Weight Fluctuations in Free-Flight Birds

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Audiences are entertained daily around the globe by the plethora of free-flight bird shows performed in zoos, aquariums and other facilities. Much of their delight comes from the opportunity to have close encounters with birds of all shapes and sizes flying inches over their heads. These birds are trained using a combination of techniques, one being weight management. By carefully manipulating a bird's diet to create motivation, a trainer can encourage a bird to perform a particular behavior on cue. In order to raise or lower a bird's weight, it is crucial to know both their ad lib and current weights. At Natural Encounters Inc., our birds that are flown in shows are weighed daily to ensure accurate data in regards to their weight. Birds are voluntarily trained to step onto a scale in order to ascertain their weight, and then a diet is written that attempts to raise or lower their overall weight towards a target weight, which is adjusted on a regular basis.

Setting a bird's individual target weight is an exercise in fluidity, since these target weights can change on a daily basis. These weights vary not only with the bird's performance of a desired behavior, but also with the environment[ii]. In order to ascertain what a bird's target weight is, an ad lib weight must first be found by placing the bird on full feed-up. When a bird is on feed-up, they are given all the food they can possibly eat. For instance, a parrot would be given a full bowl of pelleted diet for a period of several weeks, which they would have access to all day to insure they are fully satiated. If a formerly weight managed bird is placed on feed up, initially one would see the bird's weight spike due to the access of an unlimited amount of food, however after several weeks, you will see the weight slowly decrease and level out. The weight may begin to decrease again and finally, after a few months, level out at the bird's ad-lib weight[ii]. Once this weight has been determined, the training process begins with trying to work the bird at their ad lib weight.

A commitment is made at NEI to work birds at the highest weights possible, therefore the beginning of the training process starts with working birds at their ad lib weight. A bird is never dropped in weight prior to training, and all attempts are made to work the bird while on free feed. It is important to note that the bird's behavior should drive the target weight when it comes to raising or lowering that target weight[ii]. If a bird is not motivated to do a particular behavior, a myriad of reasons are considered before ever lowering the bird's weight. However, when all other training options have been exhausted, sometimes a bird's weight is lowered - but only as a last option[ii]. A target weight is then adjusted to a weight that is believed to create enough motivation to perform the behavior asked. Once the bird is performing the behavior without hesitation, the target weight is incrementally raised until the point at which the behavior breaks down, at which point, after exhausting all other options, a new target weight is set. The birds' behavior is what dictates the target weights; therefore a bird is never raised or lowered in weight

arbitrarily. By working birds heavy, their health and well-being is maintained in addition to having them perform the desired show behavior.

In order to determine not only the health of the NEI collection, but also their target weights, birds worked in shows are voluntarily weighed on a daily basis. Daily weights on NEI's collection of show birds offered the opportunity to track their weights over time to see if there were any observable patterns. Trios of individual Green Wing Macaws, Harris Hawks and White-Necked Raven's weights were graphed over a period of several years. Weights from the first of every month were used to examine yearly trends in the weights of these birds.

When superficially looking at the weights of the three Green Wing Macaws, we noted significant differences in their weights. The smallest of the three macaws, Uno, had weights that oscillated in the 1100g rage; whereas the largest macaw, DeeDee had weights that were consistently over 1220g. MacGyver, the third macaw, had weights that fell in between the two other parrots in the 1160g range. All three of these birds are weight managed, and have gram specific diets, which are different every day. Upon closer inspection, their weights followed a similar yearly fluctuation; their weights would decrease every summer and increase every winter. The highest weights were usually in late winter or early spring. This stood in contrast to their lowest weights, which occurred in late summer or early fall. For instance on January 1st 2009, DeeDee weighed 1272g. On September 1st 2009, DeeDee weighed in at 1181g. These trends were consistent with all three birds, and over the several years that weight data was recorded. Over the course of the year, these birds' weights fluctuated an average 7-10% from their winter highs to their summer lows.

Yearly weight fluctuations are not species specific, rather they applied to birds of different species, weights and ages. Both Harris Hawks and White Necked Ravens demonstrated that their weights would increase during the winter and drop during summer, fluctuating at approximately 7-10% per year. All of these birds are weight managed, meaning their diets and weights are manipulated to a certain target, however all of these birds still exhibited seasonal changes over a pattern of several years. It is interesting that even with human intervention for the purpose of training, their weights still followed a pattern that is seen in nature[ii].

