Guidelines for the Humane and Ethical Acquisition and Management of Vertebrate Feeder Animals (Excluding Fish)

AZA Nutrition Scientific Advisory Group

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It is vitally important that omnivorous and carnivorous species in the care of zoos and aquariums receive the appropriate foods needed to meet their nutritional and behavioral requirements. Oftentimes this entails using 'feeder animals' as part of their diet. It is important that zoos and aquariums accredited by the Association of Zoos and Aquariums (AZA) make certain that feeder animals are treated humanely and ethically while in their care. This document, meant to supplement AZA accreditation standards on nutrition (AZA Accreditation Standards 2.6.1-2.6.4), written euthanasia policy (AZA Accreditation Standard 2.9, 2.9.1), and the AZA Policy on Responsible Population Management, provides guidelines for the humane and ethical acquisition and management of vertebrate feeder animals (excluding fish) to:

1. Enhance environmentally sustainable practices of acquiring feeder animals for the purposes of providing zoo and aquarium animals with appropriate diets. Each zoo/aquarium should balance the ecological impacts on the global environment of feeder animal acquisition with its responsibility to sustain a living collection.
2. Establish a framework for the ethical and humane treatment of all feeder animals including rodents, rabbits, medium/large mammals, poultry, reptiles, and amphibians by zoo/aquarium staff and their vendors throughout these animals' entire lifespan under human care (Lintzenich et al., 2001; Franske and Gamble, 2011).
3. Assist AZA-accredited zoos and aquariums to establish a process for evaluating how commercial vendors acquire and manage feeder animals.

Enhancing Environmentally Sustainable Practices for Acquiring Wild-caught Feeder Animals

Balancing the potential ecological impacts of feeder animal acquisition with zoo and aquariums' responsibility to sustain the animals in their care is an important ethical consideration. AZA-accredited zoos and aquariums should focus on procuring feeder animals from sustainable populations and on encouraging the development of more sustainable acquisition practices. The acquisition of animals from their natural ranges must comply with all relevant local, state/provincial, and federal wildlife laws and regulations (Accreditation Standard 1.1.1). In addition, opportunities to develop or promote acquisition practices that do not reduce the long-term sustainability of these populations in nature should be sought.

One way to address the sustainability of feeder animal populations in their natural ranges is to evaluate the possibility of substituting one sustainable species for another less sustainable species (or targeting a comparable non-native invasive species to meet the need). For example, some small lizards (*Anolis spp.*) are commonly acquired for zoos and aquariums to use as feeder animals. To support the sustainability of the native green anole lizard (*Anolis carolinensis*), the introduced brown anole lizard (*Anolis sagrei*) can be intentionally identified as an appropriate substitute feeder species. Another consideration is to utilize commonly available prey species for less available / uncommon prey items. For example, cross-scenting rodent prey offered to ophiophagus cobras). The AZA Nutrition Advisory Group is continuously evaluating sustainable practices for the acquisition of feeder animals and recommendations can be found at: https://nagonline.net.

Establishing a Framework for the Ethical and Humane Treatment of Feeder Animals

Feeder Animal Capture Methods - Any animals used as feeder animals should be captured in a manner that limits stress and risk of injury to them. The impacts that these capture techniques have on surrounding wildlife and habitat should be minimized (Schemnitz et al., 2012). The American Veterinary Medical Association states that chemical and gas anesthetic agents should not be used in the capture of

feeder animals since they can have adverse secondary effects on the animals to which they are fed (AVMA, 2013). The AZA Policy on Responsible Population Management provides additional guidance on acquisitions from nature: https://www.aza.org/assets/2332/aza_policy_on_responsible_population_management_1_12_2016.pdf).

