ASSOCIATION OF ZOOS & AQUARIUMS

OWL
(Strigiformes)
CARE MANUAL

CREATED BY THE
AZA Raptor Taxon Advisory Group
IN ASSOCIATION WITH THE
AZA Animal Welfare Committee

Owl (*Strigiformes*) Care Manual

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Disclaimer: This manual presents a compilation of knowledge provided by recognized animal experts based on the current science, practice, and technology of animal management. The manual assembles basic requirements, best practices, and animal care recommendations to maximize capacity for excellence in animal care and welfare. The manual should be considered a work in progress since practices continue to evolve through advances in scientific knowledge. The use of information within this manual should be in accordance with all local, state, and federal laws and regulations concerning the care of animals. While some government laws and regulations may be referenced in this manual, these are not all-inclusive nor is this manual intended to serve as an evaluation tool for those agencies. The recommendations included are not meant to be exclusive management approaches, diets, medical

treatments, or procedures, and may require adaptation to meet the specific needs of individual animals and particular circumstances in each institution. Commercial entities and media identified are not necessarily endorsed by AZA. The statements presented throughout the body of the manual do not represent AZA standards of care unless specifically identified as such in clearly marked sidebar boxes.

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Introduction

Preamble

AZA accreditation standards, relevant to the topics discussed in this manual, are highlighted in boxes such as this throughout the document (Appendix A).

AZA accreditation standards are continuously being raised or added. Staff from AZA-accredited institutions are required to know and comply with all AZA accreditation standards, including those most recently listed on the AZA website (http://www.aza.org), which might not be included in this manual.

Taxonomic Classification

Table 1. Taxonomic classification for owls

Classification	Taxonomy
Kingdom	Animalia
Phylum	Chordata
Class	Aves
Order	Strigiformes
Family	Tytonidae
	Strigidae

Owl Species Commonly managed in Zoological Institutions

Table 2. Owl species commonly managed in zoological institutions

Genus	Species	Common name
Tyto	*alba*	Barn owl
Phodilus	*badius*	Oriental bay owl
Aegolius	*acadicus*	Saw-whet owl
Asio	*flammeus*	Short-eared owl
Asio	*otus*	Long-eared owl
Athene	*cunicullaria*	Burrowing owl
Bubo	*bubo*	Eurasian eagle owl
Bubo	*lacteus*	Milky eagle owl
Bubo	*sandiacus*	Snowy owl
Bubo	*virginianus*	Great-horned owl
Micrathene	*whitneyi*	Elf owl
Ninox	*boobook*	Boobook owl
Ptilopsis	*leucotis/granti*	White-faced scops owl
Pulsatrix	*perspicillata*	Spectacled owl
Strix	*aluco*	Tawny owl
Strix	*nebulosa*	Great gray owl
Strix	*occidentalis*	Spotted owl
Strix	*uralensis*	Ural owl
Strix	*varia*	Barred owl
Glaucidium	*californicum*	Northern pygmy owl
Glaucidium	*perlatum*	Pearl-spotted owlet
Glaucidium	*brasilianum*	Ferruginous pygmy owl
Megascops	*asio*	Eastern screech owl
Megascops	*kennicottii*	Western screech owl

Genus, Species, and Status

Table 3. Genus, species, and status information for owls

Genus	Species	Common Name	USA Status	IUCN Status	AZA Status
Tyto	*tenebricosa*	Greater sooty owl	-	Least concern	-
Tyto	*multipunctata*	Lesser sooty owl	-	-	-
Tyto	*inexspectata*	Minahassa masked owl	-	Vulnerable	-
Tyto	*nigrobrunnea*	Sula island masked owl	-	Endangered	-
Tyto	*sororcula*	Lesser masked owl	-	Data deficient	-
Tyto	*manusi*	Manus masked owl	-	Vulnerable	-
Tyto	*aurantia*	New Britain masked owl	-	Vulnerable	-
Tyto	*novaehollandiea*	Australian masked owl	-	Least concern	-
Tyto	*castanops*	Tasmanian masked owl	-	-	-
Tyto	*rosenbergii*	Sulawesi masked owl	-	Least concern	-
Tyto	*soumagnei*	Madagascar grass owl	Endangered	Vulnerable	-
Tyto	*alba*	Common barn owl	-	Least concern	-
Tyto	*deroepstorffi*	Adaman masked owl	-	-	-
Tyto	*glaucops*	Ashy-faced owl	-	Least concern	-
Tyto	*capensis*	African grass owl	-	Least concern	-
Tyto	*longimembris*	Eastern grass owl	Under review	Least concern	-
Tyto	*prigoinei*	Congo bay owl	-	-	-
Phodilus	*badius*	Oriental bay owl	-	Least concern	-
Phodilus (Tyto)	*prigoginei*	Congo bay owl	-	Endangered	-
Otus	*sagittatus*	White-fronted scops owl	-	Vulnerable	-
Otus	*rufescens*	Reddish scops owl	-	Near threatened	-
Otus	*thilohoffmanii*	Serendib scops owl	-	Endangered	-
Otus	*icterorhynchus*	Cinnamon scops owl	-	Least concern	-
Otus	*ireneae*	Sokoke scops owl	Endangered	Endangered	-
Otus	*balli*	Andaman scops owl	-	Near threatened	-
Otus	*alfredi*	Flores scops owl	-	Endangered	-
Otus	*spilocephalus*	Mountain scops owl	-	-	-
Otus	*brookii*	Rajah scops owl	-	Least concern	-
Otus	*angelinae*	Javan scops owl	-	Vulnerable	-
Otus	*mentawi*	Mentawai scops owl	-	Near threatened	-
Otus	*bakkamoena*	Indian scops owl	-	Least concern	-
Otus	*lettia*	Collared scops owl	-	-	-
Otus	*lempiji*	Sunda scops owl	-	-	-
Otus	*semitorques*	Japanese scops owl	-	-	-
Otus	*fuliginosus*	Palawan scops owl	-	-	-
Otus	*megalotis*	Philipine scops owl	-	Least concern	-
Otus	*silvicola*	Wallace's scops owl	-	Least concern	-
Otus	*mirus*	Mindanao scops owl	-	Near threatened	-
Otus	*longicornis*	Luzon scops owl	-	Near threatened	-
Otus	*mindorensis*	Mindoro scops owl	-	Near threatened	-
Otus	*brucei*	Pallid scops owl	-	Least concern	-
Otus	*senegalensis*	African scops owl	-	Least concern	-
Otus	*scops*	Eurasian scops owl	-	Least concern	-
Otus	*sunia*	Oriental scops owl	-	Least concern	-
Otus	*flammeolus*	Flammulated scops owl	Status undefined	Least concern	-
Otus	*magicus*	Moluccan scops owl	-	Least concern	-
Otus	*mantananensis*	Mantanani scops owl	-	Near threatened	-
Otus	*elegans*	Ryukyu scops owl	-	Near threatened	-
Otus	*manadensis*	Celebes scops owl	-	Least concern	-
Otus	*siaoensis*	Siau scops owl	-	Endangered	-
Otus	*collari*	Sangihe scops owl	-	Least concern	-
Otus	*beccarii*	Biak island scops owl	-	Endangered	-

Genus	Species	Common Name	USA Status	IUCN Status	AZA Status
Otus	*insularis*	Seychelles scops owl	Endangered	Endangered	-
Otus	*umbra*	Mentaur scops owl	-	Near threatened	-
Otus	*enganensis*	Enggano scops owl	-	Near threatened	-
Otus	*alius*	Nicobar scops owl	-	Data deficient	-
Otus	*pembaensis*	Pemba scops owl	-	Vulnerable	-
Otus	*pauliani*	Grand Comoro scops owl	-	Endangered	-
Otus	*capnodes*	Anjouan scops owl	Endangered	Endangered	-
Otus	*moheliensis*	Moheli scops owl	-	Endangered	-
Otus	*rutilus*	Madagascar scops owl	-	Least concern	-
Otus	*mayottensis*	Mayotte scops owl	-	Least concern	-
Otus	*madagascariensis*	Torotoroka scops owl	-	-	-
Otus	*hartlaubi*	Sao thome scops owl	-	Vulnerable	-
Megascops	*kennicottii*	Western screech owl	-	Least concern	-
Megascops	*seductus*	Balsas screech owl	-	Near threatened	-
Megascops	*cooperi*	Pacific screech owl	-	Least concern	-
Megascops	*asio*	Eastern screech owl	-	-	-
Megascops	*lambi*	Oaxaca screech owl	-	-	-
Megascops	*trichopsis*	Whiskered screech owl	-	Least concern	-
Megascops	*choliba*	Tropical screech owl	-	Least concern	-
Megascops	*koepckeae*	Koepcke's screech owl	-	Least concern	-
Megascops	*roboratus*	Dark-crowned Screech owl	-	Least concern	-
Megascops	*clarkii*	Bare-shanked Screech owl	-	Least concern	-
Megascops	*barbarous*	Bearded screech owl	-	Near threatened	-
Megascops	*ingens*	Rufescent screech owl	-	Least concern	-
Megascops	*colombianus*	Colombian screech owl		Near threatened	-
Megascops	*petersoni*	Cinnamon screech owl	-	Least concern	-
Megascops	*marshalli*	Cloud forest screech owl	-	Near threatened	-
Megascops	*watsoni*	Northern tawny-bellied Screech owl	-	Least concern	-
Megascops	*usta*	Southern tawny-bellied Screech owl	-	-	-
Megascops	*guatemalae*	Guatemalan screech owl	-	Least concern	-
Megascops	*vermiculatus*	Vemiculated screech owl	-	-	-
Megascops	*roraime*	Roraima screech owl	-	-	-
Megascops	*napensis*	Rio Napo screech owl	-	-	-
Megascops	*hoyi*	Montane forest screech owl	-	Least concern	-
Megascops	*atricapilla*	Black-capped screech owl	-	Least concern	-
Megascops	*sanctaecatarinae*	Long-tufted screech owl	-	Least concern	-
Megascops	*nudipes*	Puerto Rican screech owl	*M.n. newtoni*: species of concern	Least concern	-
Megascops	*albogularis*	White-throated Screech Owl	-	Least concern	-
Pyrroglaux	*podarginus*	Palau scops owl	Recovery	-	-
Gymnoglaux	*lawrencii*	Bare-legged Screech Owl	-	Least concern	-
Ptilopsis	*leucotis*	Northern white-faced scops owl	-	Least concern	-
Ptilopsis	*granti*	Southern white-faced scops owl	-	Least concern	-
Mimizuku	*gurneyi*	Giant scops owl	Endangered	Vulnerable	-
Note: All *Nyctea* and *Ketupa* are now placed in *Bubo*					
Bubo	*viginianus*	Great-horned owl	-	Least concern	-
Bubo	*magellanicus*	Magellan horned owl	-	-	-