One should note that even birds on a feed-up diet still undergo seasonal weight changes much like those birds whose weight is currently being managed. An example is a Hyacinth Macaw named Grover who is on a feed up diet, yet still underwent a seasonal fluctuation of 7-10%. It has been shown that wild birds undergo weight gain in winter and lose the excess weight in summer; therefore it is interesting that Grover followed a similar pattern. Even though he has access to more food than he eats daily, he still underwent a similar pattern to both wild birds and ones being weight managed. Therefore it seems that even if a bird is on feed up, their weights would still follow the same yearly trend. In order to address this, birds would either need to have a larger diet in the winter months, or a large enough diet for the individual bird to self-regulate their weight. Since Grover is offered a diet large enough that he has leftover food, he was able to

manage his own weight and follow the same annual weight changes that both weight managed and wild birds undergo.

Birds' weights naturally undergo seasonal changes that respond to yearly challenge they face. Wild birds typically undergo a yearly change where they weigh most in winter, and weigh the least during the breeding season. Their weights then increase again during the fall before coming to a peak in late winter[iii]. Energy expended on things like laying eggs and raising fledglings drives down their weights during the spring and summer months. Decreases in weight during the spring and summer are also due to activities like singing, in caring for the young, and of the long periods of sitting on the eggs during incubation, instead of feeding[ii]. These irregular feedings in the spring in summer due to other activities are what has been shown to lower their weights, unlike other seasons where part or all of their time is devoted to eating[ii]. Therefore it is interesting that despite being flown in shows and not being bred, show birds' weights still follow a similar trajectory to wild birds.

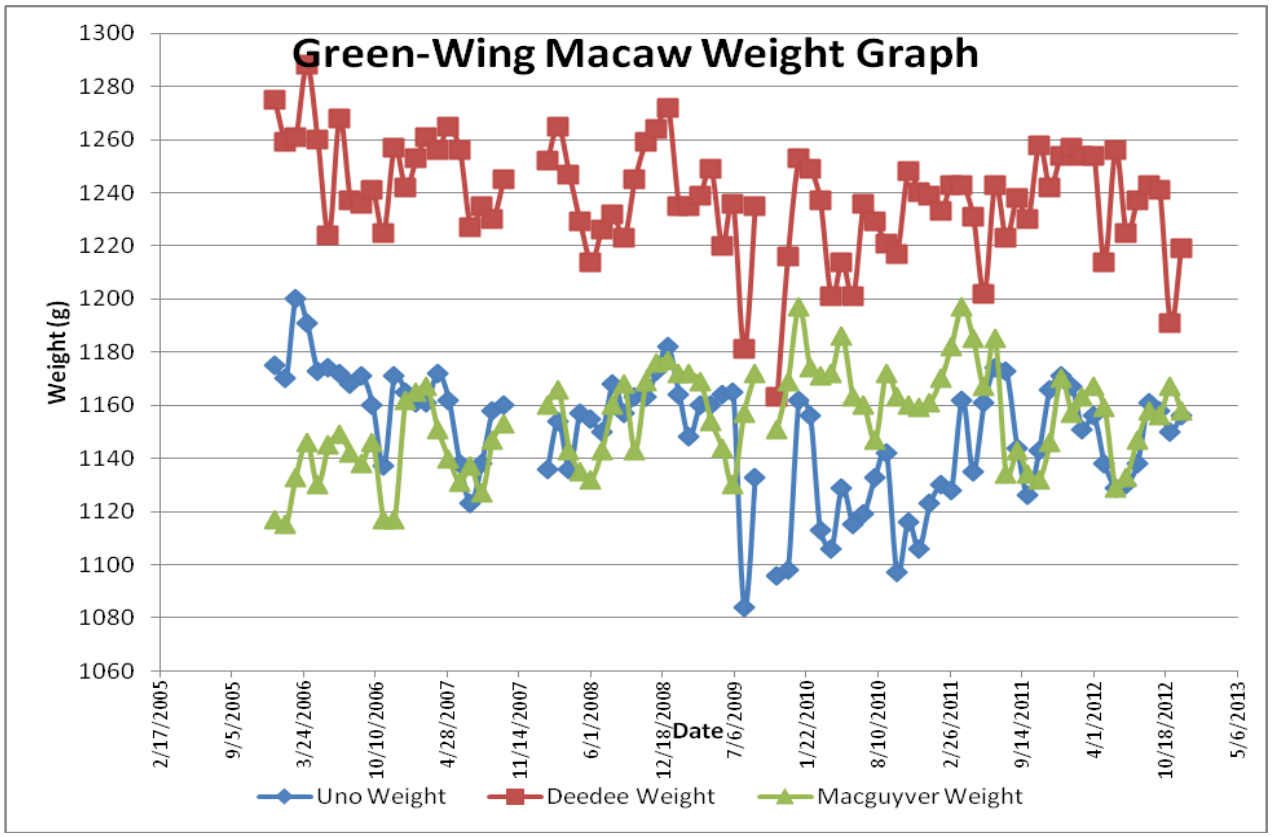
When embarking on this study, it was no shock that birds' weights changed over the course of a given year. Many trainers working with weight-managed birds know that their weights tend to decrease in the warmer months and increase in colder ones. These show birds' diets also change to reflect the seasons, and birds usually have smaller diets in the summer to maintain the same show behavior, since the birds' weights are lower than in the winter. Some birds may even leave uneaten food leftover during the warm summer months, thereby causing trainers to reevaluate their diets. Therefore while the seasonal fluctuations were no surprise, it was nevertheless interesting to see that throughout the years these birds had predictable changes in weight of 7-10%. Despite changes in location, year and show behavior, these patterns remain consistent - even with their diets being managed. Due to these patterns, facilities that manage their birds' weights can take this data and apply it to their own birds to see if these trends hold true for their birds. In addition, facilities can also use this data to support varying their birds' target weights with their natural seasonal fluctuations.

