

# **TRAINING, ENRICHMENT AND SOUND ANIMAL NUTRITION CAN COEXIST THE DEVELOPMENT OF A MULTIFACETED BIRD FEEDING PROGRAM AT THE PHILADELPHIA ZOO**

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## **Abstract**

In conjunction with the development of a new training program, the Zoo developed a 4 part-feeding program for collection birds that integrates training with nutrition and enrichment. This program allowed the Zoo to better monitor the feed intake of individual birds within a mixed species exhibit and collect data on individual animals. The program placed birds into three general groupings by diet category. Diets were broken down into four component parts: base diet, enrichment feed, training feed and, for appropriate species, energy feed. The amount of base diet offered for each bird was formulated to meet the bird's calculated energy need for maintenance. The base diet was offered early in the morning, placed in the feed dish most frequently visited by the target bird, and left all day. Enrichment feeds were offered as early as late morning and anytime after during the day. Base diet and enrichment feeds were pulled at the end of the day. Energy feeds are available at all times in exhibits that house animals requiring such feeds. Training feeds were only offered during training sessions and are target fed to the specific bird involved in the session. Since the introduction of the program, the bird and nutrition departments have noted profound improvements in animal base diet feed intake, improved keeper morale, heightened bird activity, a reduction in food wastage, decreased diet prep time and improved pest control within bird exhibits.

## **Introduction**

The Philadelphia Zoo has long struggled with the best manner to feed the Zoo's diverse bird collection. Mixed species bird exhibits in particular pose a multitude of feeding challenges. Ensuring adequate intake of a nutritionally complete diet and managing the appropriate presentation of foods is difficult in a large mixed-species exhibit. We have recently re-evaluated all of our bird diets and developed a new feeding program for collection birds that integrates nutrition, enrichment, and training. This new program was designed to achieve the following goals:

- 1- To provide appropriate nutrition at each life stage of the individual bird
- 2- To improve consumption of a nutritionally complete diet and better monitor food intake
- 3- To reduce food wastage
- 4- To reduce food preparation time
- 5- To provide keepers with more flexibility to tailor diets to individual bird preferences
- 6- To support our enrichment and training programs through the use of positive reinforcement to encourage mental and physical activity

## Methods

The new feeding program was phased in over a 4-month period from February 2003 through May 2003. Exhibits were placed on the new regime one at a time to ease the transition and allow for more accurate evaluation of the program. Nutrient allotments within the total diet were based on published requirements for domestic birds and cage birds and on SSP husbandry guidelines. The plan categorizes birds into three general diet groupings. Although each species has a specific diet formulation, the diet category approach allows for a standardized methodology within a grouping. Feeding Plan 1 included fruit/seed/insect feeders and applies to most of the birds typically housed in mixed species exhibits. These animals are typically flighted foragers, have a small body size and tend to flock. Species in this group also typically expend a high level of energy and therefore require an energy feed as part of their diet plan. Feeding Plan 2 covered omnivorous feeders. Energy needs of this group are filled through whole prey or commercial complete feeds, and thus energy feeds are not appropriate for most species within this grouping. Whole prey is used as the base diet for several species within this plan. Feeding Plan 3 was designed for all birds housed in single species or single order exhibits, as well as birds that are target fed within mixed species exhibits. Energy feeds are not necessary for animals within this grouping. All plans were designed such that presentation allows birds from all three feeding plans to be exhibited together if desired. The total food allotments for each bird within an exhibit were tallied and each exhibit was provided with 1.5 X the total base diet amount. Diets were broken down into four component parts, which included the base diet, enrichment feed, training feed, and energy feed where appropriate.

**Base Diet:** The base diet was intended to provide all the nutrients needed by the birds with the exception of energy. The nutrient requirements of birds at maintenance do not fluctuate with energy need, rather remain constant<sup>4</sup>; therefore, it was necessary to ensure birds had a base diet which will meet all their nutrient requirements before or concurrently with their energy requirement. A 1997 in-house study by the nutrition staff at the Philadelphia Zoo on feed dish utilization gave the staff confidence that birds within mixed species exhibits would consistently feed from a favored feed dish. Additionally, results from this earlier study indicated that the majority of birds would eat most readily and for the longest duration from the favored feed dish at the first morning feeding. The zoo took advantage of this feeding practice in offering the base diet alone in the favored feed dish at the first morning feeding.

