

## Zoo Animal Nutrition Matrix

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Providing optimal nutrition by developing an appropriate diet for captive exotic animals is complex. The complexity arises from the many factors that must be considered that may affect the final diet. The zoo animal nutrition matrix was developed to provide those new to developing captive exotic animal diets a guide to affecting factors and to illustrate to all in the zoo and nutrition communities the factors that are considered when formulating a diet. The matrix is best illustrated in a flow chart format. Since there are so many factors, the magnitude of the flow chart does not allow for presentation on a regular sized sheet of paper. Thus it is described below and on the poster, will be presented in flow chart format.

To provide appropriate zoo animal diet one must consider the animal's: 1) dietary consumption 2) nutritional requirements, 3) current health status, and 4) particular management constraints/opportunities. Consumption is affected by a) the diet, b) the client (zoo animal manager, keeper or veterinarian) wishes, and c) animal preference. The diet is affected by food items offered including water (quantity and quality) and quantity of food offered. The quantity offered is affected by cost, availability, quality, waste and client perception. The form of food offered includes live, frozen/thawed, size, hard, soft, freshness and the ability to process, mix or chop. Food items selected include produce (affected by location, season, processing, soil), invertebrates (affected by diet, life cycle, life stage), manufactured diets (affected by manufacturer and storage), meat (affected by processor/manufacturer, storage, quality), whole prey (affected by supplier, diet, storage, life cycle, age), supplements (affected by nutrient, directions, other items, information), browse (affected by season, soil, climate), and forage (affected by season, soil, transportation, storage). "Non-food" items, such as the animal's consumption of bedding, also may need to be considered. Client perceptions are affected by the client's experience, dedication and knowledge. Consumption also is affected by animal preference, which is affected by animal behavior, experience, and competition.

Nutritional requirements should be considered for a specific animal. A particular animal's requirements are defined by known species requirements, NRC requirements, morphology (includes gastrointestinal tract, dentition and

other physical characteristics), feeding ecology (includes qualitative information and quantitative information). Requirements are affected by season, life-stage, activity, health, stress, and body temperature. Requirements may include 64+ nutrients as well as ultraviolet radiation.

Health is affected by a) infectious agents which can be virus, bacteria, protozoa, parasites, b) non-infectious agents which can be from dietary origin (deficiency or toxicity - both can be affected by amount or chemical form), contamination, trauma, congenital, toxins, and/or metabolic alterations, c) preventive health measures (including parasite control, vaccinations, sanitation, health monitoring), and d) veterinarian role (which includes treatment and diagnosis).

Management constraints or opportunities are affected by a) environment, environmental stress, ambient temperature, b) enclosure size and type also are affected by other animals c) food storage and preparation capacity, d) feeding regime (timing and location) affected by training, exercise, and behavioral enrichment.

It is probable that all factors are not listed in this matrix thus this matrix should expand or contract and be individualized as needed. Each of these factors listed has intricacies and peculiarities for each institution and situation. It is often thought by non-nutritionists that once a good diet is formulated there is no need for change. It can be seen that for each animal, and often there are hundreds or even thousands of animals in an institution, a change in just one of the factors listed above may cause consideration of all the other factors and a diet change. Thus a zoo nutritionist's job is complex and never ending. Also, it must be performed in a teamwork approach with animal managers, veterinarians and keepers. An essential component to providing an appropriate diet that meets an animal's nutritional needs that is not mentioned in this matrix, is communication. If the factors considered and the reason for the diet or diet change can not be explained to all, it is quite possible that the appropriate diet will never be offered.