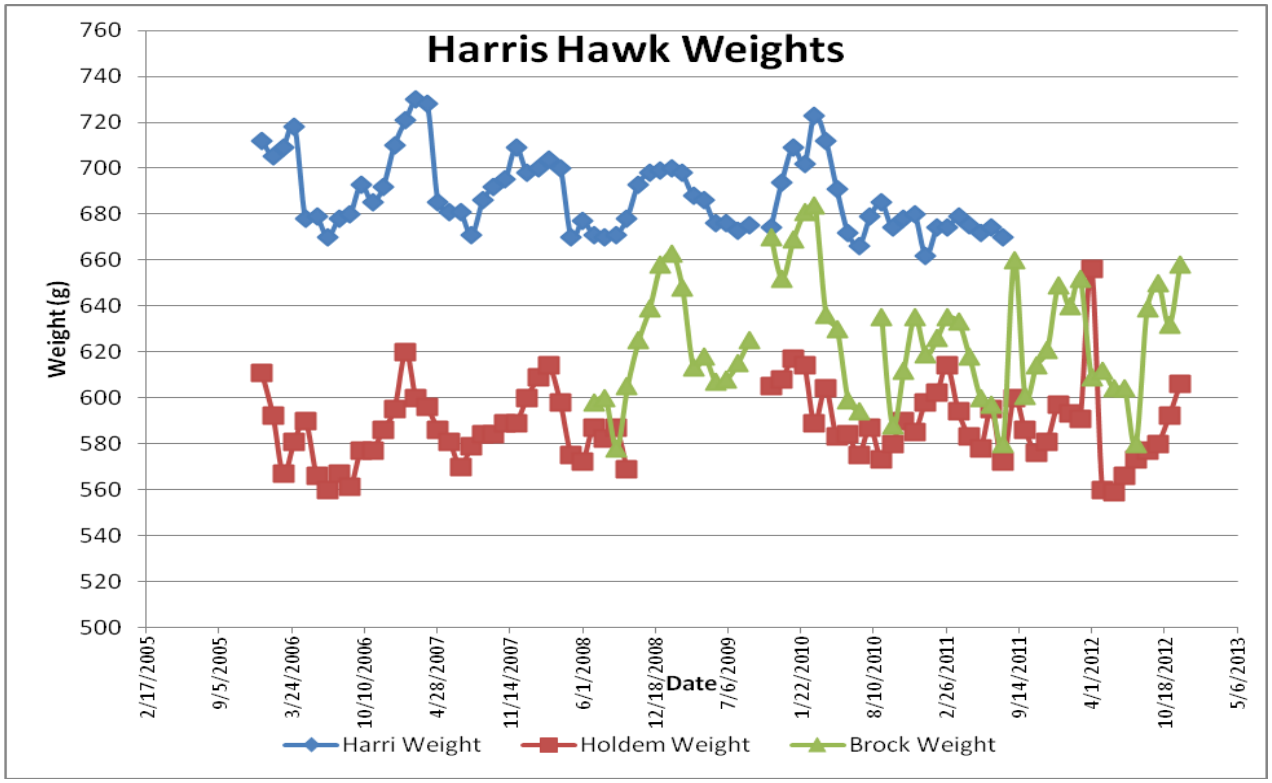
While these seasonal changes in birds' weights may assist in the writing of diets, it is important to note that the bird's behavior is the most important factor in raising or lowering a bird's weight. Just because it is spring or summer, does not alone justify dropping a bird in weight in anticipation of their show behavior breaking down. An individual bird's behavior is an antecedent to our diet writing, and a bird should not be dropped in weight until all other options have been exhausted. Facilities working their birds should not begin to manipulate their birds' weights with the sole reasoning being the season; instead they should be consistently assessing the behavior of their birds in order to raise or lower the target weights of their birds.