Feeder Animal Housing and Husbandry Practices - Animal housing for feeder animals should conform to appropriate guidelines for the care and welfare of each species. General guidelines for housing and husbandry of select feeder animals are listed in Appendix 1 (Toddes, 2006, and see AZA Accreditation Standard 2.6.2). For species specific details consult the following:

- For *rodents and rabbits*, refer to the National Research Council's Guide for the Care and Use of Laboratory Animals (2011), http://grants.nih.gov/grants/olaw/Guide-for-the-Care-and-Use-of-Laboratory-Animals.pdf and Sikes et al (2011); http://www.mammalsociety.org/uploads/Sikes%20et%20al%202011.pdf
- For *farmed animals*, refer to the Federation of Animal Science Societies Guide for the Care and Use of Agricultural Animals in Research and Teaching (2010); http://www.fass.org/docs/agguide3rd/Ag_Guide_3rd_ed.pdf
- For *reptiles and amphibians*, refer to the American Society of Ichthyologists and Herpetologists (ASIH) Herpetological Animal Care and Use Committees Guidelines for Use of Live Amphibians and Reptiles in Field and Laboratory Research (2004) http://www.asih.org/sites/default/files/documents/resources/guidelinesherpsresearch2004.pdf; Kreger, M. and the ASIH Amphibian and Reptile Guidelines (2004)
- For *birds*, refer to Fair Ornithological Guidelines (2010); http://naturalhistory.si.edu/BIRDNET/guide/guidelines.html

Primary Enclosures (terrestrial environments) - The primary enclosure for terrestrial feeder animals should be constructed with materials that balance the needs of the animal with the ability to provide for sanitation. They should have smooth, impervious surfaces with minimal ledges, angles, corners, and/or overlapping surfaces so that accumulation of dirt, debris, and moisture is reduced and satisfactory cleaning and disinfecting are possible. The enclosure should be constructed of durable materials that resist corrosion and withstand rough handling without chipping, cracking, or rusting. Less-durable materials, such as wood, can provide a more appropriate environment in some situations (such as runs, pens, and outdoor corrals) and can be used to construct perches, climbing structures, resting areas, and perimeter fences for primary enclosures. Wooden items might need to be replaced periodically because of damage or difficulties with sanitation. If the feeder species under care needs grass or other soft substrate, the specific type of grass and its management should be considered in relation to the health of the feeder animals. Acceptable primary terrestrial enclosures should:

- Allow for the normal physiologic and behavioral needs of the animals, including urination and defecation, maintenance of body temperature, normal movement and postural adjustments, and, where indicated, reproduction. In the case of ectotherms such as reptiles and amphibians, special attention should be given to provision of thermal gradients and appropriate UV lighting.
- Allow for conspecific social interaction and development of hierarchies within enclosures, and other forms of enrichment.
- Make it possible for the animals to remain clean and dry (as consistent with the requirements of the species).
- Allow adequate ventilation.
- Allow animal access to appropriate food and water and permit easy filling, refilling, changing, servicing, and cleaning of food and water utensils.
- Provide a secure environment that does not allow egress by or accidental entrapment of animals or their appendages, or ingress or reach-through by other species.
- Be free of sharp edges or projections that could cause injury to the animals.
- Allow observation of the animals with minimal disturbance to them.

Primary Enclosures (aquatic or semi-aquatic environments) - The primary enclosure for aquatic and semi-aquatic feeder animals should have an appropriately designed and maintained life support system. Solids may be removed by siphoning and/or filtration, while nitrogenous wastes may be

removed via biofilters or denitrification units. Disinfection is accomplished through water changes and/or water treatment. Acceptable aquatic or semi-aquatic primary enclosures should:

- Allow for the normal physiologic and behavioral needs of the animals, including excretory function, control and maintenance of body temperature, normal movement and postural adjustments, and, where indicated, reproduction. In the case of ectotherms such as reptiles and amphibians, temperature gradients may be needed for certain physiologic functions such as feeding and digestion.
- Allow for appropriate conspecific social interaction and other forms of enrichment.
- Provide the appropriate water quality and permit monitoring, filling, and changing of water.
- Allow access to adequate food and removal of food waste.
- Provide a secure environment that does not allow escape or accidental entrapment of animals or their appendages or access by other species.
- Be free of sharp edges or projections that could cause injury to the animals.
- Allow observation of the animals with minimal disturbance of them.
- Be constructed of nontoxic materials that do not leach toxicants or chemicals into the aquatic environment and do not present direct or indirect electrical hazards.

