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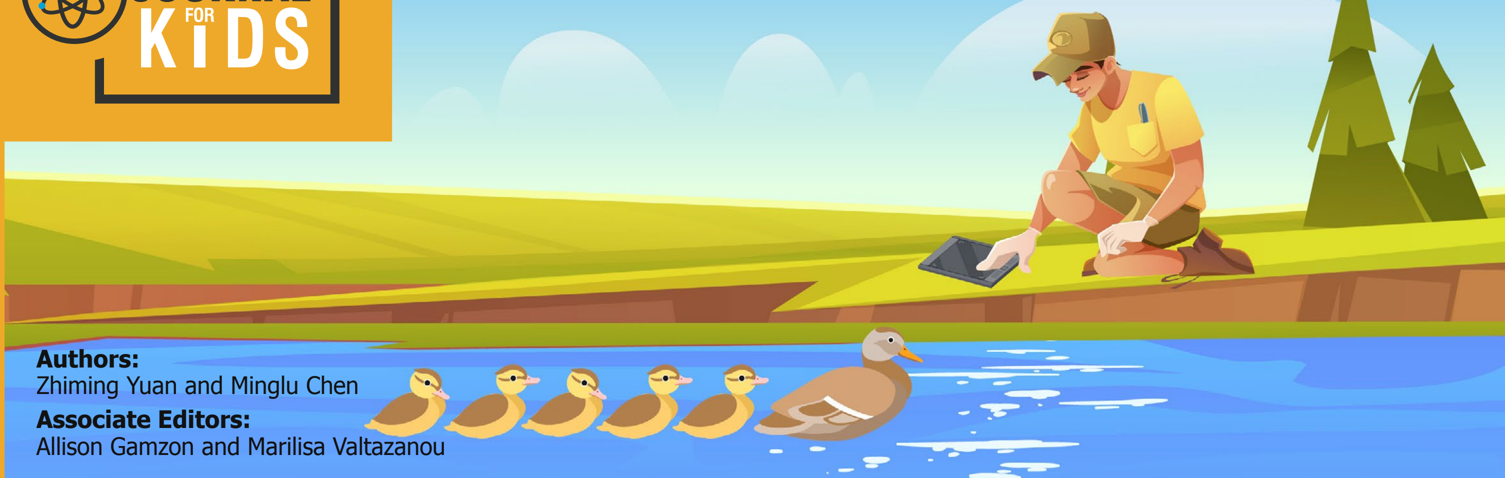
Why do ducklings swim in a line behind their mother?



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Abstract

LOWER READING LEVEL

Have you ever seen baby ducks or geese swimming in line behind their mother? They're so cute! But why do they do that? Is it to keep everyone together? Or is it to make swimming easier for the babies? We wanted to figure out how swimming in a line benefits ducklings. We thought that swimming in a line behind the mother saves energy. Our research made us realize that if the ducklings try to swim in front or to the side of their mother, they need to use more energy. But if they swim behind her, they need less energy. We also learned that it is only easier at certain spots behind the mother. That's because at these spots the waves created by the mother interact with the waves created by the ducklings. The resulting wave pushes the ducklings forward, saving lots of energy!

Introduction

We all know that being the line leader is an important job. When you are the line leader, you help keep your classmates organized. But being the line leader might be even more important for birds that swim, like geese and ducks. Scientists have always thought that water birds moved in a line to save energy. But no one knew how it worked.

We predicted that when ducks swim behind their mother, it lowers their **wave drag**. When an object moves through a **fluid** (like water or air), the air or water pushes against the object. We call this push **drag**. If you have ever been in a busy pool, then you know about wave drag. As people move in the water, they create waves. When you try to swim, these waves push against you, making it harder to swim.

To test our **hypothesis**, we created a computer program to calculate the wave drag for ducklings. We found the wave drag in front of, behind, and to the side of the mother. We also figured out why the mother changes the ducklings' wave drag.

A family of geese swimming with the baby geese in a line behind the mother goose.
Photo: Chris F

Methods

Our computer program calculated a number called C. This number described what happened to the amount of wave drag.

- If C was between 0 and 99, there was less wave drag.
- If C was less than 0, there was more wave drag.
- If C was 100 or greater, the wave drag changed into a force that pushes the duckling forward.