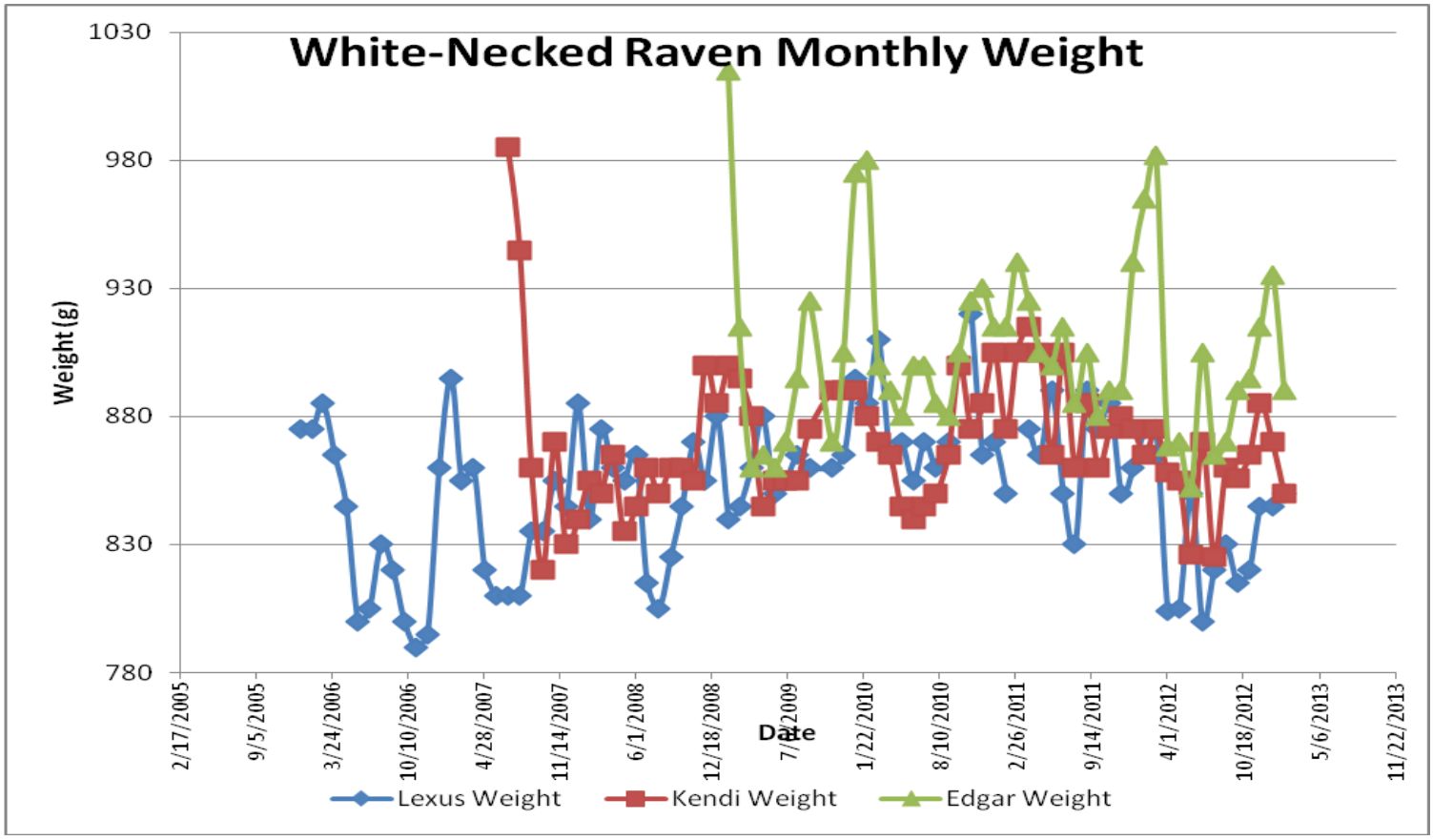
With that mindset, it is interesting to note that the weight fluctuations of 7-10% are driven by the bird's behavior over the course of several years. Our birds are not being raised or lowered unless their behavior dictates it; therefore it is interesting to note that these birds are the driving factor in their weight changes. Their target weights are not lowered unless their behavior demonstrates