Genus	Species	Common Name	USA Status	IUCN Status	AZA Status
Bubo	*bubo*	Eurasian eagle owl	-	Least concern	SSP
Bubo	*bengalensis*	Indian eagle owl	-	-	-
Bubo	*ascalaphus*	Desert eagle owl	-	Least concern	-
Bubo	*capensis*	Cape eagle owl	-	Least concern	-
Bubo	*africanus*	Spotted eagle owl	-	Least concern	-
Bubo	*cinerascens*	Vermiculated eagle owl	-	-	-
Bubo	*poensis*	Fraser's eagle owl	-	Least concern	-
Bubo	*vosseleri*	Usambara eagle owl	-	Vulnerable	-
Bubo	*nipalensis*	Forest eagle owl	-	Least concern	-
Bubo	*sumatranus*	Barred eagle owl	-	Least concern	-
Bubo	*shelleyi*	Shelley's eagle owl	-	Least concern	-
Bubo	*lacteus*	Verreaux's eagle owl	-	Least concern	SSP
Bubo	*coromandus*	Dusky eagle owl	-	Least concern	-
Bubo	*leucostictus*	Sooty eagle owl	-	Least concern	-
Bubo	*phillippensis*	Philippine eagle owl	-	Vulnerable	-
Bubo	*balkistoni*	Blakiston's fish owl	-	Endangered	-
Bubo	*zeylonensis*	Brown fish owl	-	Least concern	-
Bubo	*flavipes*	Tawny fish Owl	-	Least concern	-
Bubo	*ketupa*	Malay fish Owl	-	Least concern	-
Bubo	*scandiacus*	Snowy owl	-	Least concern	SSP
Scotopelia	*peli*	Pel's fishing owl	-	Least concern	-
Scotopelia	*ussheri*	Rufous fishing owl	-	Endangered	-
Scotopelia	*bouvieri*	Vermiculated fishing owl	-	Least concern	-
Note: All *Ciccaba* are now placed in *Strix*					
Strix	*seloputo*	Spotted wood owl	-	Least concern	-
Strix	*ocellata*	Mottled wood owl	-	Least concern	-
Strix	*leptogrammica*	Brown wood owl	-	Least concern	-
Strix	*newarensis*	Himalayan wood owl	-	-	-
Strix	*aluco*	Eurasian tawny owl	-	Least concern	-
Strix	*butleri*	Hume's tawny owl	-	Least concern	-
Strix	*occidentalis*	Spotted owl	Threatened	Near threatened	-
Strix	*varia*	Barred owl	-	Least concern	-
Strix	*fulvescens*	Fulvous owl	-	Least concern	-
Strix	*hylophila*	Rusty-barred Owl	-	Near threatened	-
Strix	*rufipes*	Rufous-legged Owl	-	Least concern	-
Strix	*chacoensis*	Chaco owl	-	Least concern	-
Strix	*uralensis*	Ural owl	-	Least concern	-
Strix	*davidi*	Sichuan wood Owl	-	-	-
Strix	*nebulosa*	Great gray owl	-	Least concern	-
Strix	*woodfordii*	African wood owl	-	Least concern	-
Strix	*virgate*	Mottled owl	-	Least concern	-
Strix	*nigroineata*	Black and White Owl	-	Least concern	-
Strix	*huhula*	Black-banded Owl	-	Least concern	-
Strix	*albitarsus*	Rufous-banded Owl	-	Least concern	-
Jubula	*lettii*	Maned owl	-	Data deficient	-
Lophostrix	*cristata*	Crested owl	-	Least concern	-
Pulasatrix	*perspicillata*	Spectacled owl	-	Least concern	SSP
Pulasatrix	*pulsatrix*	Short-browed owl	-	Least concern	-
Pulasatrix	*koeniswaldiana*	Tawny-browed owl	-	Least concern	-
Pulasatrix	*melanota*	Band-bellied owl	-	Least concern	-
Surnia	*ulula*	Northern hawk owl	-	Least concern	-
Glaucidium	*passerinum*	Eurasian pygmy owl	-	Least concern	-
Glaucidium	*brodiei*	Collared owlet	-	Least concern	-

Genus	Species	Common Name	USA Status	IUCN Status	AZA Status
Glaucidium	*perlatum*	Pearl-spotted owlet	-	Least concern	-
Glaucidium	*californicum*	Northern pygmy owl	-	-	-
Glaucidium	*gnoma*	Mountain pygmy owl	-	Least concern	-
Glaucidium	*costaricanum*	Costa Rican pygmy owl	-	-	-
Glaucidium	*cobabense*	Guatemalan pygmy owl	-	-	-
Glaucidium	*hoskinsii*	Cape pygmy owl	-	-	-
Glaucidium	*nubicola*	Cloud forest pygmy owl	-	Vulnerable	-
Glaucidium	*jardinii*	Andean pygmy owl	-	Least concern	-
Glaucidium	*bolivianum*	Yungas pygmy owl	-	Least concern	-
Glaucidium	*palmarum*	Colina pygmy owl	-	Least concern	-
Glaucidium	*sanchezi*	Tamaulipas pygmy owl	-	Least concern	-
Glaucidium	*griseiceps*	Central American pygmy owl	-	Least concern	-
Glaucidium	*parkeri*	Subtropical pygmy owl	-	Least concern	-
Glaucidium	*mooreorum*	Pernambuco pygmy owl	-	Endangered	-
Glaucidium	*hardyi*	Amazonian pygmy owl	-	Least concern	
Glaucidium	*minutissumum*	Least pygmy owl	-	Least concern	-
Glaucidium	*brasilianum*	Ferruginous pygmy owl	-	-	-
Glaucidium	*ridgwayi*	Ridgway's pygmy owl	-	-	-
Glaucidium	*tucumanum*	Chaco pygmy owl	-	-	-
Glaucidium	*peruanum*	Peruvian pygmy owl	-	-	-
Glaucidium	*nanum*	Austral pygmy owl	-	Least concern	-
Glaucidium	*siju*	Cuban pygmy owl	-	Least concern	-
Glaucidium	*tephronotum*	Red-chested Owlet	-	Least concern	-
Glaucidium	*sjostedti*	Sjostedt's owlet	-	Least concern	-
Glaucidium	*cuculoides*	Asian barred owlet	-	Least concern	-
Glaucidium	*canstanopterum*	Javan owlet	-	-	-
Glaucidium	*radiatum*	Barred jungle owlet	-	Least concern	-
Glaucidium	*castanontum*	Chestnut-backed owlet	-	Near threatened	-
Glaucidium	*capense*	African barred owlet	-	Least concern	-
Glaucidium	*albertinum*	Albertine owlet	-	Least concern	-
Glaucidium	*castaneum*	Chestnut owlet	-	Vulnerable	-
Xenoglaux	*loweryi*	Long-whiskered owlet	-	Endangered	-
Micrathene	*whitneyi*	Elf owl	Species of concern	Least concern	-
Athene	*noctua*	Little owl	-	Least concern	-
Athene	*brama*	Spotted owlet	-	Least concern	-
Athene	*blewitti*	Forest spotted owlet	-	-	-
Athene	*cunicularia*	Burrowing owl	Western sub species of concern	Least concern	SSP
Aegolius	*funereus*	Boreal owl	-	Least concern	-
Aegolius	*acadicus*	Northern saw whet owl	-	Least concern	-
Aegolius	*ridgwayi*	Unspotted saw whet owl	-	Least concern	-
Aegolius	*harrisii*	Buff-fronted owl	-	Least concern	-
Ninox	*rufa*	Rufous owl	-	Least concern	-
Ninox	*strenua*	Powerful owl	-	Least concern	-
Ninox	*connivens*	Barking owl	-	Least concern	-
Ninox	*rudolfi*	Sumba boobook owl	-	Near threatened	-
Ninox	*boobook*	Boobook owl	-	-	-
Ninox	*novaeseelandiae*	Morepork	-	-	-
Ninox	*sumbaensis*	Little Sumba Hawk-owl	-	Near threatened	-
Ninox	*scutulata*	Brown hawk owl	-	Least concern	-
Ninox	*affinis*	Andaman hawk owl	-	Near threatened	-
Ninox	*superciliaris*	Madagascar hawk owl	-	-	-

Genus	Species	Common Name	USA Status	IUCN Status	AZA Status
Ninox	*philippensis*	Philippine hawk owl	-	Least concern	-
Ninox	*mindorensis*	Mindoro hawk owl	-	-	-
Ninox	*ochracea*	Ochre-bellied hawk owl	-	Near threatened	-
Ninox	*ios*	Cinnabar hawk owl	-	Vulnerable	-
Ninox	*burhani*	Togian hawk owl	-	Near threatened	-
Ninox	*squamipila*	Moluccan hawk owl	-	Least concern	-
Ninox	*natalis*	Christmas island hawk owl	-	Vulnerable	-
Ninox	*theomacha*	Sooty-backed hawk owl	-	Least concern	-
Ninox	*meeki*	Manus hawk owl	-	Least concern	-
Ninox	*punctulata*	Speckled hawk owl	-	Least concern	-
Ninox	*variegate*	Bismarck hawk owl	-	Least concern	-
Ninox	*odiosa*	New Britain hawk owl	-	Vulnerable	-
Ninox	*jacquinoti*	Solomon Islands hawk owl	-	Least concern	-
Uroglaux	*dimorpha*	New guinea hawk owl	-	Data deficient	-
Sceloglaus	*albifacies*	Laughing owl	-	-	-
Pseudoscops	*grammicus*	Jamaican owl	-	Least concern	-
Asio	*clamator*	Striped owl	-	Least concern	-
Asio	*stygius*	Stygian owl	-	Least concern	-
Asio	*otus*	Long-eared owl	Species Of Concern	Least concern	-
Asio	*abyssinicus*	Abyssinian long-eared owl	-	Least concern	-
Asio	*madagascariensis*	Madagascar long-eared owl	-	Least concern	-
Asio	*flammeus*	Short-eared owl	Hawaiian sub sp. Species of concern	Least concern	-
Asio	*capensis*	African marsh owl	-	Least concern	-
Nesasio	*solomonensis*	Fearful owl	-	Least concern	-

*(Information gathered from IUCN, ESA, and AZA websites.)

General Information

The information contained within this Animal Care Manual (ACM) provides a compilation of animal care and management knowledge that has been gained from recognized species experts, including AZA Taxon Advisory Groups (TAGs), Species Survival Plan® Programs (SSPs), biologists, veterinarians, nutritionists, reproduction physiologists, behaviorists and researchers (visit the AZA Animal Program page to contact these individuals). It is based on the most current science, practices, and technologies used in animal care and management and is a valuable resource that enhances animal welfare by providing information about the basic requirements needed and best practices known for caring for *ex situ* owl populations. This ACM is considered a living document that is updated as new information becomes available and at a minimum of every five years.

Information presented is intended solely for the education and training of zoo and aquarium personnel at AZA-accredited institutions. Recommendations included in the ACM are not exclusive management approaches, diets, medical treatments, or procedures, and may require adaptation to meet the specific needs of individual animals and particular circumstances in each institution. Statements presented throughout the body of the manuals do not represent specific AZA accreditation standards of care unless specifically identified as such in clearly marked sidebar boxes. AZA-accredited institutions which care for owls must comply with all relevant local, state, and federal wildlife laws and/or regulations; AZA accreditation standards that are more stringent

AZA Accreditation Standard

(1.1.1) The institution must comply with all relevant local, state/provincial, and federal wildlife laws and/or regulations. It is understood that, in some cases, AZA accreditation standards are more stringent than existing laws and/or regulations. In these cases, the AZA standard must be met.

than these laws and/or regulations must be met (AZA Accreditation Standard 1.1.1).

The goal of this ACM is to facilitate excellent owl management and care, which will ensure superior owl welfare at AZA-accredited institutions. Ultimately, success in our owl management and care will allow AZA-accredited institutions to contribute to owl conservation and ensure that owls are in our future for generations to come.

Owls are found on every continent except Antarctica and have evolved into many different niches. Most owls are crepuscular or nocturnal, but there are diurnal species. Owls live in all temperature ranges from the snowy owl (*Bubo scandiacus*) in the frigid latitudes of the north, to the burrowing owl (*Athene cunicularia*in) in the furnace heat of the deserts. Despite these variations, owls generally have much the same needs in zoological institutions; therefore, the families and species are grouped together in these guidelines, with the known similarities and differences between them highlighted.

