

DATA *Nugget*

Deadly windows

Featured scientist: Natasha Hagemeyer from Old Dominion University

Research Background:

Glass makes for a great windowpane because you can see right through it! However, the fact that windows are see-through makes them very dangerous for birds. Have you ever accidentally run into a glass door, or been confused by a tall mirror in a restaurant? Just like people, birds can mistake a see-through window or a mirrored pane for an opening to fly through or a place to get food, and will accidentally fly into them.

These **window collisions**

can hurt the bird, or even kill it. Window collisions kill nearly 1 billion birds every year!

Urban areas, with lots of houses and stores, have a lot of windows. **Resident birds** that live in the area may get to know these buildings well, and may learn to avoid the windows. However, not all the birds in an area live there year-round. There are also **migrant birds** that fly through urban areas during their fall migrations. They will use gardens and parks in urban areas to rest along their journeys to their winter southern homes. During the fall migration, people have noticed that it seems like more birds fly into windows. This may be because migrant birds are not familiar with the local buildings. While looking for food and places to sleep, migrant birds might have more trouble identifying windows and fly into them more often. However, it could also be that there are simply more window collisions in the fall because there are more birds in the area when migrant and resident birds co-occur in urban areas.

Natasha was visiting a friend who worked at a zoo when he told her about a problem they were having. For a few weeks in the fall, they would find dead birds under the



Researchers identify the species of each bird caught in one of the nets used in the study. They then place a metal bracelet on one leg so they will know if they catch the same bird again.



Researcher identifying a yellow-rumped warbler, one of the birds captured in the net as part of the study.

windows, more than they would during the rest of the year. He wanted to figure out a way to prevent birds from hitting the exhibit windows. Natasha became interested in learning whether migrant birds were more likely to fly into windows than resident birds, or if the number of window collisions only increase in the fall because there are lots of birds around. To do this she would have to count the total number of birds in the area, and also the total number of birds that were killed in window collisions. To count the total number of birds in the area, Natasha hung nets that were about the same height as windows. When the birds got caught in the nets, Natasha could count and identify them. This data could then be used to calculate the proportion of migrants and residents flying at window-height. She put ten nets up once a week for four hours, over the course of 3 months, and checked them every 15 minutes for any birds who got caught.

Then, she also checked under the windows in the same area to see what birds were killed from window collisions. She checked the windows every morning and evening for the three months of the study. Different species of bird are migratory or resident in the area where Natasha did her study. Each bird caught in nets was examined to identify it to species using its feathers, which would tell us whether the bird was a migrant or a resident. The same was done for birds found dead below windows.

If window collisions are really more dangerous for migrants, she expected to see a higher proportion of migrants would fly into windows than were caught in the nets. But, if window collisions were in the same proportion as the birds caught in the nets, she would know that windows were just as dangerous for resident birds as for migrants.

Scientific Question: Do migrant birds collide with windows more frequently than expected by their population?

Check for Understanding: After reading the Research Background, students should be able to

- describe why windows and mirrored surfaces are so dangerous for birds.
- describe the difference between resident and migrant birds, and why these two types of birds may collide with windows at different rates.
- describe why Natasha had to measure both the total number of birds in the area, as well as how many birds collided with windows.

What is the hypothesis? Find the two hypotheses in the Research Background and underline them. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies. Having two alternative hypotheses means that more than one mechanism may explain a given observation. Experimentation can determine if one, both, or neither hypotheses are supported.

Scientific Data:

Use the data below to answer the scientific question:

Teacher Note: To complete the following tables, students will have to do several calculations. First, they will have to add up the total number of birds that were caught in nets, and the total number of birds that died from window collisions. For example:

Table 1: 23 migrants + 1 resident = 24 total collisions with windows

Those values can then be used to help complete the second table where students will have to calculate proportions. For example:

Table 2: 23 out of 24 birds that collided with windows were migrants
 $= 23/24 = 0.958$

Counts	Resident	Migrant	Total
Netted	50	129	179
Window Collision	1	23	24

Proportions	Resident	Migrant
Netted	0.279	0.721
Window Collision	0.042	0.958

What data will you graph to answer the question?

