Lesson 12 - Genetic Variation in a Species

Purpose - *Analyze shifts in numerical distribution of traits and use these shifts as evidence to support explanations.* **Adapted from [NextGen Storylines] by Paul Andersen**

Warm up - Explain an example of how human structures and design has impacted animal behavior in nature.

Example - City lights have caused sea turtles born on a beach to walk toward the city and get killed on roads due to their instinct to follow the light. Before city lights, they used to go toward the ocean reflecting moonlight

Explain - Today we will discuss bird wing measurements. Here is how that is done.
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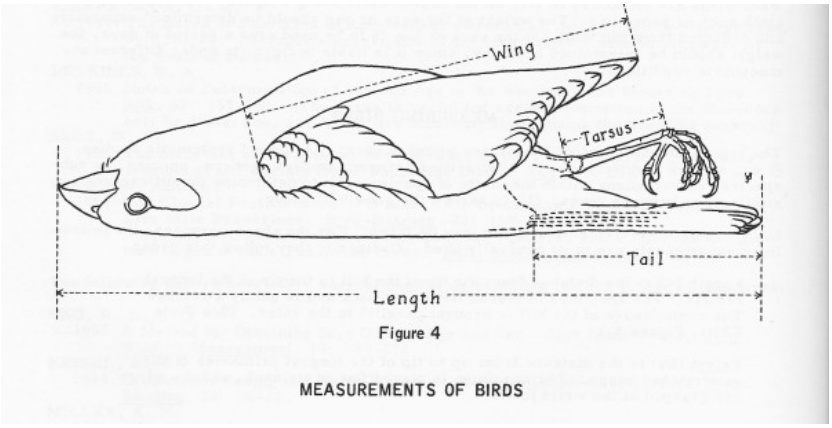


Figure 4

MEASUREMENTS OF BIRDS

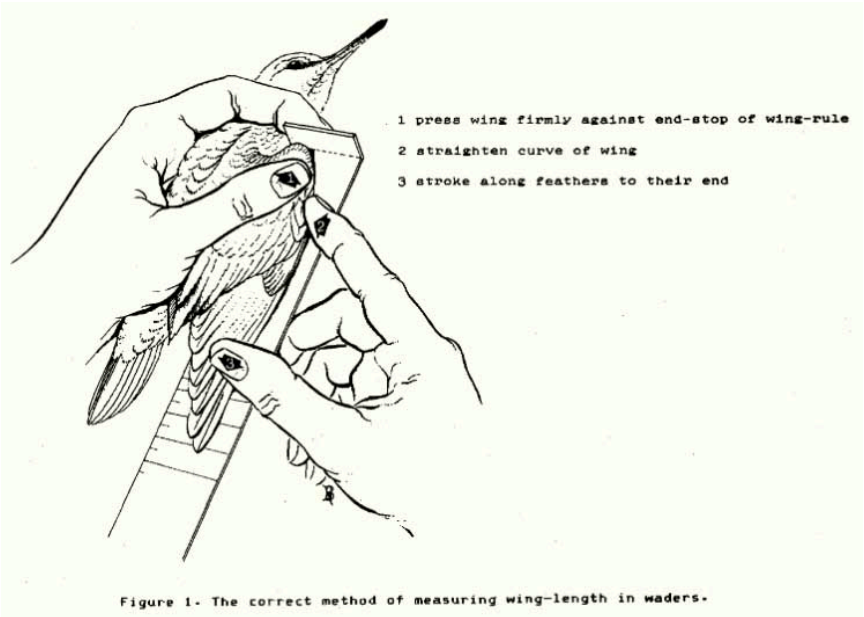
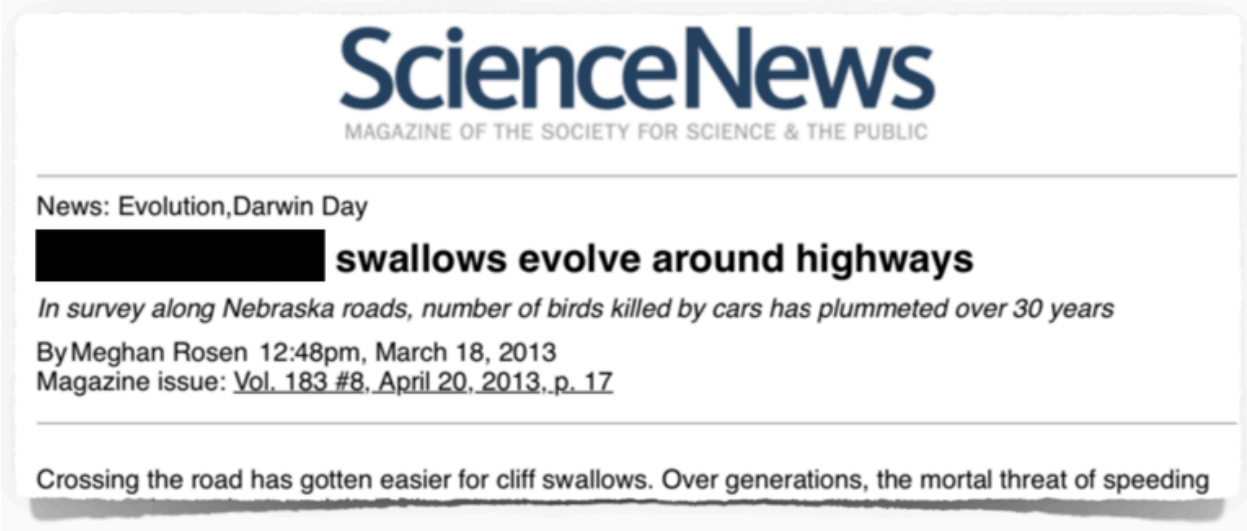