Owls are predators and will eat insects, bats, fish, crabs, birds, small mammals, and sometimes even other owls, depending on the species. Owl species tend to nest in burrows, cavities in trees, or open nests commandeered from other species. Generally, owls are monogamous, at least within a breeding season. Owls are often very vocal, especially pairs when duet calling. Expected lifespans may be as short as 5 years or well into the 40-year range. There are thought to be at least 200 species of owls, although this figure is revised regularly as new research is carried out, and they can range in size from the giant-sized eagle owls weighing up to 4 kg to the tiny 40 g elf owl (*Micrathene whitneyi*) (Kemp & Calburn, 1987). A group of owls is usually referred to as a "parliament." Other less common group names include bazaar, brood, congress, diss, eyrie, glaring, hooting, looming, nest, sagaciousness, stare, stooping, wisdom, silence, stable, jail, prohibition, schizophrenia, volery, and blizzard. Young owls are called owlets, but there are some smaller species of owls that are also commonly called owlets in adulthood such as the pearl-spotted owlet (*Glaucidium perlatum*).

Owls can be characterized by having large, forward-facing eyes; a downward pointing hooked bill with a cere (fleshy nares) at the base; and large, curved, sharp talons on the ends of their toes that are zygodactyl. These morphological characteristics are the result of adaptations as a predator with nocturnal habits. Owls have little or no sense of smell and will rely primarily on their aural and visual senses. Their ear design has evolved to be extremely efficient at picking up and pinpointing the sources of sound. As a result, hearing is the primary sense used to locate prey. Experiments have shown that barn owls (*Tyto alba*) can catch mice in complete darkness, and great gray owls (*Strix nebulosa*) can catch small mammals moving in runways under a blanket of snow and ice, by hearing and pinpointing the source of sound (Mikkola, 1983). Some owl species such as screech owls (Strigidae) and great-horned owls (*Bubo virginianus*) have "ear tufts." These are not actually ears or even associated with hearing; instead, they are feathers that can be raised or lowered dependent on the bird's attitude.

Additionally, owls have a very good sense of vision and can find their way readily in full daylight as well as in the dark. In the far Northern Hemisphere, some owls—such as the snowy owl and Eurasian pygmy owl (*Glaucidium passerinum*)—have little or no dark hours to hunt in during the summer months, while the reverse is true in the winter. Owls have binocular vision that enables depth perception and precise distance judgment. The eyes cannot rotate in their orbits, but excellent overall visual coverage is achieved with the owl's ability to rotate its head through 270°. Improved vision at low light levels is achieved by having very large pupils to maximize the eyes' light gathering capacity. The retinal structure has more rod than cone receptors, so although color vision is poor, nighttime visual acuity is enhanced accordingly (Del Hoyo et al., 1999). The unique anatomy of the owl's eye predisposes it to intraocular trauma, such as detached retinas from impact injuries, because of the inability of the eye to absorb the force (J. Sikarskie, personal communication, 2008).

Native owls of North America are considered migratory species and are protected by federal law. All owls, native and exotic, are at least considered CITES II. Federal laws are enforced by the United States Fish and Wildlife Service (USFWS). Presently, the United States Department of Agriculture (USDA) does not inspect collections of birds, including owls, in the same manner it does for mammals. This is expected to change at some point in the future. States often have laws governing the transport of birds, including owls, into and out of their borders, usually enforced by their department of natural resources or commission. Each state's regulations may vary; check with other state laws before sending any birds out of state.

For information on the description and natural history of the two main families (Tytonidae and Strigidae), please refer to Parry-Jones & Ferguson (2003) and Sarro (2004).

Chapter 1. Ambient Environment

1.1 Temperature and Humidity

The animals must be protected or provided accommodation from weather, and any adverse conditions. (AZA Accreditation Standard 1.5.7). Animals not normally exposed to cold weather/water temperatures should be provided heated enclosures/pool water. Likewise, protection from excessive cold weather/water temperatures should be provided to those animals normally living in warmer climates/water temperatures.

AZA Accreditation Standard

(1.5.7) The animals must be protected or provided accommodation from weather or other conditions clearly known to be detrimental to their health or welfare.

Temperature: Owl body temperature varies between 39–41 °C (102.2–105.8 °F) (Kemp & Calburn, 1987). There appear to be diurnal cycles in body temperature, with the highest temperature being reached just before dawn (Fowler, 1986). It is important to consider the climatic conditions the species would be exposed to in its natural habitat and ensure that the enclosure location and design meet these requirements.

Owls can be divided into cold hardy and non-cold hardy groups. In general, the species' natural history will determine if the bird is capable of handling outdoor temperatures in particular zoo and aquarium environments. More northern-climate species, such as great-horned, Eurasian eagle, burrowing, barn, and screech owls, can easily handle temperatures down to freezing and below if windbreaks and covered areas are provided. Other more southern or tropical species, such as spectacled owls (*Pulsatrix perspicillata*) and Verreaux's eagle owls (*Bubo lacteus*), are much less cold hardy. With temperatures below 7.2 °C (45 °F) they should be moved indoors or provided with heated shelters located high in the exhibit. Care should be taken to ensure that the birds are actually using these shelters and that there is enough personal space for each individual, so they do not feel crowded by cage mates. If unsure, err on the side of caution and bring the birds indoors. Snowy owls have the reverse concern, and while they have evolved to handle extreme cold, they cannot handle hot and humid conditions. For southern zoos, this species may not be the best choice.

Table 4. Common owl species and their corresponding temperature ranges (as cited in Parry-Jones 1998).

Common Name	Temperature Range
Barn owl	+/- 0–29.4 °C (+/- 32–85 °F)
Oriental bay owl	+/- 0–29.4 °C (+/- 32–85 °F)
Saw-whet owl	+/- 0–29.4 °C (+/- 32–85 °F)
Short-eared owl	+/- 0–29.4 °C (+/- 32–85 °F)
Long-eared owl	+/- 0–29.4 °C (+/- 32–85 °F)
Burrowing owl	+/- 0–29.4 °C (+/- 32–85 °F)
Eurasian eagle owl	+/- 0–29.4 °C (+/- 32–85 °F)
Verreaux's eagle owl	+/- 7.2–32.2 °C (+/- 45–90 °F)
Snowy owl	+/- -17–21.1 °C (+/- 0–70 °F) (easily overheated)
Great-horned owl	+/- 0–29.4 °C (+/- 32–85 °F)
Elf owl	+/- 7.2–32.2 °C (+/- 45–90 °F)
Boobook owl	+/- 7.2–29.4 °C (+/- 45–85 °F)
White-faced scops owl	+/- 7.2–32.2 °C (+/- 45–90 °F)
Spectacled owl	+/- 7.2–32.2 °C (+/- 45–90 °F)
Tawny owl	+/- 0–29.4 °C (+/- 32–85 °F)
Great gray owl	+/- 0–21.1 °C (+/- 32–70 °F)
Spotted owl	+/- 0–29.4 °C (+/- 32–85 °F)
Ural owl	+/- 0–29.4 °C (+/- 32–85 °F)
Barred owl	+/- 0–29.4 °C (+/- 32–85 °F)
Northern pygmy owl	+/- 0–29.4 °C (+/- 32–85 °F)
Pearl-spotted owlet	+/- 7.2–32.2 °C (+/- 45–90 °F)
Ferruginous pygmy owl	+/- 0–29.4 °C (+/- 32–85 °F)
Eastern screech owl	+/- 0–29.4 °C (+/- 32–85 °F)

Cold weather: Although most owls can often withstand a cold environment, it is important to ensure that birds can regulate their body temperatures and are properly acclimatized to all weather conditions. Aviaries should face away from cold prevailing winds and exposed areas. If this is not possible, non-migratory, cold tolerant species from more northern climes should be housed there. In regions that have

extreme cold, heated shelters may be a good option for the birds to get supplemental heat. Some species of owls are reported to have lower body temperatures at night compared to the day (e.g., burrowing owls, snowy owls, and short-eared owls [*Asio flammeus*]), when exposed to cold arctic weather. It has been suggested that this is an energy saving device like the torpor seen in Caprimulgidae (e.g., nightjars, frogmouths) (Fowler, 1986).

Species that come from hotter climates may require more sheltered enclosures or extra forms of heating in the winter months. Tropical species can be susceptible to damp conditions and frostbite. An overhead heat-lamp, with all wires protected and positioned so birds cannot reach the actual hot bulb, can be used in a sheltered area for species such as pearl-spotted owlets, ferruginous pygmy owls (*Glaucidium brasilianum*), African wood owls (*Strix woodfordii*), and most of the scops owls (*Otus*).

As a guide, supplemental heat should be provided for cold-intolerant species when outdoor temperatures drop below 7.2 °C (45 °F). (Remember that certain heaters add supplemental light so keep this in mind as to not disrupt circadian rhythms) If temperatures drop lower consistently, it may be wise to move the birds into a heated enclosure or relocate them indoors. Individual bird personalities and aggression potentials should be considered when enclosing any multi-bird group. Under-perch heaters, such as low voltage electric heaters used in greenhouses or to stop pipes from freezing, can also be used as it is often the feet of the birds that are most susceptible to cold. Again, all electrical cables should be hidden, covered, well protected, and checked regularly. It is important to keep the heating element, especially heat bulbs, protected from tactile impacts by the birds, and at least 30.4 cm (12 in.) from the top of the birds' heads. Birds that are continually fluffed in appearance, shivering, and/or not gripping their perch well with their feet, provide indications that the bird is at risk of frostbite and associated cold intolerance.

Multiple sheltered areas for the birds should be provided within all owl enclosures. Care should be taken to provide sufficient shelter, safe havens, and warmth for all the individuals. Shelters for many of the species may be three-sided with a covered roof and heating unit under the roof. Shelter size is directly related to the species, and a good rule of thumb is to give each bird enough perch space to spread its wings without touching another bird or the shelter side. Until pair bonds are formed, which can take several years and sometimes never happens, some individual owls will not share perches or shelters. If there is only one area providing shelter and warmth this can compromise the health and well-being of a subordinate individual if a more dominant bird refuses to allow it to share the space.

Warm weather: Consideration should be given to providing protection from exposure to strong sunlight in very warm weather for certain species, such as the snowy owl and other more northern species. These species will overheat and display increased panting, drooped wings, and decreased appetite. When exposed to heat, owls have a couple of methods of thermoregulation, including panting and a "gular flutter," which increases airflow over the oral surfaces thus increasing cooling by evaporation (Fowler, 1986). All species should be provided with "hide" areas where they can get out of direct sunlight. Windbreaks, shelters, and heavy plantings will help with this. Shelters should be designed to have good ventilation, but without drafts. A summer shelter can be like the winter shelter but may have additional ventilation in the sides and back. The roofing material used, such as shingles or exterior non-toxic paint, should be light-colored to prevent excessive buildup of heat in the summer. Additional approaches that can be used to help prevent heat stress are fans that move air around the exhibit, opportunities for the owls to bathe, and a light misting system to lower the exhibit temperatures. If the birds remain heat-stressed, it may be wise to relocate the bird to an indoor cooler environment.