Independent variable: Bird type (resident, migrant)

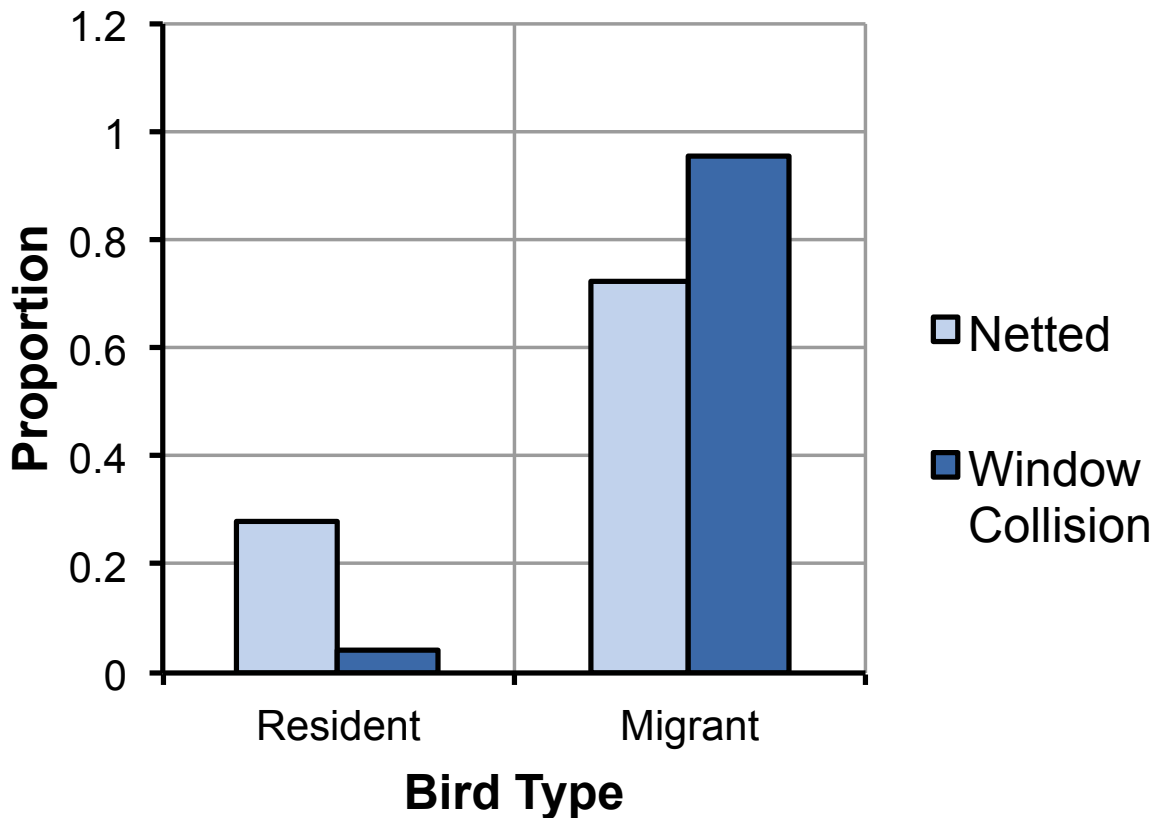
Dependent variables: Proportion caught in nets (netted),
 proportion collided with windows (window collision)

Draw your graph below: Identify any changes, trends, or differences you see in your graph. Draw arrows pointing out what you see, and write one sentence describing what you see next to each arrow.

Teacher Note: Students can become overwhelmed when they try to interpret graphs, figures, or data tables. The Identify and Interpret (I²) strategy, developed by BSCS, is a way to help students make sense of the information by breaking it down into smaller parts. In the I² strategy, students first *identify* changes, trends, or differences. They draw an arrow to each observation and then write a “What I see” comment. These comments should simply be what the student observes, such as a positive slope on a graph or increasing numbers in a data table. After students have made all their observations, they should *interpret* the meaning of their observations by writing a “What it means” comment for each.

Below are examples of student observations and interpretations for the data:

- I see that the bars for migrant birds are higher than the bars for resident birds.
 - This means that there are more migrant birds than resident birds.
- I see that the pattern is reversed for resident birds and migrant birds.
 - This means that more resident birds were caught in nets than collided with windows, but more migrant birds collided with windows than were caught in nets.



Interpret the data:

Make a claim that answers the scientific question.

Migrant birds collide with windows more frequently than expected by their population size.

