**Problem Definition Worksheet**

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A: Problem Statement: My family and I love to feed and watch the birds at our house. Though we get a few species of birds, such as titmice, chickadees, goldfinches, and cardinals; the dominant species by a small number of species, including Common Grackles and Mourning Doves. It is difficult to tell if some of these birds are driving away other birds, or if the other birds are not as attracted to the seed we put out. Regardless, these species are by far the most numerous, and the numbers of other species are limited.

B: Business Impact: It costs a lot of money to feed the birds. A 20 lbs. bag of sunflower hearts costs $32.99, while the same amount of safflower seeds costs $29.99 (not including tax). This isn’t including other things we feed the birds with, such as suet, mixed seeds, oranges, and hummingbird nectar. With so much money being invested in feeding wild birds, we (my family and I) want to be able to attract and enjoy as great a variety of birds as we possibly can.

C: Goals: Currently, our feeders attract around 2-3 of most birds, while Common Grackles and Mourning Doves appear in much greater numbers (around 7-10). The goal of this project is to increase the number of other feeder regulars to at least 5 individuals per species. In addition, we wish to bring the Simpson’s index to at least 0.5 (see below).

D: Project Scope: The inputs I would be interested in measuring are the volume of seed added to the feeders, the type of seed used and which feeder had which type of seed. I would also divide the price of the bags spent with the volume of the bags, so I could obtain the amount of money spent every time I filled up the feeders. I would also record the type of suet I put in the two suet cages and how much of it was eaten. Some extraneous variables that will need to be accounted for are the time of day I was observing as well as weather conditions. The latter would include temperature, cloud cover (clear, partly cloudy, mostly cloudy, and overcast), wind, and precipitation.

For the output data, I would record the species that visited and the number of each species (e.g. Northern Cardinal: 3; Eastern Towhee: 1). The migratory status of a species will also be noted, so birds that are here for a certain part of the year could be accounted for. I would then measure the diversity for that day by calculating the Simpson’s Index to calculate the diversity of birds at our feeders. The formula for this index is D = ∑n(n-1)/N(N-1); where D is the index, n is the number of individuals of a species, and N is the number of species (Simpson 1945). Since this index decreases with increasing diversity, I will transform it by subtracting 1 from it (1 – D), so that larger values will mean greater diversity (Hill 1973). Other animals also use the feeders, such as squirrels, which can affect the bird diversity. In addition, predators such as Cooper’s Hawks (*Accipiter cooperii*) attempt to hunt our feeders as well, so these animals will need to be accounted for.

E: Team: My mother and father usually put up the feeders, and we all enjoy observing the birds.

F: Project Plan:

Define: April 7 – 13

Manage: April 14 – May 4

Analyze: May 5 – 11

Improve: May 12 – 25

Control: May 26 – June 6

G: Process Map:

Diagram

Description automatically generated

References:

Hill, M. O. 1973. Diversity and Evenness: a Unifying Notation and its Consequences. Ecology

54 (2): 427-432.

Simpson, E. H. 1949. Measurement of Diversity. Nature 163 (4148): 688.