Humidity: *In situ* populations of owls experience a variety of humidity ranges depending on the season and their location; however, an optimal humidity range has not been scientifically demonstrated for *ex situ* populations. In zoos and aquariums, great care should be taken to ensure that owls are provided the ability to always regulate their own body temperatures through their behavior. Systems employed to raise or lower humidity within indoor exhibits include air conditioning, dehumidifiers, misters, sprinklers, and fans. Outdoor exhibits should always have adequate shade opportunities and access to fresh water. The owls can self-select the spot in the outdoor exhibit which is most comfortable for them. Be mindful of potential perching locations the owls would use versus those that have associated external stressors such as proximity to the public.

All owls that are compromised by age, illness, or active reproductive status should be managed similarly as healthy adults, but additional attention to supplemental heat or cold and ambient weather conditions is warranted. These "compromised" individuals may need extra care.

AZA institutions with exhibits which rely on climate control must have critical life-support systems for the animal collection and emergency backup systems available. Warning mechanisms and backup systems must be tested periodically (AZA Accreditation Standard 10.2.1).

> **AZA Accreditation Standard**
>
> **(10.2.1)** Critical life-support systems for the animals, including but not limited to plumbing, heating, cooling, aeration, and filtration, must be equipped with a warning mechanism, and emergency backup systems must be available. Warning mechanisms and emergency backup systems must be tested periodically.

Climate control systems can include, but are not limited to, the following items: HVAC system, heat exchanger, air handling unit, chiller, furnace, or boiler system, and the computer hardware to run the system. It is important that these systems have back-up protocols including temporary generators, fully up-to-date preventative maintenance protocols, and trained personnel to manage these programs and associated equipment. These should be on-file in animal areas and/or maintenance departments and/or on a computer network.

1.2 Light

Careful consideration should be given to the spectral, intensity, and duration of light needs for all animals in the care of AZA-accredited zoos and aquariums.

Most owls are nocturnal or crepuscular. Even if aviaries are completely roofed, they should still be light and airy. Painting the back wall of pens with a white or light-colored non-toxic paint will maximize light levels. For most species, normal daylight hours are adequate. Even species that have dramatic, seasonally based photoperiod changes, such as snowy owls, do well with more southern photoperiods. For indoor exhibits, it is advisable to provide a gradual change in light levels in the morning and evening. For indoor lighting, a broad-spectrum light is suggested.

Owls are generally inactive during the day, with a few exceptions. Burrowing owls are diurnally active, although they will perch for most of the day. In certain cases, providing food to owls may elicit activity regardless of the light levels. This is more of an individual characteristic and not a broad generalization for all owls.

Daily changes in lighting are not a real necessity. However, for some species it may be necessary to alter the duration of the light cycle to stimulate reproduction. This varies between species and more information is needed for many of the more unique species found in zoo collections. In the absence of specific information, utilizing the natural history of the species is the best approach for determining proper light cycles.

1.3 Water and Air Quality

AZA-accredited institutions must have a regular program of monitoring water quality for aquatic animals and a written record must document long-term water quality results and chemical additions (AZA Accreditation Standard 1.5.9). Monitoring selected water quality parameters provides confirmation of the correct operation of filtration and disinfection of the water supply available for the collection. Additionally, high quality water enhances animal health programs instituted for aquatic collection.

> **AZA Accreditation Standard**
>
> **(1.5.9)** The institution must have a regular program of monitoring water quality for fish, marine mammals, and other aquatic animals. A written record must be maintained to document long-term water quality results and chemical additions.

Air quality: As previously stated, if owl structures are completely roofed, they should still be light and airy. Ventilation is highly important because it reduces the risk of a build-up of pathogens. An indoor air exchange of 5–10 times per hour is an acceptable rate (S. Sarro personal communication, 2007). Air filtration is highly critical for the snowy owl, where additional air filtration for indoor exhibits is suggested to limit fungal contamination. Otherwise, air filtration is not critical for most species. Indoor exhibits should have good HVAC equipment that provides for clean air and adequate circulation. All ductworks should be inspected regularly for debris and removed as needed. Filters should be periodically replaced as per equipment recommended maintenance.

Water quality: Potable water should be provided to all owls, and all water sources should meet standard facility water quality requirements. Owls generally do not drink a great deal; however, clean, fresh drinking water should be provided daily. Plastic and rubber water containers are better than metal

because feathers and toes have the potential to become stuck on frozen metal pans. Water containers should be located on the ground and away from perching to prevent fouling from feces. Deep baths increase the risk of drowning, especially for young birds; a depth of 1.2–2.5 cm (0.5–1 in.) for smaller species, and 5–7.6 cm (2–3 in.) for larger species, is recommended.

Water should be potable and acceptable for human consumption. Regular testing of water, especially well water, may be indicated to ensure potability. Water quality may be checked regularly for bacteria, mineral content, and other contaminants. Generally, water testing is not done due to the water utilized from public water systems approved for human consumption.

1.4 Sound and Vibration

Consideration should be given to controlling sounds and vibrations that can be heard by animals in the care of AZA-accredited zoos and aquariums.

Owls have incredible hearing and do react to sounds and vibrations. Their frequency range appears to be like humans, but more acute to frequencies of some sounds such as slight forest floor movement, animal vocalizations, and substrate rustling. In general, owls appear adaptable to auditory stimuli within their environments and can acclimate to new noises and vibrations that are slowly introduced and associated with positive stimuli. However, noise can be a stressor, so alerting zoo staff and creating awareness to ambient noise, either chronic or acute, is extremely important. New sounds and/or sources of vibrations (e.g., generators, water filters, construction noise, concerts, etc.), and activities that may create chronic or acute auditory stressors, should be eliminated, or minimized especially during sensitive animal management periods such as animal introductions, nesting, chick rearing, the arrival of animals in quarantine, and when animals are ill or infirm. Additional research on stress related issues within the hearing range of owls is needed.

Chapter 2. Habitat Design and Containment

2.1 Space and Complexity

Careful consideration should be given to exhibit design so that all areas meet the physical, social, behavioral, and psychological needs of the species. Animals must be well cared for and presented in a manner reflecting modern zoological practices in exhibit design (AZA Accreditation Standard 1.5.1). All animals must be housed in safe enclosures that meet their physical and psychological needs, as well as their social needs. (AZA Accreditation Standard 1.5.2, 1.5.2.1, 1.5.2.2).

AZA Accreditation Standard

(1.5.1) All animals must be well cared for and presented in a manner reflecting modern zoological practices and philosophies, exhibit design, balancing animals' welfare requirements with aesthetic and educational considerations.

Most owls require individual territories when breeding in the wild. In zoos and aquariums, adequate shelter and perching should be available for each bird. This means providing separate enclosures for each potential breeding pair. Large, naturalistic enclosures are recommended, but care should be taken to provide sufficient shelter, safe havens, and warmth for all individuals. Aviaries that are being used for several species (see Chapter 4.2) should be spacious enough to house the individuals without inciting aggression. Over-crowding can cause significant problems such as stress. Aggression between owls will manifest itself in many ways, from simple displacement and chasing, to direct challenges and physical talon contact. Exaggerated upright postures, body bobbing, wings spread, head down posture with wings fanned, repetitive head movement from side-to-side, triangulation, and direct staring from bird to bird are all indicators of potential stress and aggression.

AZA Accreditation Standard

(1.5.2.1) All animals must be kept in appropriate groupings which meet their social and welfare needs.

AZA Accreditation Standard

(1.5.2.2) All animals should be provided the opportunity to choose among a variety of conditions within their environment.

Enclosure design: Since pinioning or wing clipping are not recommended for any of the Strigiformes (see Chapter 8.1), aviaries with enclosed tops are needed to prevent birds from escaping. Non-releasable, rehabilitated birds may not need a covered enclosure due to flight restricting injuries, but protection from avian and terrestrial predators is still very important (see Chapter 2.2). Keep in mind that physically imperfect owls, such as those from rehab, may not be able to access higher perching without lower branches to utilize as a lower for higher exhibit access.

High enclosures should be long enough for birds to fly safely between high perches and the ground, particularly for the larger, clumsier birds. The exhibit length allows birds to slow down their flight and land gently, thus avoiding bruising to the feet.

Once the shell of an enclosure has been built, it then needs to be furnished with perches, nest areas, retreats, a bath, plants, and feed stations. The arrangement of these will influence how much of the aviary space is available for the birds to use. Plants give cover within enclosures, and can be planted in pots, buried in the substrate, and also placed where they can be easily watered from the outside. However, the unchecked growth of undesirable undergrowth, especially weed species, can be dangerous for the smaller owl species in wet, cold weather. Birds may get into the undergrowth, get wet and become tangled, unable to get off the damp floor. They are then susceptible to hypothermia.

Young birds leaving the nests that are not yet strong flyers are often at risk for leg injuries as they may have not yet learned to hold their legs up and parallel to their bodies. They can fall from branches or get tangled in plant material. There are specific grassland species adapted for slow, low growth, and investigation into these is recommended. While keeping sand under the perch areas, using ground cover plants such as winter heathers, *Pachysandra* spp. or similar plantings, will allow for natural appearances without high growth of vegetation. A variety of plants can be used to landscape aviaries to emulate different types of habitats (Sayers, 1997). Additionally, all enclosures should be built with places to hide that allow the birds to get away from human attention. These areas can be built into the exhibit, such as an L-shaped addition, or provided by the creative plantings of shrubs and trees.

Enclosures that are housing birds with breeding as the top priority should incorporate design features that allow monitoring and feeding with minimal disturbance. For instance, nest ledges or boxes should be placed on solid walls with keeper access permanently available, as well as viewing panels, cameras, or viewing holes for intensive monitoring purposes.

Many owls are naturally nervous so at least one side of the enclosure, preferably two, should be constructed of a solid material to ensure the birds have a feeling of security. This also allows for keepers

to approach for husbandry purposes without being seen by the birds. Care should be taken to avoid startling the birds, as this can result in injury. Signs that owls are nervous include performing quick, erratic flights or specific territorial behaviors such as directed flight toward caretakers. In response, windbreak tarps (or a similar product) can be stretched across the inside of the wire using battens, providing an inside barrier that the birds can fly into without incurring any physical harm. Persistently nervous or territorial birds should be relocated to a quieter location. Some species or individual birds are particularly nervous, and often become more settled if they can hide in provided areas, away from the viewing public. When designing and locating an exhibit, the background noise of the planned area should be kept in mind. Areas subjected to chronic noise (e.g., generators) and acute loud auditory events (e.g., fireworks or concert arenas) should be avoided for owl exhibits.

Enclosure substrates: Concrete floors should be covered with a suitable material such as sand, pea gravel, or mulch. A concrete floor that slopes down to a drain should be covered with at least 10 cm (4 in.) of suitable substrate. The concrete is easy to clean and can be disinfected and scrubbed after removal of the substrate in case of infection. Additionally, sand absorbs droppings well, is easy to rake and keep clean, and will absorb rainwater if drainage is sufficient. Pea gravel can also be hosed to keep it clean.

Bark mulch is another option. On one hand, it looks natural and provides a soft landing for birds. However, it can harbor spores of the fungus *Aspergillus*, which can lead to fungal infection in birds. For this reason, its use is controversial. However, bark mulch will not present a significant risk if the mulch quality is good, used in well-ventilated aviaries (i.e., outside), raked over regularly, and replaced annually. Owl species that spend a larger proportion of their time on the ground (e.g., grass owls [*Tyto*], marsh owls [*Asio capensis*], short-eared owls, and burrowing owls) may succumb to health problems including respiratory and systemic infections if they constantly must land on hard, cold, wet, or muddy floors. Substrates provided for dustbathing such as sandy soil, or the clay-sandy soil mix provided to burrowing owls for burrowing, should be sheltered from the rain whenever possible. An artificial burrow and nest box will prevent the possibility of a natural burrow collapse. To prevent escape, a containment barrier should also be used under the ground (see Chapter 2.2).