What evidence was used to write your claim? Reference specific parts of the table or graph.

There are many more migrant birds in the area than there are resident birds (50 resident birds versus 129 migrant birds caught in the nets). We also see that many more migrant birds collided with windows than did resident birds (1 resident bird versus 23 migrant birds).

If we compare the proportion of migrant birds that collided with windows (0.958) with the proportion of migrant birds that were caught in the nets (0.720) we see that more migrant birds collided with windows than what we would expect based on their population size. Migrant birds make up 95.8% of window collisions while they only make up 72.0% of the population.

Explain your reasoning and why the evidence supports your claim. Connect the data back to the reasons why windows and mirrored surfaces may be so dangerous for birds.

The data follows the prediction that more migrant birds collide with windows than do resident birds. However, there are also more migrant birds in the area, compared to resident birds. Therefore, we have to compare the proportion of migrant birds that are caught in the nets, versus those that collide with windows, instead of comparing the raw number of collisions or catches in the nests.

A higher proportion of migrant birds fly into windows than are present in the area (netted), and a lower proportion of resident birds that fly into windows than are present. If both migrant and resident birds struck windows at rates exactly equal to their proportion in the population, we would expect that migrants would only make up 72% of the birds that were found dead under windows, not the 96% that Natasha found. There was also a lower proportion of resident birds that fly into windows than area present in the area. This suggests that window collisions are more dangerous for migrants than for residents.

Did the data support one, both, or either of Natasha's two alternative hypotheses? Use evidence to explain why or why not. If you feel the data was inconclusive, explain why.

The data supports just one of the two alternative hypotheses. It supports the hypothesis that migrant birds collide with windows more at a higher frequency than do resident birds that may know urban areas better and therefore be able to avoid windows.

Teacher Note: There are two alternative hypotheses that may explain the increase in bird window collisions in the fall. These two hypotheses are: (1) Migrant and resident birds are at equal risk of window collisions, but there are more window collisions in the fall because more birds are in the area at that time. (2) Migrant birds are not familiar with the locations of windows in urban areas and are at a greater risk for window collisions. You could consider hypothesis (1) the "null" hypothesis, which would be supported if there were no difference between migrant and native birds. If both types of birds collide with windows at the same proportions as their population sizes then the null hypothesis would be supported.

Your next steps as a scientist: Science is an ongoing process. What new question do you think should be investigated? What future data should be collected to answer your question?

While this study shows a correlation between migrant status and window collisions, it doesn't answer the question of why. One way to test why could be to look at migrants at their summer homes, during migration, and at their winter homes. Migrant birds might be familiar with both their resident locations (where they breed in the summer, and live in the winter) and thus not hit windows, but during migration they encounter new places that they might not be familiar with, and are more likely to accidentally fly into glass. If different species are just better than others at seeing windows, however, then the migratory species that hit windows more often should have the same rate of striking windows during migration as they do at their two homes. Natasha and her colleagues are currently doing this by working with other scientists in different locations along the bird migration routes, and seeing if migrating birds are more likely to hit windows during their migration than at their summer homes.

Or, it might be possible to see if birds can learn to recognize windows over time, perhaps by setting up an experiment where birds are kept in an aviary with windows. Birds such as zebra finches can live in a cage very happily, and like to fly, so it would be possible to build a long cage with a glass divider in the middle. If birds can learn where windows are, then we would expect that a bird might fly into the glass divider once or

twice, but after that would learn to avoid it, even if there was something attractive on the other side, like perches or food. Since birds are capable of learning the locations of other things, like where food can be found (like a bird feeder or a bush with berries), and avoid other “invisible” hazards like areas with a lot of predators, it makes sense that they might be able to learn to avoid windows, even if they can’t see them very well.

Some additional questions include:

- Are younger birds more likely to strike windows than older birds? (Young birds might not have learned about windows yet.)
- Do different species collide with windows more often? Which species are more or less likely to fly into windows?

Additional teacher resources related to this Data Nugget:

There is one scientific paper associated with the data in this Data Nugget:

Sabo, A.M., Hagemeyer, N.D.G., Lahey, A.S., and E.L. Walters. 2016. Local avian density influences risk of mortality from window strikes. PeerJ 4:e2170; DOI 10.7717/peerj.2170.

http://www.ericlwalters.org/Sabo_et_al_2016.pdf