

**Angry Birds**Exploring Behavioral Trade-offs

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A KBS K-12 Partnership Activity

Have you wished you could clone yourself so you could do two things at once? Animals face the same challenge. Every animal has a limited amount of time and energy to perform its daily activities and every animal has to chose which activities to focus on. Different animal species handle these trade-off in different ways. Some animal species focus on producing lots of offspring, but then have little energy left to provide extensive care. Other animal species produce only a couple babies, but spend a lot of energy caring for them. Within a single species, individual animals will also adopt different strategies to solve the trade-offs they face every day. In this activity you will explore one such trade-off: should you spend your energy protecting the best place to live or spend it on making more offspring?

***The Challenge…***

Imagine yourself as a territorial bird that has just made your back to your summer habitat after a long spring migration. The clock is ticking and you must find a territory and raise offspring before the winter sets in.

1. *Hold the popsicle sticks so the colored end is covered. Each person draws a stick.*

Not all birds are the same. Some birds in the population have a trait that makes them highly aggressive and good at winning fights. Other birds have a trait for medium aggressiveness, and still others have a low aggression trait that makes them very bad at fighting.

1. *With the cards shuffled and face down, each person draws a strategy card. This should be kept secret until you are in a fight.*

Additionally, not all territories are the same. Some territories are in good locations with plenty of food that will allow you to produce 8 babies. Other territories are of poorer quality and will only allow you to produce 5 babies.

1. *If you drew a pink stick, go to one of the pink, high quality territories. If you drew a green stick, go to one of the green, low quality territories. If your stick doesn’t have a color you do not get a territory and start in the “floater” pool.*
2. *(optional) The instructor will hand out “offspring” to high and low quality territory holders. High quality birds get 8 and low quality birds get 5. These represent the babies you will have if you keep your current territory.*

The stage is set for a fight! There are not enough territories to go around. Which strategy will win the challenge to keep the best territories and raise the most young?

**Part A: The “Fight for Free” Game**

**Pre-question:**

1. Which aggression strategy do you think will produce the most babies at the end of the game? Why?

The “floaters”, the birds that didn’t get an initial territory, aren’t going to take that laying down. They will challenge the current territory holders and see if they can gain a spot in the population.

1. *Each person in the “floater” pool picks ONE territory owner to challenge. Reveal your strategy cards and follow the instructions to determine who wins the fight. If you won, you now stand in the territory square. If you lose, join the floater pool.*
2. *(optional) The instructor will redistribute the offspring giving 8 to new high quality territory birds, 5 to new low quality territory birds, and 0 to the floaters.*

There’s still time left in the season! The floaters try again to gain a spot in the breeding population.

1. *Once again, each floater picks ONE territory owner to challenge and uses the cards to determine the winner. Losers join the floater pool.*
2. *(optional) The instructor redistributes offspring.*
3. *Repeat this one more time.*
4. *(optional) Redistribute offspring for a final time.*

Time has now run out and there’s no more time left to gain a new territory. Territory owners now must raise their young. The more young you have, the more successful you were!

1. *If you ended on a high quality territory, you gain 8 offspring. If you ended on a low quality territory, you gain 5 offspring. If you were left in the floater pool, you produce no offspring. If using the optional offspring cards, this will be the number of card you’re holding.*
2. *Record the data for all the birds playing in Table 1 below.*

**Table 1:** Part A: The “Fight for Free” Game- Population Data:

|  |  |  |  |
| --- | --- | --- | --- |
| **Strategy** | **Number of Total Offspring** | **Number of People** | **Average Number of Offspring** |
| High |  |  |  |
| Medium |  |  |  |
| Low |  |  |  |

**Part B: The “Cost to Fighting” Game**

In reality fighting is often costly. Individuals may risk injury, may use up energy they could have used to raise offspring, and, on a more basic level, the time you spend fighting is time you can’t use for other activities. Now the rules have changed. Each time you are involved in a fight, this decreases the energy you have left to produce offspring. The more intensely you fight, the bigger the cost. High aggression individuals lose 2 offspring for every fight they have. Medium aggression individuals lose 1 offspring for every fight. Low aggression individuals spend so little energy trying to fight, they don’t lose any offspring.

**Pre-question:**

1. Do you think this game will be the same as the last game? Please explain.
2. *As before, each floater picks ONE territory owner to challenge and uses the cards to determine the winner. If you lose, join the floater pool. Additionally, any birds that were involved in a fight, either as the challenger or the one challenged, add a tally mark in the “Number of Fights You Had” column in table 2. If you were not involved in a fight this round, do not write any tally marks.*
3. *(optional) When handing out offspring, the instructor should ask each student how many fights they’ve had so far. Offspring are deducted from the number given by each territory based on the rule on the strategy card. For example, a high aggression bird on a high quality territory that had one fight gets only 6 offspring instead of 8.*
4. *Repeat this for a second round, keeping track of whether you had a fight.*
5. *Repeat this for a third round, keeping track of whether you had a fight.*

Once again, time has now run out and there’s no more time left to gain a new territory. The territory owners settle down to raise their young, only now some birds have lost a lot of energy fighting for territories and can no longer raise as many offspring.

1. *Using table 2 as a guide, calculate the number of offspring you produced. Once again, high quality territories have the capacity to produce 8 offspring and low quality territories have the capacity to produce 5 offspring. The number of offspring lost per fight is either 2, 1, or 0 depending on your card. If using the offspring cards, this should once again be the number of cards each student is holding.*
2. *Record the data for all the birds playing in the table 3 below.*

**Table 2-** The “Cost to Fighting” Game- Your data:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Your Strategy** | **Offspring from Final Territory**  **(8, 5, or 0)** | **# of Fights You Had** | **# of Offspring Lost from Fighting**  **(see card)** | **Your Final Offspring** |
|  |  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Strategy** | **Number of Total Offspring** | **Number of People** | **Average Number of Offspring** |
| High |  |  |  |
| Medium |  |  |  |
| Low |  |  |  |

**Table 3:** The “Cost to Fighting” Game- Population data:

How did the three aggression strategies fare in each of these conditions? In the graphs below, make a bar graph for the average number of offspring produced for each aggression strategy.

**Graph 1:** The “Fight for Free” Game

Low

Medium

High

**Aggression Strategy**

**Average**

**Number of**

**Offspring**

**Graph 2:** The “Cost of Fighting” Game

Low

Medium

High

**Aggression Strategy**

**Average**

**Number of**

**Offspring**

**Post Questions:**

How did the aggressive strategy affect reproductive success in part A with no fighting costs?

How did the type of territory affect reproductive success in part A?

Were all aggressive strategies equally effective at occupying the most favorable environments? Explain your answer.

How did the benefits of aggression change between the part A and part B? Why?

Animals in the natural world face a trade-off between spending energy defending territories and spending energy raising young. Based on this activity, which strategy do you think is most effective?