Water features: As stated in Chapter 1.3, owls generally do not drink a great deal; however, there should be clean, fresh, drinking water provided daily. Plastic and rubber water containers should be used rather than metal because of the metal's propensity to freeze in the winter. Water containers should be located on the ground and away from perching to prevent fouling from feces.

Bathing water should also be available. Water sources for bathing should be at least as large as the length of the bird's body to allow enough room to bathe sufficiently, with a depth of 1.2–2.5 cm (0.5–1 in.) for smaller species, and 5–7.6 cm (2–3 in.) for larger species, with a non-slip surface (e.g., brush-finish concrete). Baths in enclosures for *ex situ* breeding are best situated so they can be cleaned and filled without keepers entering the enclosure (i.e., on an outside wall with an access door). Baths should be cleaned out at least once a week in winter, and possibly daily during the summer months when green algae can build up very quickly. It is recommended that baths are located under a roofed area, so droppings from wild birds cannot contaminate the water. If hoses are used to fill baths, the water should be run long enough so that it is fresh as bacteria can build-up in the hose.

Enclosure complexity: Care should be taken to provide sufficient shelter, safe havens, perches, water features, and feeding stations for all the individuals. This means duplication of exhibit furniture and resources may be necessary until individuals are comfortable with each other. Until pair bonds are formed, which can take several years (and sometimes never happen), some owls will not share perches or shelters. If there is only one area providing shelter and warmth, this can compromise the health and well-being of a subordinate individual. This behavior can also manifest itself even in previously compatible pairs. In general, owls will often perform their normal feeding, bathing, and exhibit exploration as individuals and not in pairs.

Altering the perching and shrub arrangement in the aviary on an annual basis will stimulate the bird to explore, but some of the primary perching should remain constant. Other owls calling (or tape recordings) nearby might also serve to enrich the owls' environment and stimulate vocalizations. However, playing recordings of larger species of owls for smaller species of owls (e.g., great-horned owl recordings for screech owls) may become stressful, as the smaller species of owl can be prey species for larger owl species.

Enclosure size: The following are suggested minimum sizes for aviaries holding a pair of birds together, with the wingspan of the birds:

Table 5. Minimum enclosure size recommendations

Size of owl	Wingspan	Enclosure dimensions (L x W x H)
Eagle owls and other large owls	1.5–2 m (4.9–6.6 ft)	6 m x 4 m x 3.7 m (19.7 ft x 13.1 ft x 12.1 ft)
Medium sized owls	1–1.5 m (3.3–4.9 ft)	3.7 m x 3 m x 3 m (12.1 ft x 9.8 ft x 9.8 ft)
Small owls	0.3–0.5 m (1–1.6 ft)	2.5 m x 1.5 m x 2.2 m (8.2 ft x 4.9 ft x 7.2 ft)

An acceptable enclosure size equals three to four times the wingspan of a bird. Non-releasable, non-flighted, rehabilitated birds will require less space, but the dimensions provided in Table 5 are acceptable for these birds as well. Birds that are utilized in education programs may be housed in mews, which are smaller than exhibits for breeding birds. Mew size for ambassador birds is recommended to be a minimum of 2x the wingspan (length) by 2x the wingspan (width) by 2x the length of the bird (height). Managing ambassador owls has different special needs that those for exhibit animals. In general, there is much less exhibit space needed in a mew than in a typical exhibit. This is done for the overall health of the owl whose purpose and training is different than for exhibit owls.

Species-appropriate behavior: All owls food-hunt with their talons; even the smallest owl species have very powerful feet. A variety of hunting methods used in the wild can be promoted in zoos and aquariums.

Ambush hunting: “Ambush” hunting involves the animal finding a good vantage point and sitting quietly, watching, and listening for prey. Many owls, such as eagle and barred owls, hunt their prey using this technique. Once food is located, the bird swiftly launches into the air, and makes a swift grab with its feet. Perches overlooking feeding stations are recommended for these species.

Quartering/constant flight: Quartering/constant flight is a hunting technique in which owls quarter the ground in a low, steady, and methodical flight, watching and listening for the movement of mice, voles, insects, or reptiles in the grass or cover below them. Owls of the open country, such as barn owls, grass owls, and short-eared owls, use this practice.

Locomotion: Flight is the normal mode of owl locomotion, and they will generally fly from perch to perch. Occasionally, they will circle within an exhibit when disturbed. Owls will sometimes walk on the ground, landing near water sources and prey items, approaching them on foot.

Roosting: Most owls spend their inactive daylight hours roosting, hidden in dense cover such as ivy, pressed up against the trunk of a tree, or tucked away in holes or crevices. Vegetation, hideaways, ledges, and crevices are critical to ensure that owls feel comfortable within their space. It is recommended to have nest areas under cover to provide security and shelter and a place to get out of the elements.

Perching: Providing enough high perches for each bird is essential; owls generally feel more secure on higher perches, especially perches higher than 2.1 m (7 ft) or “people height,” although lower perching for use as steps to get to the higher perching is essential (Sayers, 1997). There should be enough open space surrounding the perches for large birds to land easily, avoiding contact with enclosure structures. Perches of differing diameters provide valuable gripping exercise for the birds, and the irregular shapes lessen the chance of pressure sores or bumble foot occurring. Perches made of a variety of materials can also help prevent the development of foot maladies. Some perches can even be made less stable, but still safe, to approximate wobbling, which happens in the wild. Allowing the perches to wobble when a bird lands on it makes the owl work a little harder to balance and grip onto the perch, allowing the owl to maintain proper leg and foot fitness. Perches should be horizontal or vertical, set at a variety of heights, and positioned with a space of 0.9–1.2 m (3–4 ft) between perches to make maximum use of aviary space and encourage the birds to exercise. These recommendations are for fully flighted birds; perches should be placed closer together for birds in rehabilitation that have poor or limited flight capability.

It is not recommended that perches be placed across corners because this may lead to the flight feathers becoming damaged as they fly into and out of the corners. Perches sited away from walls make for better visibility and better feather condition on the birds. Good perches with plenty of branches should be placed close to nest areas so that young birds have a place to hop to for their first flight. With age, wooden perches season and the timber can get very hard and slippery. It is recommended to monitor perch conditions and change them when necessary. Metal perches should not be used, as they get very hot and cold with the prevailing weather conditions.

Nesting: When planning to breed owls, it is essential to check the literature to ascertain the preferred nest site for the species in the wild, and then provide a similar alternative (König et al., 1999). See Chapter 6.2 for more information on recommended nest management.

More specifically, burrowing owls use burrows (either natural or man-made) for nesting, as well as a secure place to roost. They will dig their own burrows, or PVC pipes can be installed within the exhibit for them to use. Effective designs have included 15.2 cm (6 in.) PVC tubes (4–45.7 cm [10–18 in.] in length) sloping at about 20°, ending in a nesting chamber roughly 25.4 cm x 25.4 cm x 25.4 cm (10 in. x 10 in. x 10 in.), which can be made of wood or plastic. Providing traction within the PVC tubes should prevent slipping. The nesting chamber can be partially buried or covered with soil and the owls will likely perch on this mound.

Enclosure cleaning: Whatever substrate material is used; enclosure floors should be kept as clean and dry as possible. Old food in enclosures should be removed each morning and disposed of daily unless breeding is going on. Many owls will cache or hide their food to be eaten later, but generally all uneaten food should be removed daily.

Ideally, each enclosure should be completely cleaned at least once a year; about 6–8 weeks before the start of the breeding season is a recommended time. The birds should be caught and placed in a dark appropriately-sized box that is lined with carpet and left somewhere quiet and cool (between 7.2–21.1 °C [45–70 °F]) while their enclosure is cleaned, disinfected, and inspected. (This capture also offers the perfect opportunity for a complete health check.) Ideally, the owls should be trained to enter a kennel or box through operant condition so that actual contact capture is not needed. Owls should not spend more than 12 hours in a box without being fed. Nest boxes should be cleaned, inspected, and made ready for the next breeding season (see Chapter 7.2). Once the enclosure is cleaned and ready, the birds can be returned. If some of the perches and other furniture have been changed, make sure the location of any favorite perching spots is kept constant to prevent poor landings and potential injury. Natural substrate exhibits like burrows may be more of a challenge to clean annually. Sampling soil for pathogens may indicate the need for treatment or replacement. Veterinarians should be consulted for direction.

The same careful consideration regarding exhibit size and complexity and its relationship to the owls' overall well-being must be given to the design and size of all enclosures, including those used in exhibits, holding areas, hospital, and quarantine/isolation (AZA Accreditation Standard 10.3.3). Sufficient shade must be provided by natural or artificial means when sunlight is likely to cause overheating or discomfort to the animals (AZA Accreditation Standard 10.3.4).

Generally, owls will sit near their mates, yet often not in contact as seen in many other avian species. Non-pair bonded cage mates will usually keep a distance from each other. Usually, age-related hierarchies do not generally hold true. Multiple owls in exhibits have been successful in non-breeding situations within on-exhibit and off-exhibit enclosures. It is worthwhile to add designated structural visual exclusion barriers such as an L-shaped design and/or plantings that limit visibility.

AZA Accreditation Standard

(10.3.3) All animal enclosures (exhibits, holding areas, hospital, and quarantine/isolation) must be of a size and complexity sufficient to provide for the animal's physical, social, and psychological well-being. AZA housing guidelines outlined in the Animal Care Manuals should be followed.

AZA Accreditation Standard

(10.3.4) When sunlight is likely to cause overheating of or discomfort to the animals, sufficient shade (in addition to shelter structures) must be provided by natural or artificial means to allow all animals kept outdoors to protect themselves from direct sunlight.

AZA Accreditation Standard

(11.3.3) Special attention must be given to free-ranging animals so that no undue threat is posed to either the institution's animals, the free-ranging animals, or the visiting public. Animals maintained where they will be in contact with the visiting public must be carefully always monitored and treated humanely.

AZA Accreditation Standard

(11.3.1) All animal exhibits and holding areas must be secured to prevent unintentional animal egress.

AZA Accreditation Standard

(2.8.1) Pest control management programs must be administered in such a manner that the animals, paid and unpaid staff, the public, and wildlife are not threatened by the pests, contamination from pests, or the control methods used.

AZA Accreditation Standard

(1.5.15) All animal exhibit and holding area air and water inflows and outflows must be securely protected to prevent animal injury or egress.

2.2 Safety and Containment

Animals housed in free-ranging environments should be carefully selected, monitored, and treated humanely so that the

safety of these animals and persons viewing them is ensured (AZA Accreditation Standard 11.3.3).

Animal exhibits and holding areas in all AZA-accredited institutions must be secured to prevent unintentional animal egress (AZA Accreditation Standard 11.3.1). All animal exhibit and holding area air and water inflows and outflows must also be securely protected to prevent animal injury or egress (AZA Accreditation standard 1.5.15). Pest control methods must be administered so there is no threat to the animals, staff, public, and wildlife (AZA Accreditation Standard 2.8.1). Exhibit design must be considered carefully to ensure that all areas are secure and particular attention must be given to shift doors, gates, keeper access doors, locking mechanisms and exhibit barrier dimensions and construction.