Figure 1. The correct method of measuring wing-length in waders.

WRITE ALL ANSWERS IN YOUR NOTEBOOK



ScienceNews

MAGAZINE OF THE SOCIETY FOR SCIENCE & THE PUBLIC

News: Evolution,Darwin Day

[redacted] swallows evolve around highways

In survey along Nebraska roads, number of birds killed by cars has plummeted over 30 years

By Meghan Rosen 12:48pm, March 18, 2013
Magazine issue: Vol. 183 #8, April 20, 2013, p. 17

Crossing the road has gotten easier for cliff swallows. Over generations, the mortal threat of speeding

An estimated 80 million birds are killed by colliding with vehicles on U. S. roads each year. In the 1970's along the I-80 highway in Keith County, Nebraska, drivers started noticing large numbers of dead swallows on the road. This led to a 45-year long study on swallow roadkill to figure out why this was happening.

Cliff Swallows traditionally built their nests on vertical cliff faces. However, with the expansion of roads, they have adopted many bridges, overpasses, and culverts as their colonial nesting sites. Their nests are grey or brown with openings at one end. Cliff Swallows zoom around in complicated aerial patterns to catch insects for food.

Image source: http://www.cell.com/cms/attachment/2021743115/2041577164/gr1_lrg.jpg
Source of data: Brown, C. R., & Brown, M. B. (2013). Where has all the road kill gone? Current Biology, 23(6), 233-234.

According to an article published in 2013 the researchers described how, “over the last 30 years, the number of cliff swallows killed along roads in southwestern Nebraska has plunged, and the birds’ average wing length has [redacted]”

The Cause

The table below shows some disadvantages and advantages of shorter and longer wings for bird flight.

Longer wings	Shorter wings
• Require less energy to use because there's less drag • Harder to change directions quickly, turning is slow • Take off speed is slow	• Require more energy to use • Easier to change direction quickly • Allow birds to take off quickly

Consider that the cliff swallows who live under highway bridges might need to get food from the road.