The base diet consisted of commercial complete feeds and provided a minimum of twice the calculated basal metabolic rate (BMR) for the target bird. To calculate the maintenance BMR for each species, a target body weight for each species was first established. The institutional Animal Record Keeping System weight logs and the International Species Information System<sup>3</sup> web site weight logs were reviewed for each species. A comfortable weight range was established for each species based on the collected data as well as the behavior and condition of individual birds. A target body weight was chosen near the top of the range. Sexual dimorphism was considered when appropriate. BMR was calculated as:

$$\begin{aligned} \text{Nonpasserines- (kJ energy day}^{-1}\text{=308 X kg body weight}^{0.73}\text{)}^1 \\ \text{Passerines- (kJ energy day}^{-1}\text{= 480 X kg body weight}^{0.73}\text{)}^1 \end{aligned}$$

Base diets were presented in the morning and removed at the end of the keeper workday. Keepers monitored base diet consumption for the first 7 days of the new diet. Based on results of consumption analysis, alterations in feed type, diet presentation and feed preparation were made. Another 7-day period of data collection was performed when Curator and Nutritionist deemed alterations to be significant. This process was repeated until the consumption of the base diet was consistently twice the calculated BMR. A maximum of two commercial feeds were offered/species as part of the base diet. Effort was made to reduce the variety of feeds offered within a mixed species exhibit.

**Energy Feed:** The energy requirements of birds are extremely variable. Birds will typically consume an amount of food necessary to meet their energy needs; the amount consumed will fluctuate based on the energy concentration of the foods as well as activity level and life stage. Confined chickens only require about 1.5 X BMR, whereas free-living passerines require an average of 2.8X BMR for maintenance. Additional energy expenditures for birds that fly while foraging may increase energy need as much as 38% above maintenance requirement<sup>5</sup>. Allowance for these vast differences in energy needs was accomplished through providing energy feeds in feeders targeted to serve the birds with the highest energy need. Specific energy foods provided were seeds and nectar. Energy feeds were provided *ad libitum* 24 hours a day. During the initial introduction of the base diet, energy feeds were removed from the exhibit for the first two hours when the base diet was available to encourage the birds to eat the base diet. Energy feed restriction was eliminated after the first week in all exhibits.

**Enrichment Feeds:** Items used for enrichment with captive birds typically included foods such as fruit, nuts, seeds and insects. In all plans within the new PZG program, enrichment feeds were allowed only after the base diet had been provided, with a minimum of a 2-hour delay following presentation of the base diet. Enrichment feeds could then be offered at any other time throughout the day. The 2-hour delay between presentation of the base diet and the enrichment feeds was designed to encourage a higher consumption of the base diet and to reduce the risk of increased iron absorption (many of the fruit enrichment items are high in vitamin C: see discussion). Keepers were able to tailor the presentation and type of enrichment feed to the individual preferences of the birds under their care. They were provided with an exchange chart and could provide enrichment feed totaling up to the sum BMR for all birds within the exhibit each day.

**Training Feeds:** Training feeds were not necessary nutritionally and were only offered as part of the training program in accordance with approved protocols. Keepers were provided with a caloric exchange chart and could choose an appropriate training feed not to exceed 15% of the calculated base energy requirement for species within Plan 1 or 20% of the calculated base energy requirement for species within Plan 2 and 3. The base energy requirement is twice the calculated BMR. Keepers were required to monitor the body weight and condition of birds and reduce the amount of feed offered during training sessions for birds whose weights exceeded the established weight range for the species.