Walk-through exhibits: There is an inherent safety concern for owls in walk-through exhibits as the owls and the visitors will be sharing the same space. Depending on the species, successful walk-through exhibits will depend on whether the owl will be involved in potential breeding, and if the owl is mobile enough to approach a guest. Therefore, based on the temperament of the species or individual birds, a successful walk-through owl exhibit may be hard or impossible to do safely. Fully flighted eagle owls (*Bubo* spp.) are at an especially high risk in walk-through exhibits because they may interact negatively with visitors, especially during the breeding season when they may be more territorial. Certain species, such as burrowing owls, may be better suited for these types of exhibits, but the temperament of individuals will need to be carefully considered. While long-eared owls (*Asio otus*), short-eared owls, and burrowing owls have been exhibited in walk-through exhibits successfully, it is not recommended to attempt walk-through exhibits for most owl species. In any walk-through exhibit, careful monitoring by staff, volunteers, or camera is important where contact between animals and visitors can occur. Some seemingly open walk-through exhibits do not allow contact due to creatively hidden barriers and the use of non-flighted owls (S. Sarro, personal communication, 2011). These exhibits may make capture of free-range owls challenging. Utilizing a catch cage and dedicated feed stations may assist in capture of owls for hands-on care. Nets and poles may be needed to keep the owls moving to eventually come low enough for net capture. If the exhibit is open-roofed, predators or territorial, aggressive conspecifics may gain access. Generally, it is best practices to have covered exhibits with a sunken dig barrier on the ground section of the exhibit barrier. Flight restriction is generally not needed but occasionally non-releasable rehabilitated owls will be flight impaired, and an open roofed exhibit is potentially an option. The challenge with any open topped exhibit is the easier access to the owls for predators (IE: raccoons, feral cats, mink, otters, birds of prey) and this may not be a risk you wish to take, even with non-flighted eagle owls.

Enclosure containment: There are many different types of wire and net meshes available for use as boundary material.

Welded mesh: Welded mesh appears to be the most suitable material for the walls and ceiling of owl enclosures. A suitable mesh size of 50 mm x 50 mm (2 in. x 2 in.) will work for all except the smallest owls (e.g., pygmy [*Glaucidium*] or scops [*Otus*] owls). Small owls require a mesh size of 25 mm x 25 mm (1 in. x 1 in.), or 25 mm x 75 mm (1 in. x 3 in.) if the birds are on view to the public. Use of small mesh for larger birds is not recommended, as they may catch a talon in the mesh and become entangled, causing injuries to their toes. Black wire provides much better visibility for the public than either galvanized or green wire. Smaller, welded mesh can be bought already coated with PVC or polyurethane, which will increase visibility and barrier lifespan. Failing this, the wire can be painted with non-toxic black emulsion paint, which dries quicker than gloss, and is non-reflective. Coated wire tends to last longer than un-coated wire. Galvanized wire may cause a zinc toxicity issue if the owl is constantly mouthing the wire. Wire mesh is the best product to combat rodent pests from entering the exhibit.

Nylon netting: Using nylon netting as a boundary material provides a “soft” barrier if birds fly against it but can be easily compromised by animal pests such as squirrels and rats. Hot wire has limited success against climbing rodents. Additionally, snow should not be allowed to accumulate on netting, as this may put pressure on the aviary structure. Netting failure due to heavy snow loading has been documented and plans to handle this challenge should be addressed before the first threat of snow. One option to consider is to install an auto-lowering net system, which counterweights the netting; snow weight lowers the net and melting of snow raises the net.

Underground containment: Installing a concrete base or under wiring the enclosure floor is important to prevent digging species such as the burrowing owl from escaping. Additionally, these barriers will also

help prevent pest species, such as rats and foxes, from digging into the exhibit. Check with your maintenance department or contractors for local building code recommendations for cement depth and gravel base.

Access doors: Aviary access systems should be from a service passage or vestibule, with double-door access to feeding trays and the aviary. A double-door system is recommended to avoid escapes, especially with the smaller, faster moving species such as scops owls and burrowing owls. Doorways should be large enough to allow easy access for wheelbarrows, aviary furnishings, and keepers. Access doors should swing into the enclosure.

Pests and predators: Where foxes are a problem, it is advisable to use small mesh 25 mm x 25 mm (1 in. x 1 in.) around the bottom of the enclosure, or incorporate a low, solid visual barrier to minimize the risk of injury to the inhabitants. To prevent owls from digging out (or predators digging in), a concrete base or a wire-mesh under the substrate floor can be added to a depth of 30.4–45.7 cm (12–18 in.) for cement and for wire. The wire should be "dog-legged" so that it goes down 30.4 cm (12 in.) and out away from the enclosure by 30.4 cm (12 in.). Together with these measures, a completely covered aviary will help to protect the owls against a wide range of predators (e.g., corvids, raptors, domestic cats and dogs, rats, raccoons, foxes, etc.) that may be drawn to the enclosure. Terrestrial and avian predators can be clever, and will find any available opening. All sections of the enclosure should be carefully and frequently assessed for gaps. Wire mesh of the right size will prevent raccoons and accipters from inserting a grabbing foot into the exhibit to secure an owl that has roosted too close to the mesh.

Public safety barriers: Exhibits in which the visiting public is not intended to have contact with animals must have a barrier of sufficient strength and/or design to deter such contact. (AZA Accreditation Standard 11.3.6). A public safety barrier should be built away from the enclosure fence to discourage visitors from putting fingers or foreign objects though wire mesh fronts. A post and rail fence about 1 m (3 ft) away from the aviary will discourage close contact and should last for several years if the posts are set in concrete. Wire can be put on the inside of the fence posts to stop small children from crawling under the rails. When new birds are moved into an enclosure, or if birds are breeding and become aggressive, temporary barriers and warning notices can be used to keep public away from the wire. For habitually aggressive individuals, double wiring is recommended.

All emergency safety procedures must be clearly written, provided to appropriate paid and unpaid staff, and readily available for reference in the event of an actual emergency (AZA Accreditation Standard 11.2.4).

Appropriate emergency protocols for all owl exhibits, especially walk-throughs, are important and should be written for each specific type of emergency including fire, weather event, human impact, and other events. All staff and volunteers should be well trained, well versed in the protocols, and understand the importance of such protocols. Security contact information should be easily accessed by all staff.

Staff training for emergencies must be undertaken and records of such training maintained. Security personnel must be trained to handle all emergencies in full accordance with the policies and procedures

AZA Accreditation Standard

(11.3.6) There must be barriers in place (for example, guardrails, fences, walls, etc.) of sufficient strength and/or design to deter public entry into animal exhibits or holding areas, and to deter public contact with animals in all areas where such contact is not intended.

AZA Accreditation Standard

(11.2.4) All emergency procedures must be written and provided to appropriate paid and unpaid staff. Appropriate emergency procedures must be readily available for reference in the event of an actual emergency.

AZA Accreditation Standard

(11.6.2) Security personnel, whether employed by the institution, or a provided and/or contracted service, must be trained to handle all emergencies in full accordance with the policies and procedures of the institution. In some cases, it is recognized that Security personnel may be in charge of the respective emergency (i.e. shooting teams).

AZA Accreditation Standard

(11.2.5) Live-action emergency drills (functional exercises) must be conducted at least once annually for each of the four basic types of emergencies (fire; weather or other environmental emergency appropriate to the region; injury to visitor or paid/unpaid staff; and animal escape). Four separate drills are required. These drills must be recorded, and results evaluated for compliance with emergency procedures, efficacy of paid/unpaid staff training, aspects of the emergency response that are deemed adequate are reinforced, and those requiring improvement are identified and modified.

AZA Accreditation Standard

(11.2.6) The institution must have a communication system that can be quickly accessed in case of an emergency.

of the institution and in some cases, may be in charge of the respective emergency (AZA Accreditation Standard 11.6.2).

It is suggested that staff be well-versed in owl capture in case the need for exhibit evacuation be necessary due to an emergency situation. Adequate safe and secure holding sections must be ready in case of emergency needs.

Emergency drills must be conducted at least once annually for each basic type of emergency to ensure all staff is aware of emergency procedures and to identify potential problematic areas that may require adjustment. These drills must be recorded, and results evaluated for compliance with emergency procedures, efficacy of paid/unpaid staff training, aspects of the emergency response that are deemed adequate are reinforced, and those requiring improvement are identified and modified (AZA Accreditation Standard 11.2.5). AZA-accredited institutions must have a communication system that can be quickly accessed in case of an emergency (AZA Accreditation Standard 11.2.6). A paid staff member or a committee must be designated as responsible for ensuring that all required emergency drills are conducted, recorded, and evaluated in accordance with AZA accreditation standards (AZA Accreditation Standard 11.2.0).

AZA-accredited institutions must also ensure that written protocols define how and when local police or other emergency agencies are contacted and specify response times to emergencies (AZA Accreditation Standard 11.2.7)

AZA-accredited institutions that care for potentially dangerous animals must have appropriate safety procedures in place to prevent attacks and injuries by these animals (AZA Accreditation Standards 11.5.2 and 11.5.3).

Animal attack emergency response procedures must be defined, and personnel must be trained for these protocols (AZA Accreditation Standard 11.5.3).

Animal attack emergency drills should be conducted at least once annually to ensure that the institution's staff know their duties and responsibilities and know how to handle emergencies properly when they occur. All drills need to be recorded and evaluated to ensure that procedures are being followed, that staff training is effective, and that what is learned is used to correct and/or improve the emergency procedures. Records of these drills must be maintained and improvements in the procedures duly noted whenever such are identified (AZA Accreditation Standards 11.5.3 and 11.5.2).

If an animal attack occurs and injuries result from the incident, a written account outlining the cause of the incident, how the injury was handled, and a description of any resulting changes to either the safety procedures or the physical facility must be prepared and maintained for five years from the date of the incident (AZA Accreditation Standard 11.5.3).

Owls will generally avoid human interactions. There are times when owls, especially those used in education programs and that are comfortable around people, may injure a human inadvertently or on purpose. For owls in programs, ensure the equipment is in good repair and appropriate. Falconry gloves should be long enough to prevent the birds from "walking" up an unprotected arm and thick enough to ensure handler safety from the force of

AZA Accreditation Standard

(11.2.0) A paid staff member or a committee must be designated as responsible for ensuring that all required emergency drills are conducted, recorded, and evaluated in accordance with AZA accreditation standards (see 11.2.5, 11.5.2, and 11.7.4).

AZA Accreditation Standard

(11.2.7) A written protocol should be developed involving local police or other emergency agencies and include response times to emergencies.

AZA Accreditation Standard

(1.4.7) Animal records must be kept current.

AZA Accreditation Standard

(11.5.3) Institutions maintaining potentially dangerous animals must have appropriate safety procedures in place to prevent attacks and injuries by these animals. Appropriate response procedures must also be in place to deal with an attack resulting in an injury. These procedures must be practiced routinely per the emergency drill requirements contained in these standards 11.2.5, 11.5.2, and 11.7.4. Whenever injuries result from these incidents, a written account outlining the cause of the incident, how the injury was handled, and a description of any resulting changes to either the safety procedures or the physical facility must be provided to AZA staff and maintained on file at the institution for five years from the date of the incident.

