**Understanding Natural Selection**

**The concept of Fitness**

**Step #1: Problematizing Fitness**

Adapted from Evolution by Natural Selection

Below are descriptions of four male African lions. Examine the data and record your thinking about which lion biologists would consider the “fittest”. Be prepared to explain your thinking about which is the “fittest” lion.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | George | Dwayne | Spot | Tyrone |
| Age at death | 13 years | 16 years | 12 years | 10 years |
| # of cubs fathered | 19 | 25 | 20 | 20 |
| # of cubs surviving to adulthood | 15 | 14 | 14 | 19 |
| Size (length) | 10 feet | 8.5 feet | 9 feet | 9 feet |
| Other information | George drove away more male lions trying to take over his family group than the other males did. | Dwayne had the most lionesses in his family group. | A fire burned Spot’s home territory, and he moved his family group to a new area. | Tyrone’s family group included four lionesses. |

**Write down your thinking -**

Use the Talking Sticks Protocol to have a group conversation about which lion is fittest.

Talking Sticks

Each person places his or her pencil/pen in the center of the group.

* Take turns by making a comment about the reading by picking up your “talking stick” and making your comment while you hold it.
* One you are finished with your comment, set your “talking stick” in front of you and your are not allowed to comment again until all the other group members have had a turn (group members may pass their turn with the “talking stick”).
* After everyone in the group has had a chance to comment, repeat the process.

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**Step #2: Reading and processing information about the Fitness Concept**

**Summary Protocol**

1. In each group, one person is chosen to keep the group on-task and all participating.
2. Read one paragraph silently (leader makes sure all group members know where paragraphs start and end). Each person reads silently to themselves and only when all in the group are finished with paragraph under consideration does the group progress to the next step.
3. Group discusses the content of the paragraph. All group members should contribute.
4. Group comes to consensus about the main idea(s).
5. Talk about how to write the main idea(s).
6. Each group member writes down the main idea(s).
7. Repeat steps 2 - 6 for each paragraph of the reading.
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**Evolution by Natural Selection** (adapted from Biology, Miller and Levine, 2007)

Through observation Charles Darwin recognized in nature a process that operates in a manner similar to the way artificial selection worked on farms. Darwin called this process **natural selection** and explained its action in terms of several important observations.

Darwin observed that wild animals and plants showed variations just as domesticated animals and plants did. His field notebooks were filled with records of height, weight, claw size, tail length, and other characteristics among members of the same species. Darwin did not understand the reasons for these variations, but he realized that many of them were inherited.

Darwin observed that high birthrates and a shortage of life's necessities forced organisms into a constant “**struggle for existence**”, both against the environment and against each other. Plant stems grow tall in search of sunlight; plant roots go deep in the soil in search of water and nutrients. Animals compete for food and space in which to build nests and raise young. But who among all the contenders wins the struggle for existence?

Darwin knew that each individual differs from all the other members of that species. Sometimes the differences are easy to observe; sometimes differences are subtle. Individuals who characteristics are well suited to the environment survive. Individuals whose characteristics are not well suited to the environment either die or leave fewer offspring. This principle called Darwin called **survival of the fittest**.

##### Fitness: to survive and reproduce

Darwin was also impressed by the many different ways in which organisms survive and produce offspring. He noted that most animals and plants have body parts and behaviors that do certain things very well. The physical traits and behaviors that enable organisms to survive and reproduce in their environment give them what Darwin called **fitness**.

Darwin argued that fitness arises through a process called **adaptation**. Successful adaptations enable organisms to become better suited to their environment, better able to survive and reproduce. Darwin also used the word adaptation to describe any inherited characteristic that increases an animal’s or plant’s fitness for survival. Thus, the long neck and legs of a giraffe are adaptations that permit giraffes to feed on leaves of trees. With these adaptations, giraffes can eat leaves too high for most grazing animals to reach and thus are better able to survive and reproduce passing, their genes on to their young.

Each time an organism reproduces, it passes copies of its genes to its offspring. Thus, we can define evolutionary fitness as the success an organism has in passing on its genes to the next generation. And we can define an adaptation as any genetically controlled characteristic of an organism that increases its fitness.

**Step #3: Applying the Fitness Concept**

Review the original data on the lions in the light of what you learned from the dialogues you’ve had and the reading.

**Writing Prompt:**

You are a wildlife biologist working in Africa. Another biologist makes the statement that “George was the largest lion, so he had the best chance of fighting off enemies. George must have the most evolutionary fitness.” Write a letter to your colleague either agreeing or disagreeing with him. In your letter make sure you support your position with evidence from the data, from text sources, and from your thinking.

**Preparing to Write Your Letter**

Based on your thinking, dialogue, reading and what the writing prompt asks for, list below the most important arguments used to support claims for and against each lion.

|  |  |
| --- | --- |
|  | **Supporting Arguments or Claims** |
| Lion | Arguments For | Arguments Against |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |



**Guiding Questions-**

1. Fitness: “To Survive and Reproduce”

a. What was Darwin’s definition of fitness?

b. According to Darwin, how do organisms develop fitness?

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