Name: _____ Date: _____

Period: _____ **AP Environmental Science**

El Niño & Darwin's Finches- Graphing & Analysis

Graphing- Part 1

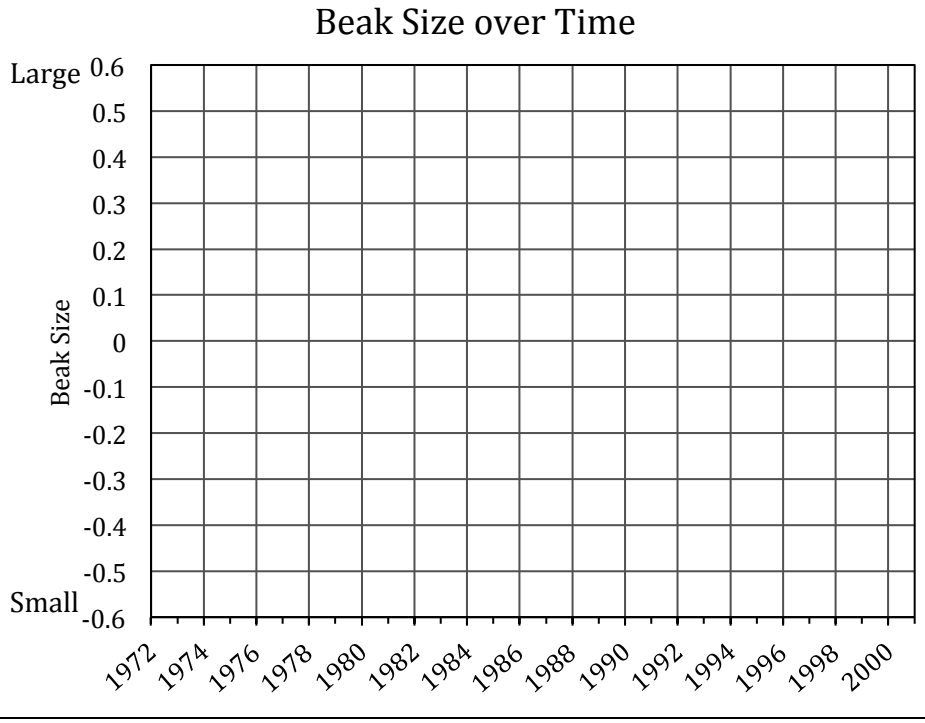
Year	Beak Size
1972	0.29
1973	-0.04
1974	-0.06
1975	-0.30
1976	-0.23
1977	No Data
1978	0.35
1979	0.40
1980	0.45
1981	0.38
1982	0.42
1983	0.38
1984	0.30
1985	0.27
1986	0.11
1987	0.02
1988	0.01
1989	0.00
1990	-0.02
1991	-0.08
1992	-0.10
1993	-0.10
1994	-0.09
1995	-0.20
1996	-0.13
1997	-0.15
1998	-0.02
1999	0.04
2000	-0.12
2001	-0.12

The table to the left presents beak size changes over time for G. fortis.

Beak size is a composite measurement & dimensionless quantity (no units), which combines measurements of beak width, depth, and length, as defined by researchers studying the birds in the Galapagos. This quantity is derived from a Principle Component Analysis, which statistically compares relative variation among different measurements using different units. Therefore, no units are present, but think of it as an overall beak size measurement.

Data Adapted from Grant, P. R., & Grant, B. R. (2002). Unpredictable Evolution in a 30-Year Study of Darwin's Finches. Science, (5568). 707.

DIRECTIONS: Plot beak size over time



Graphing- Part 2

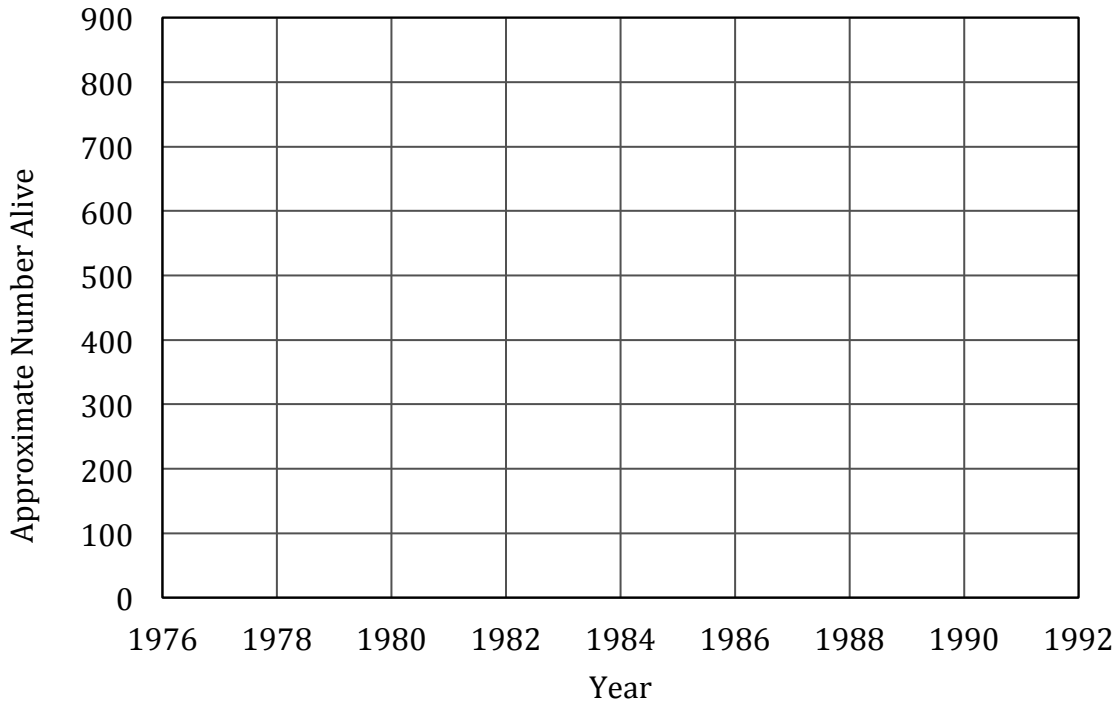
Year	*G. fortis*
1976	890
1977	400
1978	190
1979	270
1980	275
1981	230
1982	350
1983	280
1984	700