AZA Accreditation Standard

(11.5.2) Institutions maintaining venomous animals must have emergency alarm systems and/or protocols in place specifically addressing animal bite injury, attack, or escape from enclosure. All areas housing venomous animals must be equipped with appropriate alarm systems, and/or have protocols in place to notify paid and unpaid staff in the event of a venomous animal emergency. These systems and/or protocols must be routinely checked to assure proper functionality. Live action envenomation drills must be conducted at least annually to assess emergency alarm systems and/or protocols. The live action envenomation drill is in addition to the emergency drills required in 11.2.5 and 11.7.4 and the drill should be recorded and evaluated in the same manner as other emergency drills. (see 11.2.5 and 11.7.4 for other required drills).

a talon's grip. There is no approved chemical immobilization that will quickly negate an attack from an escaped owl. Animal recapture drills should be held routinely as per AZA recommendations, but owls generally will not be a lethal threat while at large. Escaped owls will often remain in the area due to familiarity with the location or due to a cage mate. Utilize your institution's reporting system to document the recapture events and contact local wildlife agencies as warranted. When needing to capture an owl, remember that their talons are incredibly strong and sharp, even in small- and medium-size.

Chapter 3. Records

3.1 Definitions

In the zoo and aquarium world, animal records are defined as "data, regardless of physical form or medium, providing information about individual animals, samples or parts thereof, or groups of animals". Most animals in zoo and aquarium collections are recorded as (referred to as) individuals, though some types of animals are recorded as (referred to as) groups or colonies of animals, particularly with invertebrates and in aquariums (see Appendix B for definitions and Recordkeeping Guidelines for Group Accessions). The decision about how to record its animals usually resides with each institution, but in certain cases, the AZA Animal Program Leader (i.e., AZA TAG Chair, AZA SSP Coordinator, or Studbook Keeper) may request that animals be recorded in a certain manner, whether as individuals or as groups.

Owls are individually identified. This can be in the form of a leg band, transponder, or even morphological differences (i.e., in rehab owls, a missing or damaged eye or wing may make an individual in a collection unique. These decisions are left to the discretion of the institution.

3.2 Types of Records

There are many types of records kept for the animals in our care, including but not limited to, veterinary, husbandry, behavior, enrichment, nutrition, and collection management. These types of records may be kept as separate records as logs in separate locations or as part of the collection records and some may be required by regulation agencies (e.g., primate enrichment records) or per AZA Accreditation Standards (e.g., emergency drill records).

Recordkeeping is an important element of animal care and ensures that information about individual animals or groups of animals is always available. The institution must show evidence of having a zoological records management program for managing animal records, veterinary records, and other relevant information (AZA Accreditation Standard 1.4.0). These records contain important information about an individual animal or group of animals, including but not limited to taxonomic name, transaction history, parentage, identifiers, sex, weights, enclosure locations and moves, and reproductive status (see Appendix C for Guidelines for Creating and Sharing Animal and Collection Records).

A designated paid staff member must be responsible for maintaining the animal record-keeping system and for conveying relevant laws and regulations to the animal care staff (AZA Accreditation Standard 1.4.7). Recordkeeping must be accurate and current (AZA Accreditation Standard 1.4.10). Complete and up-to-date animal records and veterinary records must be duplicated and stored at a separate location (AZA Accreditation Standard 1.4.4) and at least one set of historical records safely stored and protected (AZA Accreditation Standard 1.4.5).

AZA Accreditation Standard

(1.4.0) The institution must show evidence of having a zoological records management program for managing animal records, veterinary records, and other relevant information.

AZA Accreditation Standard

(1.4.6) The institution should develop a records retention schedule and policy for its animal and veterinary records to make certain they are created, managed, and appropriately preserved or otherwise disposed of according to minimum legal, administrative, and historical values. [See 2.0.4 for veterinary records.]

AZA Accreditation Standard

(1.4.4) Animal records and veterinary records, whether in electronic or paper form, must be duplicated and stored in a separate location. Animal and veterinary records are defined as data, regardless of physical form or medium, providing information about individual animals, or samples or parts thereof, or groups of animals. Digital systems are preferable. A disaster preparedness and business continuity plan should be in place for vital animal and veterinary records, and those that have long-term or permanent retention requirements.

AZA Accreditation Standard

(1.4.5) At least one set of the institution's historical animal and veterinary records must be stored and protected. The institution should be able to demonstrate how it provides security, protection, and long-term access for vital animal and veterinary records that have enduring legal, research, or reference value, including, but not limited to permits, titles, declaration forms, and other pertinent information.

AZA Accreditation Standard

(1.4.1) An animal inventory must be compiled at least once a year and include data regarding animals added and removed from the institution's collection whether by birth, transfer, death, or introduction to the wild.

AZA Accreditation Standard

(1.4.2) The inventory must include all species owned by the institution and those on loan to and from the institution.

AZA member institutions must inventory their owl population at least annually and document all owl acquisitions, transfers, euthanasia events, releases, and reintroductions (AZA Accreditation Standard 1.4.1). All owls owned by an AZA institution must be listed on the inventory, including those animals on loan to and from the institution (AZA Accreditation Standard 1.4.2). All AZA-accredited institutions must abide by the AZA Policy on Responsible Population Management (Appendix D) and the long-term welfare of animals should be considered in all acquisition, transfer, and transition decisions.

AZA Accreditation Standard

(1.4.10) Animal records must be kept current.

Owls require standard vertebrate records. There is nothing unique to this taxon that makes custom forms imperative. Medical, diet and behavior records are all simple and commonly found in all institutions.

3.3 Permit Considerations

The native owls in North America are protected and their holding in human care is regulated by federal and/or state governments. Therefore, possession and/or specific activities involving these species usually require a permit(s) issued by the regulating agency, granting permission for possession and/or the specific activities. Depending on the agency involved, the application and approval process may take a few days to many months. These permits must be received by the applicant before the proposed possession or activity can occur.

3.4 Government Ownership

There are no owls to our knowledge that are owned by the government in the same way as native eagles.

3.5 Identification

Ensuring that owls are identifiable through various means increases the ability to care for individuals more effectively. All animals held at AZA facilities must be individually identifiable whenever practical and have corresponding identification (ID) numbers. For animals maintained in colonies or groups, or other animals not considered readily identifiable, institutions must have a procedure for identification of and recording information about these groups or colonies. (AZA Accreditation Standard 1.4.3). These IDs should be included in specimen, collection and/or transaction records and veterinary records. Types of identifiers include:

AZA Accreditation Standard

(1.4.3) Animals must be identifiable, whenever practical, and have corresponding ID numbers. For animals maintained in colonies/groups or other animals not considered readily identifiable, the institution must provide a statement explaining how record keeping is maintained.

Physical identifier: These include, but are not limited to, ear and/or wing tags, leg bands, tattoos, microchips/transponder and RFID devices, elastomers, ear and/or shell notches and toe clips. Permanent physical identifiers are often required when a species is regulated by a government agency and to distinguish separate animals in studbooks.

Intangible identifiers (called 'logical identifiers' in the Zoological Information Management System [ZIMS]): These include, but are not limited to, institutional accession number, house name, public name, studbook number, and ZIMS Global Accession Number.

All owls should be individually marked to allow for easy identification. Banding is the most common method of identification. Once young birds have reached 10–14 days old, banding can be performed, although banding at a later age is advisable in most cases due to continued leg feathering. It is vital to use the correct band and size, as damage can be inflicted to the leg of a bird with a poorly fitting band. If you are not skilled at choosing the right sized band, you should contact an expert from another zoo, the Raptor TAG, post a question to the Network on AZA or contact a local bird bander. Owls with tight bands may display lameness and/or swollen lower legs and feet. Owls are particularly susceptible to this type of injury, as their heavily feathered legs will hide band damage. It is suggested to check the individual bird bands weekly to determine appropriate fit and general wear. Generally, males are banded on the right leg and females are banded on the left.

Using transponders is another option to identify these birds. This involves the insertion of a microchip under the skin of the bird with a large gauge needle, typically into the left pectoral muscle. This is a more expensive option but is more permanent and tamperproof than other methods. One downside is that birds

cannot be visually identified with transponders. This entails a medical procedure and is best discussed with the zoo's medical team.

Chapter 4. Transport

4.1 Preparations

Animal transportation must be conducted in a manner that adheres to all laws, is safe, and minimizes risk to the animal(s), employees, and public (AZA Accreditation Standard 1.5.11). All temporary, seasonal, and traveling live animal exhibits must meet the same accreditation standards as the institution's permanent resident animals, with foremost attention to animal welfare considerations (AZA Accreditation Standard 1.5.10). Safe animal transport requires the use of appropriate conveyance and equipment that is in good working order. Include copies of appropriate permits and authorizations in transport documentation. If the animal is not owned by the shipping institution, permission is to be obtained from the owner well in advance of the move.

AZA Accreditation Standard

(1.5.11) Animal transportation must be conducted in a manner that is safe, well-planned and coordinated, and minimizes risk to the animal(s), employees, and general public. All applicable laws and/or regulations must be adhered to.

AZA Accreditation Standard

(1.5.10) Temporary, seasonal and traveling live animal exhibits, programs, or presentations (regardless of ownership or contractual arrangements) must be maintained at the same level of care as the institution's permanent resident animals, with foremost attention to animal welfare considerations, both onsite and at the location where the animals are permanently housed.

The International Air Travel Association (IATA) specifies a set of minimum standards necessary for transporting live animals on commercial airlines worldwide. IATA produces a document (Live Animal Regulations) that illustrates the acceptable crate design for various species if they are being transported by air. It is advisable to obtain the latest copy of the IATA rules to check the crate, food, and water requirements. The IATA Live Animal Regulations are updated annually, and can be seen on their website (www.iata.org).

Included in the trip to the airport, minimally, for any shipments from one facility to another should be:

- Appropriate crate perching if needed (species sized-appropriate)
- Appropriate crate substrate (carpet, wood shavings, other media)
- Food and water if necessary (IATA)
- Medical paperwork
- Animal Transaction Form (ATF)
- Contact information for receiving institution on the crate
- Contact information of the shipping institution on the crate
- Temperature approval letter from veterinarian if necessary
- Crate window/door visual barriers
- Extra electrical zip-ties
- Towel and net in the transport vehicle
- Cell phone

Transport container: A well-made wooden box or sky kennel with a low perch (or no perch if transporting snowy or burrowing owls), a non-slip surface fixed on the floor, and a padded ceiling are suggested for transporting an owl. It is recommended to not use looped materials like towels or carpet in a transport container as this type of substrate has potential for injury, such as snagging a talon. It is recommended to provide a perch for most owls within the transport crate as this will assist with separating the animal from its waste and provide a roosting site. This perch should be flush with the floor of the crate to prevent an injury if a leg or wing accidentally slips under the space between the perch and the floor. A padded ceiling prevents head injury. There should be air holes on either side. The easiest type of door to use is an upward sliding door at one end for the wooden crates, or a metal mesh door for the sky kennels. For upward sliding doors, the door can be opened slightly so that the bird can be visualized, and then grasped by the legs before opening fully to remove the animal. A handle fixed to the top of the box makes carrying easier. For wooden boxes, 2.5 cm (1 in.) square wooden slats along the outside of each side will prevent boxes from being pushed close together and air holes becoming blocked. All zoos and aquariums should have several boxes in store to use at short notice.

Boxes or sky kennels should be slightly longer than the-head to-tail length of the bird intended to travel, as well as wide and high enough for the bird to be able to stand or lie down in comfort without

impacting its shoulders or head. The box or sky kennel should provide adequate but limited space for movement based on the size of the bird.

It is paramount that the equipment provides for the adequate containment, life support, comfort, temperature control, food/water, and safety of the animal(s). Shipping by an approved transport company will ensure that temperature-controlled special “pet” care or counter-to-counter handling is best.