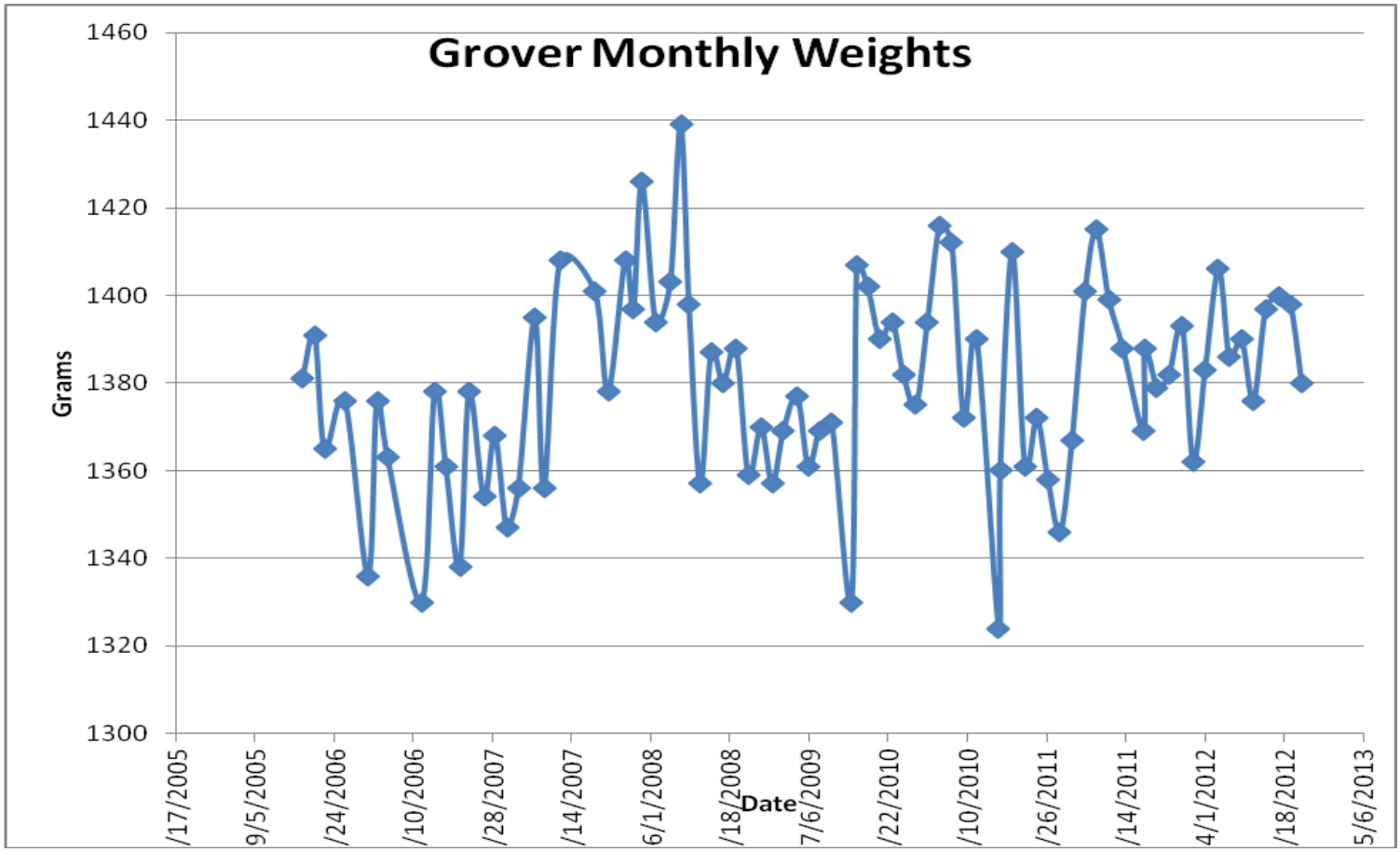
a lack of motivation to perform a particular behavior on cue. Nature's influence on behavior is what causes changes in bird's target weights, as the trainers respond to the behavior they see in the birds.