We made a few assumptions for our program. That means that for all calculations the following were true:

- Wave drag is the only type of drag on the ducks.
- No matter which spot they swim in, the ducks' size, shape, and feather type stayed the same.
- The ducks always move at the same speed.
- The ducks always stay in a line.

Results

We used our computer program to find C for three positions: in front of the mother, behind her, and to her side. We found that there are many spots with a high C behind the mother duck. These spots were at specific distances from the mother (Figure 1). We also learned that there aren't as many in front of her or to her side.

When we looked at the spots with a high C more closely, we noticed that they didn't have the same value (Table 1). C for the first two ducklings was greater than 100. C for all the other ducklings was 100.

Figure 1:
The ducklings swim in the lowest part of the new wave created by the mother and ducklings.

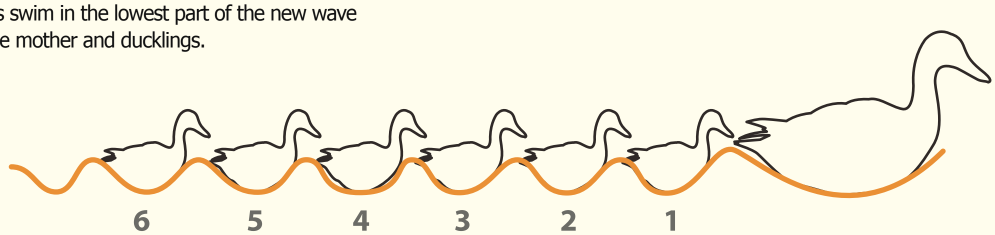

Table 1:
C for each duckling as they swim behind their mother.

DUCKLING	C
1	158
2	132
3	100
4	100
5	100
6	100

What is the lowest C value for a duckling?

Discussion

Our research proved that ducklings swim behind the mother because it is the best option. Our model showed only one spot in front with a very high C. That means most of the ducklings worked hard against wave drag. To the side, the mother's waves caused the ducklings to rotate. That means they worked harder to swim in the correct direction. Only swimming behind the mother made swimming easier for all the ducklings.

Why is it easier to swim when C is 100 or greater? At these spots, the ducklings **wave ride**. That means they get a push forward, so they don't have to use as much energy to swim. Why does that happen? We found that when the mother swam, she created waves behind her. So did the ducklings. When these waves meet, they create a new wave. Scientists call this **wave interference**. At spots with a high C, this caused the duckling to sit in the lowest point of the new wave. That means they moved without having to work against the drag!

The first two ducklings experienced more wave riding. That's because the mother's waves got smaller the farther away from her they moved. When her wave reached other ducklings, it wasn't big enough to push them forward.

So how did these ducklings get a boost from the waves? The ducklings at the front of the line passed the wave energy back to the other ducklings. That made it easier for their siblings to swim.

For wave riding and wave passing to work, the ducklings must swim at the same speed as their mother. They must also swim at the correct distance from her and the other ducklings. If they don't, they lose all the benefits of the line and must work hard to swim.

Conclusion

Understanding wave riding and wave passing in water birds like ducks and geese can help people. If boats traveled in a line, they could move using less energy. That means that we could save money and help the environment!

You can also reduce wave drag. When you swim in a pool, remember that your motion affects other people. Make sure to give them space. That way your waves won't increase their wave drag. Otherwise, it is harder for them to swim. And make sure that you have enough space, too! Then everyone can enjoy the water without using extra energy.

Glossary of Key Terms

Drag – a push on an object as it moves through a fluid, making it harder for the object to move.

Fluid – either a liquid or gas; something that can flow easily.

Hypothesis – what we think might happen in a situation, but need to investigate to see if we're right.

Wave drag – a type of drag that is related to waves.

Wave interference – when two waves meet and create a new wave.

Wave ride – what happens when the waves created by two objects meet. The new wave created pushes one of the objects forward.

Check your understanding

1. When swimming, do ducklings want to have a high wave drag or a low wave drag? Why?

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2. Why is swimming behind the mother duck the best option for the ducklings?

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3. Why do only the first two ducklings have a C greater than 100?

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4. What do the ducklings need to do to save energy while swimming?

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5. Drag forces determined the amount of energy used by the ducks for swimming. Can you think of another example of drag forces affecting the motion of an object?

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6. We proposed using the principles of wave riding and wave passing to make boats travel more efficiently. Do you think this idea should be explored? Explain your answer.

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