1. Do you think birds with longer wings or shorter wings are more likely to have an advantage that allows them to survive better in this new environment?

Explain your reasoning.

The Evidence

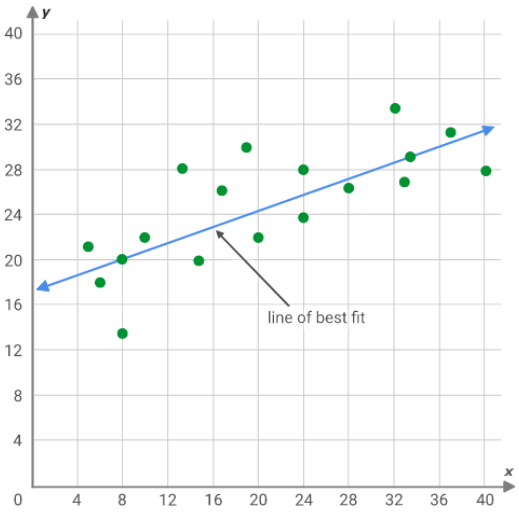
To explore a possible cause we will examine the evidence researchers have collected over the last 30 years. The following table includes the average wing length of birds that were collected from the population at large and those that were killed by cars.

Figure 1: Data collected on Swallow Wing Length
Google Spreadsheet of Data

Year	Average Wing Length (mm) **Population at large**	Average Wing Length (mm) **Roadkill**
1986	109.5	108.7
1987	108.5	108.7
1988	108.7	108.6
1989	108.3	108.2
1990	107.9	108.8
1992	107.8	109.1
1998	106.3	109.8
2000	107.2	109.8
2001	106.9	109.2
2002	107.4	110.0
2003	107.2	109.3
2004	107.0	109.1
2005	108.3	109.1
2006	107.9	110.0
2007	107.0	110.1
2010	106.4	111.0

2. Create a Graph. Organize the data above into a scatter plot (example). Use 2 symbols to plot each set of data. Your graph should show the **pattern** of distribution of genetic traits over time. After you plot your data, draw a **line of best fit** (see example below) for the living **population** AND a second line of best fit for the **roadkill**.

