1. CONTRIBUTOR'S NAME: TAMMY MILDENSTEIN

2. NAME OF INQUIRY: WHAT IS THIS BEAK FOR?

3. GOALS AND OBJECTIVES:

a. Inquiry Questions: How does beak form define beak function? How are beak differences adaptive for exploiting different food sources?

b. Ecological Theme(s): Adaptation; Food Specialists vs. Generalists

c. General Goal: To help students think about phonological adaptations in animals.

d. Specific Objectives: To give students some insight into bird beak adaptations, and the way these adaptations make them more efficient but also limit them in resource acquisition.

Experimental: students get practice making predictions, testing these predictions, and following up on why their predictions were or were not met. Students also practice designing their own data sheets.

Social: work as part of a team

Communication: oral presentations, written responses

e. Grade Level: 1st and 2nd combined and 4th grades.

f. Duration/Time Required: 1 ½ hours

→ Prep time: 30 minutes

→ Implementing Exercise During Class: 45 minutes

→ Assessment: 15 minutes

4. ECOLOGICAL AND SCIENCE CONTEXT: ADAPTATION IS A CENTRAL CONCEPT IN ECOLOGY, WHICH EXPLAINS HOW MANY ORGANISMS ARE CAPABLE OF LIVING TOGETHER IN A SINGLE ECOSYSTEM FITTING TIGHTLY TOGETHER LIKE A JIGSAW PUZZLE.

a. Background (for Teachers): Living organisms over time develop adaptations, which enable them to better live in their natural environments. Adaptations can be physiological or behavioral and have the effect of making the organism more efficient at exploiting resources, protecting themselves, and find mates in their habitat. This inquiry explores the idea of bird beaks as adaptive traits, which enable birds to more efficiently handle and eat the foods that the bird eats. These adaptations in the beaks' forms also limit what type of foods may be used by the birds. Adaptations in bird beak form are what help to separate birds into different classes each accessing different food types in an ecosystem. Bird beak difference allow for resource allocation on a very small scale, which enables many types of birds to live harmoniously in the same environment.

b. Background (to present to Students): There are many different types of birds in the world that we identify by where they live, how they look, and how they behave. One way in which birds are classified is by their beak types, since this is also related to what the birds eat and the ecological roles these birds play in their environments. Show the students pictures of seed eating birds like finches and cross bills, insect eating birds like flycatchers, burrowing insect eaters like woodpeckers, and fishing birds like herons, and discuss the relationship between bird beak types and the food these birds eat. This exercise is designed to give us all a chance to "have" different types of beaks and see what types of foods those beaks let us eat as well as what types of foods we cannot eat with the beaks.

5. MOTIVATION AND INCENTIVE FOR LEARNING:
This activity is best performed outside. For added motivation it lends itself well to making predictions about what types of "beak" will be best for the different types of "foods" that will be eaten, and then students can find out how often they were correct. It is also open to contests in which student groups choose the beak that they think will work best and the race to see who can "eat" the most "food" with their chosen "beak".

6. VOCABULARY:
granivore: seed eating animals
frugivore: fruit eating animals
nectarivore: nectar eating animals
insectivore: insect eating animals
piscivore: fish eating animals
carnivore: meat eating animals
folivore: leaf eating animals

7. SAFETY INFORMATION:
SOME OF THE UTENSILS USED AS BEAKS ARE SHARP AND MAY BE DANGEROUS IN SITUATIONS WHERE KIDS ARE COMPETITIVELY TRYING TO "EAT" AS MUCH "FOOD" AS POSSIBLE

8. MATERIALS LIST (including any handouts or transparency masters):
One of each of the following per inquiry team. We just borrowed all these so costs were minimal.
BEAKS: pliers, chopsticks, tweezers, slotted spoon, tongs, straws (more can be added—be creative!)
FOOD: mini-marshmallows, peanuts in the shell, cheerios, popcorn, apple slices, gummy worms, pine cones, little pieces of Styrofoam (for floating in the water) etc. (again, anything can work—be creative!)
OTHER: bucket filled half way with water, strings, watch for timing, data sheets or eco-notebooks, writing utensils

9. METHODS/PROCEDURE FOR STUDENTS:

a. Pre-investigation work: set up stations with different "food" types and different "beak" options at each. Food can be at the bottom of the bucket of water, hung from strings from a branch, buried in sand or on the ground, etc. to simulate various types of food available in the wild. Students are divided into the number of groups as the number of stations available. If each station has the same number of beak options, students can work in teams and rotate so each team gets a chance with each beak type on the same food type.

b. Investigation work:

1) What evidence (data, samples) do students collect? Student teams are asked to make a prediction at each food station of which beak will work best to gather and "eat" (e.g. crack open the peanut shell) the food. Then they are given the same amount of time with each beak to gather and eat as much of the food as possible. Comparisons can be made of the number of pieces of food collected and eaten among the beak options to determine the best beak for the job.

2) How do students present the evidence (data)? At the end of the exercise the class gathers around each food type and is asked which beak was best to eat each food. Each group discusses which beak worked best for them and why.

3) What conclusions are drawn from the evidence students collect? Different beaks enable students to gather and eat different types of food. Bird beaks both help birds to eat certain foods more easily and efficiently, but also make it much difficult for the birds to eat other kinds of foods. Through differences in beak forms, birds are separated in their food choices and can live together exploiting a wide range of resources in their ecosystems.

4) Include examples of data sheets. We had students write in their eco-notebooks, so they would get practice designing their own data sheets.

10. ASSESSMENT: We conducted a group discussion with the classes after the inquiry and found that the kids really enjoyed the activity. Whether the students understood that the theme of this activity, adaptation, applied to all living organisms or not, was uncertain, but the students, when asked listed a number of animal adaptations that were similar to bird beaks.

11. EXTENSION IDEAS: AS HIGHLIGHTED IN THE LAST SENTENCE (ABOVE), THIS ACTIVITY CAN BE ADAPTED FOR ANY NUMBER OF DIFFERENT ADAPTED TRAITS IN ANIMALS AND OR PLANTS, INCLUDING METHODS OF LOCOMOTION, TYPES OF SHELTER USED IN HABITATS, BEHAVIORAL ADAPTATIONS, ETC.

12. SCALABILITY: THIS LESSON CAN PROBABLY BE SCALED TO ANY GRADE LEVELS USING MORE OR LESS SOPHISTICATED ADAPTATIONS.

13. REFERENCES: UNIT C: ANIMALS; DISCOVERY WORKS; HOUGHTON MIFFLIN SCIENCE TEXTBOOK

14. LIST OF EXPERTS AND CONSULTANTS: AVIAN BIOLOGY LAB ON THE UNIVERSITY OF MONTANA CAMPUS.

15. EVALUATION/REFLECTION BY FELLOWS AND TEACHERS OF HOW IT WENT: The fellows thought that this activity was very useful and well received. Students came up with a long list of adaptations similar to beaks that could tell us as observers about how the animals live. The fact that students saw other parallels in nature, gave us at least some indication that they got the idea of adaptations. The teachers also agreed that the students showed more enthusiasm for this exercise than they had for any other science exercise in a long time.