Year	*G. fortis*
1985	600
1986	295
1987	250
1988	880
1989	620
1990	450
1991	320
1992	710

The table to the left presents the approximate numbers of *Geospiza fortis* alive on Daphne Island in January of each year. This data provides insight into population and mortality.

Data Adapted from Grant, P. R., & Grant, B. R. (2006). Evolution of Character Displacement in Darwin's Finches. Science, (5784). 224.

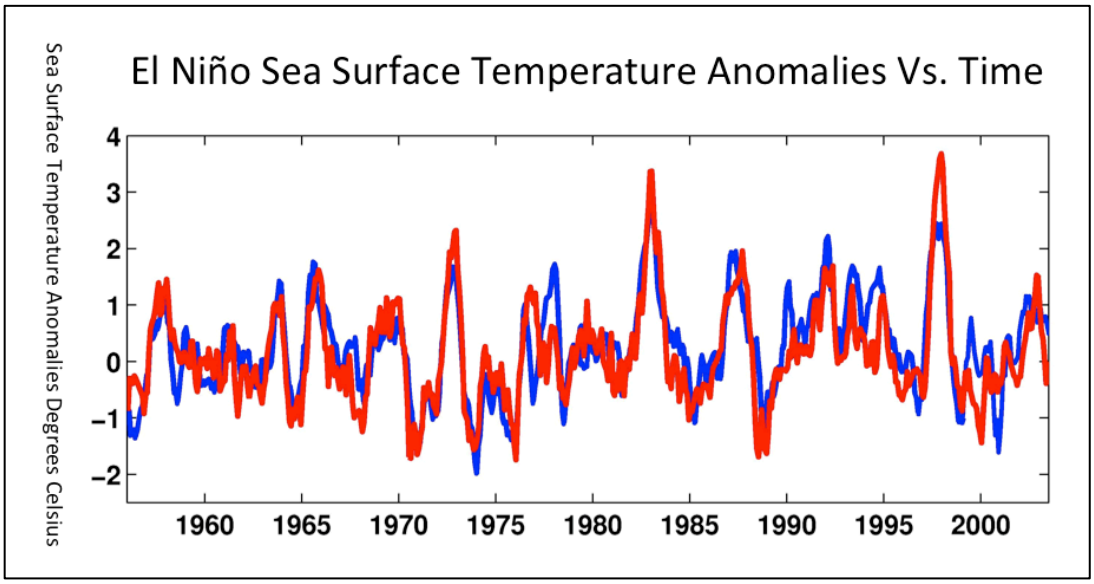
DIRECTIONS: Plot the number alive over time



Analysis- Part 1: Analyze the following graph

El Niño Sea Surface Temperature Anomalies Vs. Time

- Non El Niño periods are characterized by low sea surface temperature anomalies.
- El Niño periods are thus characterized by high sea surface temperature anomalies.



Graph Source: Cane, M. (2004). The evolution of El Nino, past and future. Earth And Planetary Science Letters, 230(3-4), 227-240.

Analysis- Part 2: Inference Questions

Refer to both the data shown on the graphs and the information in the background information to answer the following questions.

1. Citing data from the graphs, and the background information, explain the climatic and ecological conditions on the Galápagos Island of Daphne major from 1976 – 1982.

2. Describe any observable trends in the data during the 1976 – 1982 period in terms of beak size, appoximate number alive, and El Niño sea surface temperature anomalies. Explain the role that environmental conditions and natural selection played in this trend.

3. Citing data from the graphs, and the background information, explain the climatic and ecological conditions on the Galápagos Island of Daphne major from 1982 – 1984.

4. Describe any observable trends in the data during the 1982 – 1984 period in terms of beak size, appoximate number alive, and El Niño sea surface temperature anomalies. Explain the role that environmental conditions and natural selection played in this trend.

5. Did the trend that you observed from 1982 to 1984 continue beyond that timeframe? If so, why?

Conclusion

6. Explain how the Grant's research, specifically the data that they collected, provides modern evidence to support the theories of natural selection and evolution.