Draw this in your notebook



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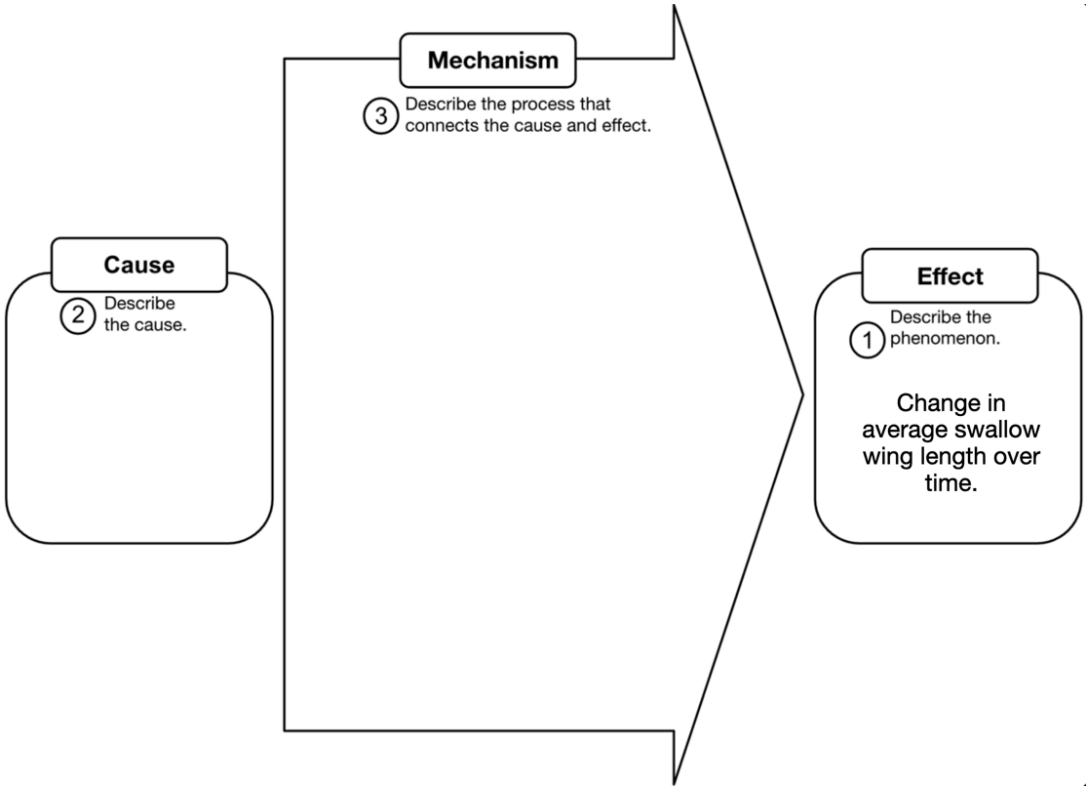
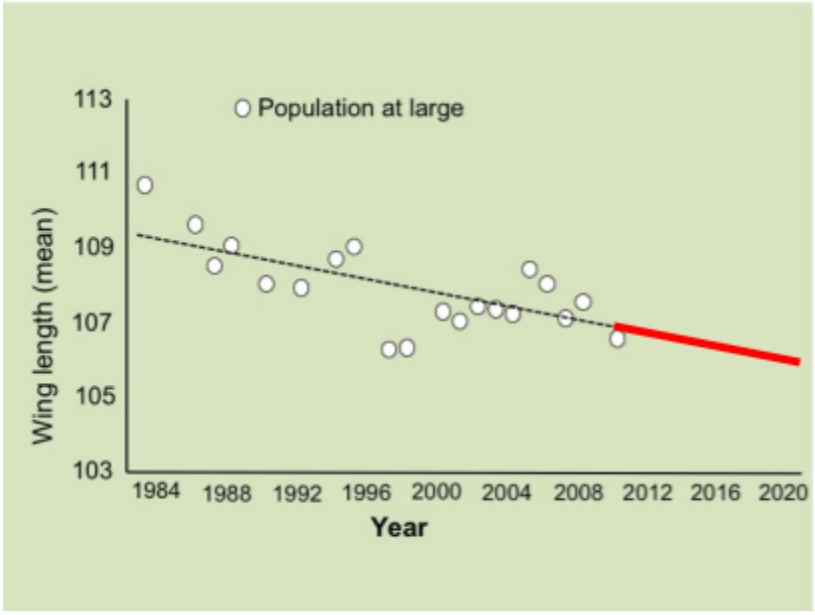
3. How would you write the title of this article to reflect changes in the swallow population?

_____ **swallows evolve around highways.**
Explain your choice -

4. Use the graphic organizer below to explain the cause/mechanism of change in the average swallow wing length over time. Draw this in your notebook and fill in the details.



5. Extrapolate (making a prediction beyond your data). Use your line of best fit to draw a NEW dot on your scatter plot graph to indicate what you predict the average wing length will be in 2020.



See the red line. That is "extrapolating" (showing a possible trend beyond the data collected). We could estimate the result in 2020, even though we don't have that data.

6. How did you estimate where to place the dot? What do you assume was changing or staying the same in the future?

7. What are the possible limits of using a technique like “extrapolation” to make predictions in this example of bird wings?

8. Explain one solution you might have to this situation of having birds killed by cars.

When finished, check StudentVUE for any missing work or low grades. Use this time to take care of any work. If you are all caught up, work on something else quietly at your seat.

Watch - Verify your thoughts - Humans are speeding up evolution

Discuss - Changes highlighted today are an idea for our next lesson. How might a species change/adapt and therefore evolve due to climate change?