Provisioning - Feeder animals should be provided a palatable, non-contaminated, and nutritionally suitable (appropriate for the feeder animals) diet regardless of whether it is a manufactured product or another feeder animal. They should not be fed diets that contain antibiotics or any other drugs and should have access to potable, uncontaminated drinking water. Zoos and aquariums should ask their vendors to provide information on the diets of feeder animals to confirm that these practices are followed.

Transport of Live Feeder Animals – Feeder animals should be transported in a way that minimizes stress and provides the most humane circumstances during the transport per American Veterinary Medical Association (AVMA), International Air Transport Association (IATA) and US Department of Agriculture (USDA) (AVMA, 2013; IATA, 2015; USDA, 1998). Common practices for the transportation of feeder animals have been published (summarized in the guide from Federation of Animal Science Societies (FASS) (FASS, 2010)) and consideration should be given to buffering animals against temperature extremes, and providing food and water to the animals when transportation is greater than 24 hours (IATA, 2015).

Temperature - Provision of a proper thermal environment is an important element of safe and humane animal transportation. Safe ambient shipping temperature ranges are listed in Appendix 2, and should be considered as a general guideline only. The maximum and minimum temperatures of the range were derived from the upper limit and lower limit, respectively, of that species' thermoneutral zone unless otherwise noted. Humidity, wind chill, sun exposure, hydration state, physiological state, age, acclimation, etc., can greatly influence these ranges. Professional judgment should be used in determining safe transportation temperature ranges.

Containers - It is essential that containers be well constructed and suitable for the intended species. For some details or recommendations see "Live Animal Regulations" in IATA (2015). The space needs of animals during transportation are different from their space needs in resident housing. Space needs also vary with animal temperament, social relationships, thermal environment, and species-specific behavioral requirements. General guidelines for transport space allowances are listed in Appendix 3. Space allowances were calculated from container density and container specification data available from the Institute for Laboratory Animal Research (ILAR) (2006). More space may be given during transportation than is listed, but more floor space could potentially increase the risk of animal injury. Space allowances are to be tempered with professional judgment to accommodate animal breeds/strains, species, thermal conditions, special models, and protocol requirements.

Food and Water - In most cases, animals will require a source of food and water if the transport lasts more than a few hours. Several commercially available gel moisture sources have been developed to provide an alternative to the use of water bottles during transportation. These gel moisture sources provide uniform, spill-proof, and contamination-free hydration for rodents; however, they are not

nutritionally complete, and a suitable food source and amount should also be provided during transportation (see National Research Council (NRC), 2011).

Social Interaction - Most laboratory and farm animals are social, and they are often housed in compatible social groups at the site of trip origin. If social groups are transported, it is recommended that the groups be established before transport. However, it has been found that rats adapt quickly to unfamiliar social environments and unfamiliar social environments have no known negative effects on chickens traveling together in the same shipping container (NRC, 2006).

Monitoring - For facilities or people that transport live animals, the quality of transportation should be monitored by tracking mortality, morbidity, and injury during transportation and comparing these measures with published or historical data. Receiving facilities should monitor the animals' condition upon arrival and provide feedback to the vendor immediately if issues arise.

Zoo and Aquarium Personnel Training - Zoological personnel who handle any animals should be properly trained in routine and emergency procedures for the species they handle *(AZA Accreditation Standards 7.3, 7.5)*. Training should include procedures applicable to the mode of transportation such as shipper and carrier responsibilities, inspection of primary enclosures, documentation, receiving procedures, loading and off-loading procedures and precautions, operator and government regulations, and any emergency procedures in place.

Zoological personnel should also be trained in species-specific husbandry and environmental requirements of animals such as the ability to recognize when an animal becomes ill or unfit for transport, ability to recognize signs of stress and alleviate the cause, if possible, and knowledge of how to contact and interact with local emergency personnel, including veterinarians who have skills in the treatment of injuries.

Zoological personnel should be trained to recognize physiological signs that a problem is developing in a particular animal or group of animals. The signs may include increased respiratory rate (in warm weather), excessive sweating (in species that sweat during warm weather), excessive shivering or huddling (in cool weather), aggressive interactions and injuries associated with fighting, and excessive weight loss and dehydration.