## **Results**

The new feeding regime adopted by the Philadelphia Zoo allowed us to make substantial progress on our goals. Each individual in the bird collection had a diet formulated specifically for that species, with individual adjustments to accommodate different needs according to life stage requirements. Observations documented that all individuals are consuming the base diet. The presentation of the base diet separately from other diet components made it much easier to monitor base diet consumption. Data collected on base diet consumption allowed the curatorial staff, nutritionist and veterinary staff more confidence that target birds were consuming the base diet most appropriate for them. Food wastage decreased substantially. Compared to the same period last year, cricket usage was down 31% and mealworm usage dropped by 25%. Target feeding of animals that receive whole prey resulted in a significant monetary savings; to date rodent usage dropped by 10% for mice and 71% for rats. The total amount of produce used dropped as well.

The savings from this reduction in food wastage allowed us to replace the chopped fruit mixture formerly used with a new mix consisting of IQF corn, mango, mixed berries, green beans, peas and fresh grapes. Although the new mixture was significantly higher in cost by weight, the decreased amount needed compensated and expenditure for produce remained relatively constant. This change also helped us decrease diet preparation time, with a conservative estimate of a 20% reduction. The program was designed to allow more flexibility for the keepers to tailor food items and their presentation to the individual needs of the birds under their care. Enrichment feeds were presented in a manner of the keepers' choosing. A variety of items were chosen based on the nutrient exchange chart provided. In addition to allowing the keeper more control over the bird diets within the parameters laid out by the nutrition staff, this has also facilitated our enrichment and training programs by building those components of food presentation into the diet structure.

## **Discussion**

The adoption of this 4-part feeding regime for the bird collection at the Philadelphia Zoo has allowed keepers and curators more involvement in food item choice and has allowed the nutrition and veterinary staff more confidence in diet consumption by target birds. Although the animal staff spent considerable time in diet development and implementation, the benefits greatly outweigh the initial time investment. Keepers have the ability to choose appropriate enrichment and training foods within guidelines set by the nutrition and curatorial staff. This freedom has resulted in less wastage and better feed consumption by the birds. Keepers have increased the amount of time spent with the animals and have decreased the amount of time spent on diet preparation. Vigilant oversight of the feeding program is initially required of the Nutrition Staff to ensure the program runs smoothly. Keepers must understand the role and importance of each part of the feeding regime, animal condition must be monitored and alterations to the feeding regime must be made in a timely manner.

In addition to helping us achieve our specific initial goals, this program also appears to be yielding benefits to bird health and welfare. Our ability to better monitor food consumption and to target feed individuals has improved pest control in addition to reducing overall food wastage.

Changes in presentation method have also assisted in reducing the amount of food available to exhibit pests. We have experienced a noticeable reduction in pests, particularly rodents, since the start of the program.

We also speculate that the new diet regime will reduce iron absorption problems for those birds prone to iron storage disease. Separating the presentation of iron-containing complete feeds, such as pellets, from produce items that are potentially high in vitamin C by a minimum of 2 hours should reduce the extent to which vitamin C increases iron absorption<sup>2</sup>. The new regime may indirectly reduce iron storage problems further through facilitating training that itself reduces stress levels. Stress is likely the most significant factor in the development of iron storage disease within prone species<sup>7</sup>. In birds, the levels of transferrin increase during stress, increasing the flux of iron to the liver and simultaneously increasing iron absorption<sup>6</sup>. To date, no physiological data have been collected to document stress reduction within the Philadelphia Zoo bird collection since the new feeding regime began. However, many training achievements linked to the diet regime change are likely sources of stress reduction. Examples include crate training and scale training that have both reduced the need for chasing and netting. Additionally, the general desensitization of the birds to keeper presence achieved through the training program may reduce the stress associated with keeper entry into enclosures. We also believe that the diet change has achieved keeper-related results beyond our initial goals. The new feeding regime reduced food prep time and also requires food presentation multiple times throughout the day. Keepers are thus spending more time in the exhibits observing the animals than previously. Better observation has led to earlier identification and resolution of problems before the development of health-compromising or life-threatening issues. The reduction in food preparation time and the greater control and flexibility this program provides has improved keeper job satisfaction as well as improved animal care. Keepers have been given greater ability to make dietary decisions that depend on their abilities as animal care professionals. Through the diet-facilitated training program, keepers have developed more positive working relationships with the birds in their care.

#### **LITERATURE CITED**

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