)
62	1978	10.10	17.34	70.19	11.93
63	1978	8.55	17.09	68.19	11.03
64	1978	9.30	17.64	72.19	10.63
65	1978	10.00	17.24	71.19	10.83
66	1978	10.70	18.04	72.19	11.23
67	1978	9.10	15.84	68.19	11.23
68	1978	8.80	15.24	65.19	10.23
69	1978	10.40	16.14	66.19	11.63
70	1978	10.70	20.19	72.69	12.23
71	1978	9.15	16.24	67.69	11.03
72	1978	11.20	21.24	72.19	11.13
73	1978	10.50	17.44	72.19	10.93
74	1978	9.70	16.94	70.19	11.03
75	1978	8.90	14.74	65.19	10.23
76	1978	10.10	17.34	69.19	11.33
77	1978	8.90	15.54	68.19	10.03
78	1979	9.60	19.00	70.00	10.70
79	1979	8.50	15.40	66.00	10.00
80	1979	10.08	16.34	68.01	12.43
81	1979	9.45	15.41	72.94	11.09
82	1979	8.31	15.37	67.95	9.63
83	1980	9.80	17.50	67.00	11.60
84	1980	9.70	16.50	71.00	11.30
85	1980	10.38	17.94	71.01	12.13
86	1980	10.61	21.22	71.45	12.03
87	1980	8.38	17.04	68.01	10.63
88	1980	10.78	17.74	71.01	11.83
89	1980	11.01	18.87	71.95	12.43
90	1980	10.68	18.44	74.01	12.73
91	1980	8.78	15.14	70.01	10.33
92	1980	10.28	17.84	71.01	11.03
93	1980	10.86	19.63	70.41	12.53
94	1981	11.21	20.82	70.45	12.13
95	1981	9.48	16.64	69.01	10.43

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Data and Observations (continued)

Individual Finch Survival and Mortality Measurements (continued)

Bird ID	Death Year	Beak Depth (mm)	Weight (g)	Wing (mm)	Beak Length (mm)
96	1981	9.86	18.07	70.95	11.23
97	1981	9.28	15.60	69.47	11.23
98	1982	9.31	16.67	69.45	10.53
99	1982	9.85	17.55	67.50	10.90
100	1982	10.00	15.00	69.00	10.50

Source: Grant, P. 1986. *Ecology and Evolution of Darwin's Finches*. Princeton University Press.

Activity Procedures

1. Prepare a survivability table by year and the number of finches that survived and died.

Year	Survivors	Non-Survivors
1976		
1977		
1978		
1979		
1980		
1981		
1982		

2. Construct a frequency distribution histogram of the finch survival data.

3. To the survival data, add the average beak depth to the table.

Year	Survivors	Non-Survivors	Avg Beak Depth of Survivors (mm)	Avg Beak Depth of Non-Survivors (mm)
1976				
1977				
1978				
1979				
1980				
1981				
1982				

4. Construct a frequency distribution histogram of beak depth and survival.

5. Select one of the other variables in the data table that you think may impact the survival of the finches during a drought and complete the same analysis as above. Generate a survivability data table and frequency distribution histogram.

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Analysis and Discussion

1. Knowing the drought occurred in 1977, interpret the frequency distribution histogram of survival data.

2. Knowing the drought occurred in 1977, interpret the frequency distribution histogram of beak depth and survival data.

3. Using your frequency distribution histograms as evidence, make a claim about the evolutionary trend in beak depth.

4. Using your frequency distribution histograms as evidence, make a claim about the evolutionary trend and adaptations in the medium ground finches that make those birds better able to survive and reproduce during a drought period.

5. Assuming there are no droughts, predict the average depth of finch beaks. Use your data to justify your prediction.