Receiving Feeder Animals - Institutions receiving animals should be prepared for accepting the animals by providing proper facilities and appropriate handling by trained personnel. Institutions should be responsible for making certain that records are kept for all animals received and all appropriate permits and associated documentation are included at the time of delivery. These records can include the source of the animals, date of arrival, and condition of animals upon receipt, such as to allow a historical log of feeder animals to be kept for verification purposes.

All animals should be brought into appropriate, clean and quiet facilities and undergo a period of acclimatization to their new facilities which can include a quarantine period. Zoonotic surveillance of feeder animals can be utilized to (1) monitor the health of the incoming feeder animals, and (2) to assist veterinarians in the preventive health care of the animal collection as a whole.

Use of Feeder Animals - Feeder animals sometimes must be fed live in order to stimulate appropriate feeding responses of some predatory species. Each zoo and aquarium should give attention to the details of how this practice is handled such that the most humane treatment of the feeder animals occurs. These practices should be approved through the appropriate Animal Management Committee, Institutional Animal Welfare Committee and/or Institutional Animal Care and Use Committee (IACUC). Institutions should consider the following questions if this practice is warranted (Watts, 2011):

- What is the physiology and behavior of the proposed species to be utilized as live feeder animals?
- How will the feeder animals be acquired?
- How long will the feeder animals be cared for? Additional procedures should comply with the institutional standards of care for similar taxa.
- Will the feeder animals cohabitate with the predatory animals? This would require additional attention to how the feeder animals are managed. Care should also be paid to the welfare of the predator animal (e.g., does the feeder animal have the potential to injure the predator animal?). What is the contingency in case of injury to the predator animal(s)?

- If the feeder animal is intended to be introduced into the predator's exhibit and consumed shortly thereafter, what is the timeframe for consumption? What is the contingency in case of injury (but not immediate consumption) of the feeder animal?
- Is using live prey necessary for the predatory animal? For previously approved use and current proposed practice, has use of live feeder animals been evaluated, based on need, or can desired outcomes be achieved via other methods? Is there an alternative to the feeder animal that achieves the same goals for predator animal behavior and welfare?

Live animal feeding practices (in instances of reintroduction/repatriation efforts, behavioral enrichment, and/or AZA SSP/TAG program recommendations) should be reviewed annually to determine whether the protocols in place at a particular institution continue to meet established criteria for predator and prey animal welfare and whether any adjustments to protocols are necessary. This recommendation is made in recognition that the most humane method is to euthanize a feeder animal first; the goal is to promote the most humane treatment possible for predator and prey.

Euthanasia Practices - Humane euthanasia should be performed in accordance with applicable federal, state and local laws governing drug acquisition, use, and storage, occupational safety, and methods according to current professional norms for the euthanasia and disposal of animals as per AVMA Guidelines for the Euthanasia of Animals (2013 Edition https://www.avma.org/KB/Policies/Documents/euthanasia.pdf). In addition, the chosen technique should minimize distress and anxiety experienced by the feeder animal prior to loss of consciousness. Method of euthanasia should not result in any adverse effects to the animal being fed.

AZA-accredited zoos and aquariums should have clear institutional euthanasia policies approved through the appropriate Animal Management Committee, Institutional Animal Welfare Committee and/or Institutional Animal Care and Use Committee (IACUC) that conforms with the general guidance provided in AZA Accreditation Standard 2.9.1.. Where circumstances occur that are not clearly covered by these documents a veterinarian should use professional judgment and knowledge of clinically acceptable methods in selecting an appropriate euthanasia technique considering animal size and species-specific physiologic and behavioral characteristics. Feeder animals should be humanely euthanized while following any applicable guidelines with methods that do not cause chemical residue or otherwise compromise the safety of the prey item for consumption by other animals. Current general guidelines for humane euthanasia of a variety of feeder animal types are provided in Appendix 4.