The goal of this study is to inspire other trainers to graph weights of their collection in order to identify and predict yearly weight changes in their birds. Awareness of these seasonal fluctuations in weight among birds has practical applications for any facility currently weight managing their birds. The observed trend of weights changing on average 7-10% can assist in diet writing for show, and provide context as to why diets change over the course of a given year. Daily weights are not only beneficial for a show, but they also allow facilities to closely monitor the health of their collection, as weight loss is one of the early signs of health issues. A 7-10% increase in weight during the fall and winter is to be expected; therefore if an individual bird's weight has remained unchanged over the course of a year, a closer examination of that bird's health status and behavioral performance might be in order. A linear graph of a bird's weight over the course of a year is a clear indication of improper management or a larger health concern. However target weights are only one indicator of a bird's health; feeling a bird's keel and observing their behavior can provide more insight into their health in addition to tracking weights. These results will hopefully encourage fellow trainers to closely examine their own birds' weights in order to see if they fall into similar trends, and see if their birds' weights fluctuate at a 7-10% rate each year.


Green-Wing Macaw Weight Graph
Weight (g)
1300
1280
1260
1240
1220
1200
1180
1160
1140
1120
1100
1080
1060
2/17/2005
9/5/2005
3/24/2006
10/10/2006
4/28/2007
11/14/2007
6/1/2008
12/18/2008
7/6/2009
1/22/2010
8/10/2010
2/26/2011
9/14/2011
4/1/2012
10/18/2012
5/6/2013
Date
Uno Weight
Deedee Weight
Macguyver Weight


Harris Hawk Weights
Weight (g)
760
740
720
700
680
660
640
620
600
580
560
540
520
500
2/17/2005
9/5/2005
3/24/2006
10/10/2006
4/28/2007
11/14/2007
6/1/2008
12/18/2008
7/6/2009
1/22/2010
8/10/2010
2/26/2011
9/14/2011
4/1/2012
10/18/2012
5/6/2013
Date
Harri Weight
Holdem Weight
Brock Weight


White-Necked Raven Monthly Weight
Weight (g)
1030
980
930
880
830
780
2/17/2005
9/5/2005
3/24/2006
10/10/2006
4/28/2007
11/14/2007
6/1/2008
12/18/2008
7/6/2009
1/22/2010
8/10/2010
2/26/2011
9/14/2011
4/1/2012
10/18/2012
5/6/2013
11/22/2013
Date
Lexus Weight
Kendi Weight
Edgar Weight


Grover Monthly Weights
Grams
1460
1440
1420
1400
1380
1360
1340
1320
1300
/17/2005
9/5/2005
/24/2006
/10/2006
/28/2007
/14/2007
6/1/2008
/18/2008
7/6/2009
/22/2010
/10/2010
/26/2011
/14/2011
4/1/2012
/18/2012
5/6/2013
Date

[ii] Malina, Cassie, and Steve Martin. "The Mouse Went Down The Hole - Psychological Appetite: Nature's Training Tool." Speech. 2003 IAATE Conference. Oregon, Portland. *Natural Encounters Inc.* N.p.: n.p., n.d. Print.

[ii] Baldwin, S. Prentiss, and S. Charles Kendeigh. "Variations in the Weight of Birds." *The American Ornithologists' Union: The Auk* 55.3 (1938): n. pag. *JSTOR*. Web. <http://www.jstor.org/stable/4078412 .>.