Evaluating how Commercial Vendors Acquire and Manage Feeder Animals

Each zoo/aquarium should create a "Vendor Profile" comprised of a list of questions used to evaluate each new feeder species and/or vendor. Employing this recommendation and establishing profiles for the vendor should provide for the humane acquisition and care of feeder animals that meets AZA accreditation standards. Evaluations can include an on-site visit or a directed interview (phone or email) to gather the necessary information to ascertain that the vendor is compliant with all applicable guidelines. Some suggested vendor profile questions are provided below (in part, Watts, 2011). In addition, a useful vendor profile and reference check information is available in the Lincoln Park Zoo Feeder Animal Policy, Appendix C (Franske and Gamble, 2011).

- Are the facilities clean? What do you do to clean and sanitize your facility? What is your cleaning / sanitizing schedule?
- Are the animals held in a safe and humane manner? What guidelines do you follow to ensure this?
- Are the facilities free of vermin and non-prey species? Describe your pest control plan.
- Are you able to meet the zoo's standards for quality animals and care?
- Are the euthanasia practices compliant with the AVMA (2013) guidelines?
- Have there been any credible complaints against the business?
- Are there credible references this business is willing to share?
- Overall, is the business open about sharing their practices and procedures?
- Do you have other animals (feeder or non-feeder) at your facility that could potentially introduce disease to into the zoo population?

Appendix 1. Guideline Reference Housing Summary Chart for Whole Prey Species[1]

Species	**Floor Area/ animal, $in^2(cm^2)$**	**Enclosure height, in(cm)**	**Room Temp C(F) /Humidity**	**Lighting**	**Ventilation**	**Social/behavioral**
Mouse, female + litter[2]	51 (330)	5(12.7)	20-26 (68-79)/ 30-70%	Low intensity, 130-400 lux,	10-15 air changes/hr	Males more aggressive than females/ Provide nesting material, deep bedding for temp. regulation
Guinea pig, <350g[2]	60(387)	7 (17.8)	20-26 (68-79)/ 30-70%	Low intensity, 130-400 lux,	10-15 air changes/hr	Provide shelters, nesting material
Rabbit, <2 kg[1]	18(140)[6]	16 (40.5)	16-22 (61-72)/ 30-70%	Low intensity, 130-400 lux,	10-15 air changes/hr	Provide elevated shelves
Chick[2,3]	14-22 (87-142)	Sufficient for animal to stand erect comfortably with feet on floor	16-27 (61-81)/ 30-70%	diurnal	Depends on room size, # of animals	Flock/Need easily crumbled substrate for forage and grooming
Anolis lizard [4,5]	10 gal tank for 1 + 5 gal per additional lizard	NA	Tank: 24-27 (75-80) with basking at 29-32(85-90); /60-85%	Diurnal, needs UVB	Low air flow, limited air changes per hour	Do not house males together due to aggression. Multiple females acceptable/ Substrate should not cause harm if consumed. Provide perches.
Bullfrog, 150g+[4]	25frogs/m^2	NA	Air temp 25-29(77-84), water pH 4.0-9.5 , highly sensitive to chlorine	Diurnal	Depends on thermal and moisture load of room	Aggression if crowded/need terrestrial and aquatic spaces with non-skid, non-abrasive floor

[1] Toddes, 2006; [2]NRC, 2011; [3]. FASS, 2010; [4] Schaeffer, 1992; [5] McLeod (no date); [6] AVMA (2016) recommends a minimum floor space of 1800 cm^2 per unknown number of individuals.

Appendix 2. Ambient temperature range for safe transportation of common adult research animals.[1]

Species	Ambient temperature range °C (°F)
Mouse	4 to 34 (39 to 93)
Rat	6 to 33 (43 to 91)
Guinea pig	4 to 34 (39 to 93)
Rabbit	7.2 to 27.5 (45 to 85)[2]
Hamster	6 to 34 (43 to 93)
Pig	-20 to 35 (-4 to 95)
Sheep	-12 to 25 (10 to 77)
Goat	-13 to 21 (9 to 70)

[1] USDA, 2013; [2]Institute for Lab Animal Research (ILAR). 2006. The temperature range for rabbits is cited to be maximum 85 °F (27.5 °C) and minimum 45 °F (7.2 °C). When ambient temperature is outside of this range, the shipment has to be accompanied with a certifying statement as described by the USDA (2013).

Appendix 3. Space recommendations for group-transported animals.[1]

	Group Stocking Weight Range		Space Recommendation Range	
Species	lbs	Kg	ft^2	m^2
Mice	0.053-0.077	0.024-0.035	0.04-0.10	0.004-0.009
Gerbils	0.077-0.154	0.035-0.070	0.08-0.18	0.007-0.017
Rats	0.110-0.992	0.050-0.450	0.13-0.89	0.012-0.083
Hamsters	0.110-0.287	0.050-0.130	0.11-0.17	0.010-0.015
Guinea pigs	0.549-1.764	0.249-0.800	0.27-0.53	0.025-0.050
Rabbits	7.915	3.59	1.44	0.134
Swine	10.00-150.00	4.54-68.00	0.70-2.90	0.065-0.269
Sheep (full fleece)	60.00-120.00	27.00-55.00	2.20-3.40	0.210-0.310
Calves	200.00-600.00	91.00-273.00	3.50-8.80	0.032-0.800

[1] ILAR, 2006.

Appendix 4. Reference Euthanasia Chart for Whole Prey Species[1]

Species	Acceptable Euthanasia[2]
Rodent and small mammals (<1 kg)	-CO_2 -Cervical dislocation (< 200 g) -Decapitation using special rodent guillotines with sharp blades (equipment should be clean, in good condition, and sharp blades) -Rapid freezing in liquid nitrogen (furless neonates < 5 days old) - If necessary, manually applied blunt force trauma[3]
Rabbits	-CO_2 (this needs to be paired with an sedative otherwise use as the sole agent will result in distress) -Cervical dislocation -Penetrating captive bolt (equipment specially manufactured for rabbits)
Birds	-CO_2 (neonatal birds require a higher concentration (80-90%) than adults) -Manually applied blunt force trauma to the head that are too large for cervical dislocation -Cervical dislocation has generally been used for small birds (<200 g) when no other method is available but also used on birds up to 2.3 kg -Decapitation is acceptable for birds (<200 g)
Hoofstock	-Penetrating captive bolt (equipment specially manufactured for this size animals) followed by exsanguination or pithing with a pithing rod for captive hoofstock - Gunshot (equipment appropriate for the size of animal) can be targeted to the head [lead has to be removed] -Nursery pigs (70 lb or lighter) - CO_2 (must have exposure to a constant supply of 80-90% gas for a minimum of 5 minutes) or methods described above
Reptiles / Amphibians because it is often difficult to confirm death, the application of two or more procedures is recommended[4,5]	-Where appropriate, CO_2 from a tank of compressed gas (not optimal due to low respiration / breath holding by many species), followed by freezing in the freezer (singular use of the freezer is not acceptable). -For small reptiles < 7g, rapid freezing in liquid nitrogen.[5] -2 step procedures involving rendering the animal unconscious followed by destruction of the brain for all reptiles -Stunning should be preceded by CO_2 anesthesia and followed by decapitation. -Decapitation after unconsciousness also requires destruction of the brain for chelonians -Rapid freezing (except for small reptiles) and pithing are unacceptable unless combined with CO_2 anesthesia.

[1]Primary reference AVMA (2013). All species should be checked/confirmed to be dead; [2]When using CO_2 proper administration of the gas and equipment is needed. The replacement volume of CO2 gas per minute should be 10-30% of total volume per minute. Prefilled chambers are unacceptable. Improper administration of CO_2 can result in inhumane euthanasia. Cervical dislocation and pithing, when used, requires skill, dexterity and training (AVMA, 2013); [3] Method should be evaluated based on anatomic features of species upon which it is performed, skill of those performing it, number of animals to be euthanized, and the environment within which it is conducted. "Replace, as much as possible, manually applied blunt force trauma to the head with alternate methods." (AVMA 2013). [4] Wright, 2001. [5] Georoff, Pers Communication (25 Jul 2014).

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