Safe transport also requires the assignment of an adequate number of appropriately trained personnel (by institution or contractor) who are equipped and prepared to handle contingencies and/or emergencies that may occur during transport. Planning and coordination for animal transport requires good communication among all affected parties, plans for a variety of emergencies and contingencies that may arise, and timely execution of the transport. At no time should the animal(s) or people be subjected to unnecessary risk or danger (AZA Accreditation Standard 1.5.11). Having two individuals involved in the transport of owls from one location to the next is good, but not necessary in all situations.

Once the owl has been placed in a shipping container, generally one individual is needed to transport it to the airport, although two is acceptable. If an escape occurs and the owl is secondarily contained in some manner (either in the vehicle or a room at the airport), it is important to attempt to recapture the owl as quickly as possible and return it to the crate. Check the transport crate to determine and prevent the method of escape before replacing the owl. For an escape into an outdoor space, do everything you can to maintain visual contact, and contact your institution for necessary guidance. Keeping spare bolts, electrical-ties, duct-tape, and an extra carrier is good practice to mitigate possible equipment malfunctions. All recapture situations are different. Check with local ordinances for laws pertaining to escaped wildlife and ensure the equipment is in good working order.

4.2 Protocols

Transport protocols should be well defined and clear to all animal care staff. Individual birds should have separate boxes. There is no reason to transport owls in a group container. If nestlings are being relocated, keeping them in one enclosed container is appropriate but be sure to monitor for sibling aggression.

Food and water: As with most bird transports, it is not necessary to provide food and water during transport for a daily move, but it is important to have food and water available upon arrival. Owls do not need to be fasted before transport. If the transport lasts more than 24 hours, there should be some way to add water to a dish, or at least provide the animal with a food item. Furthermore, a small door should be integrated into the box or crate design to allow food items to be added without opening the crate. Owls can gain hydration from eating natural food items, and these should be offered if possible. Generally, it is best to add a few size-appropriate whole prey items in the travel crate in case the owl wants to eat: mice for eagle owls and mouse pinkies for smaller species. Adding water is generally not needed as the owls usually do not drink but check with your airline to assess if it is a shipping requirement.

Substrate and bedding: Carpet or some other non-slip surface, such as artificial grass, should be fixed on the floor. Shavings, instead of carpet, may be utilized if there is a stable perch to allow the bird to get above the shavings. Using carpet or shavings allows for urates and feces to be absorbed and for less an opportunity to soil feathers.

Temperature, light, and sound: Owls are very susceptible to heat stress, so boxes should never be placed in full sun. Transporting birds during excessively hot spells should be avoided or undertaken only in the early morning or late evening. Generally, shipping owls above 29.4 °C (85 °F) should be avoided. For cold-hardy species, temperatures down to 0 °C (32 °F) are acceptable as long as the bird has been acclimatized to this temperature prior to shipment. For cold-sensitive species, temperatures below 7.2 °C (45 °F) are to be avoided. Owls travel best in completely dark boxes. Proper ventilation should be provided but covering air holes with a dark shade cloth to allow air to pass while limiting the amount of light is recommended.

Animal monitoring: Birds should be removed from boxes in secure, enclosed areas such as a locked office where accidental escape is not possible and away from exposed areas of glass, such as windows. An animal should only be removed by a trained, experienced handler. Owls generally do not need to have a person accompany the shipment. If the owl is constantly thrashing about in the crate, visual confirmation of the bird’s condition is advisable before removing it. Emergency contact information should be available on the shipping label in case of an emergency. There are no set guidelines set for the

maximum duration of travel, as each transport has its own qualities and each bird its own restrictions. Again, judgment is made on a case-by-case basis.

Post-transport release: A bird that has been crated should be at least visually evaluated by skilled husbandry staff or veterinary medical staff before release into any type of holding area. This can be done by capturing and restraining the bird or by releasing it into a smaller interior enclosure with species-appropriate perching and space for the size of the bird. In many facilities, these will be the quarantine enclosures. The size of these enclosures will vary, but all are generally smaller than exhibits and designed for easy catching of the animal for medical evaluation during the quarantine period. Birds should not be released into any new area without proper observation by trained staff, to ensure that the bird is healthy and comfortable.

General protocol list for an owl transport:

- Make shipping arrangements with the receiving institution
- Prepare all medical and permitting paperwork to accompany the shipment
- Create an appropriate transport-approved container
- Identify staff for the transport: often two staff is a good idea in case there are transport challenges
- Ensure bird is in good health to travel
- Check for travel temperature acceptability with transporter
- Prepare a transport vehicle outfitted with emergency gear that may include nets, bite-gloves, duct tape, flashlight, and eye protection.
- Make sure a cellphone and appropriate contact numbers are available, including receiving institution numbers, local police, local transport company and your medical staff and registrar
- Get owl into transport crate as quietly as possible and move into vehicle
- Be mindful of traffic and internal noise such as radio stations with the animal—keep noise to a minimum
- Arrive at transport location and decide with clerks before moving the animal from the vehicle
- Follow directions from the transport company and after leaving, contact the receiving institution alerting them to the owl's arrival at the airport and the transport numbers
- Request a call from the receiving institution upon the bird's arrival
- Arrange for crate return if needed
- Transport time from crate entry to crate exit should be kept under 24 hours
- For owls transported within campus, the animals should be moved to a crate or other secure method (some owls transport well on a fist)
- Quietly move the owl to the new location
- Perform the program but monitor the owl for signs of stress, including panting, bating, and lethargy. Remove owl from the presentation if these signs of stress occur and seek medical care.
- Replace owl in crate for transport to another or original location
- Owl exits the crate in the new target pen and monitor for changes in behavior
- There are often different schools of thought of how to transport an owl from one location on campus to another location on the same campus. Generally, a crate is best for exhibit and/or outreach owls. There are some educators that are comfortable with having the ambassador owl on the glove and walking from point A to point B. The decision will depend on many factors including weather conditions, distance, crowds, owl temperament, handler's experience, and escape potential, to name a few. Basically, it is a decision about risk assessment and situation. Probably best to lean toward the crate option in most instances.

Chapter 5. Social Environment

5.1 Group Structure and Size

Careful consideration should be given to ensure that animal group structures and sizes meet the social, physical, and psychological well-being of those animals and facilitate species-appropriate behaviors.

Group structure: Generally, owls are not a social, gregarious species, and in the wild are found singly or in pairs during the breeding season. Some pair just for the breeding season, whereas others, like the Eurasian eagle owl, remain together for life (Mikkola, 1983). Owls are usually monogamous but will take a new mate should something happen to the former partner. Specifically, barn owls have been recorded taking new mates while in the process of rearing a brood, the replacement partner taking on the role of parenthood.

In zoos and aquariums, larger groups may be kept, but only if adequate space is provided (based on the temperaments of the birds), and there is close monitoring of the individuals, as they can be aggressive and injure or kill other birds in the enclosure. A general rule of thumb is to keep only two adult birds per enclosure, and if birds are being kept with breeding as the top priority, then pairs of birds need separate enclosures. Compatible pairs may need less exhibit space than non-bonded birds.

Single-sexed groups: Some species may be kept in single-sexed groups, such as spectacled owls and burrowing owls. This option to house surplus animals needs more experimentation to determine if single-sexed groups are successful.

Group size: Again, it is recommended that owls be housed singly or in pairs. Some species such as burrowing owls may be more tolerant of their own offspring. Young birds of each species may be housed easily in multiple-bird groups, depending on adequate space and hideout availability, until they are transferred to another facility or enclosure, and/or reach sexual maturity.

Ambassador or outreach owls are generally held singly in a mew or on a bow perch. They may also be free-lofted in a pen if the training plan dictates.

5.2 Influence of Others and Conspecifics

Animals cared for by AZA-accredited institutions are often found residing with conspecifics but may also be found residing with animals of other species.

If breeding enclosures are built in proximity, some neighboring species may indulge in aggressive territorial disputes, and care should be taken to ensure that individuals cannot reach each other. A minimum distance of 30.4 cm (12 in.) between exhibit sides is recommended, as this will prevent talons from reaching the neighboring exhibit. Additionally, a smaller mesh size 1.3 cm x 1.3 cm (.5 in. x .5 in.) for smaller species, and 2.5 cm x 2.5 cm (1 in. x 1 in.) for larger species will limit contact. Generally, it is suggested that owl exhibits be built away from each other, especially when dealing with conspecifics or closely related species, in order to minimize potential stress. However, studies in this area have yet to be performed and more information is needed. Visual barriers within the exhibits and between adjoining exhibits may help with territoriality. Increased calling, posturing by each pair, and aggressive flights toward a neighboring exhibit or pair may suggest that the birds are stressed by the proximity of other birds. In some cases, however, the sound of other owls calling nearby might serve to enrich an owl's environment and stimulate vocalizations, as described in Chapter 2.1.

Mixed-species enclosures: Generally, it is not recommended to allow owls to share enclosures with other species. Breeding pairs should have their own enclosure, as they might be disturbed by the other species. Furthermore, young owls will be very vulnerable during the fledging period.

Educational aviaries can possibly mix taxa, but significant experience is needed to ensure that the species, and individual birds, are truly compatible, and that the environment offers sufficient resources and behavioral opportunities for all individuals. This means that enough shelter, perching, and food should be available for all birds to use at the same time. Different species but the same genus that have the potential to interbreed should not be kept together. Hybridization may occur.

However, there have been examples of successful mixed species exhibits with owls, as Table 6 demonstrates.

Table 6. Examples of mixed species exhibits containing owls

Mixed species	Notes
All British owl species: (Barn, tawny, long-eared, short-eared, and little owls)	All species bred within 45 m x 10 m x 10 m (147.6 ft x 32.8 ft x 32.8 ft) aviary [1]
Tawny owls with: Ring-necked pheasants	Breeding success of owls unknown [2]
Barn owls with: Domestic chickens	Breeding success of owls unknown [2]
Snowy owls with: Arctic foxes	Owls aggressive to foxes during nesting and were separated [3]
Spectacled owls with: Larger galliformes (wild turkeys).	No aggression seen by either species and breeding by the owls occurred.[4]
Burrowing owls with: Prairie dogs (*Cynomys ludovicianus*)	Housed in open air exhibits with owls flight restricted
Long and short-eared owls with: Waterfowl (*Anas* sp., *Aythya* sp., *Cynus columbianus*, *Bucecphala* sp., *Lophodytes* and *Mergus* sp., *Oxyura* sp.), small galliformes (*Colinus virginianus* and *Phasianus* sp.), and herons (*Ardea* sp., *Egretta* sp., *Butorides* sp.)	Housed in large outdoor aviary and all birds mixed well [4]

[1] T. Warburton, personal communication, [2] J. Ellis, personal communication, [3] D. Field, personal communication, [4] S. Sarro, personal communication.

Some species of owls will imprint if hand-reared by humans. For ambassador owls, this may be an advantage as the owls are usually weight-managed and often are less territorial. For exhibits where the animals are on display, be mindful that owls can be aggressive and can inflict serious injuries. It has been noted that ambassador animals and some hand-reared owls have been described as being aggressive.

5.3 Introductions and Reintroductions

Managed care for and reproduction of animals housed in AZA-accredited institutions are dynamic processes. Animals born in or moved between and within institutions require introduction and sometimes reintroductions to other animals. It is important that all introductions are conducted in a manner that is safe for all animals and humans involved.

Breeding pair introductions: Upon the death of one owl in a pair, new mates should be introduced outside the specific species' breeding season. Some birds will never accept a replacement mate, while others will pair up with the first bird provided. Any new introductions should be carefully supervised, and animal care staff members should be prepared to intervene if a bird appears to be getting injured. Indicators that birds may need to be separated include restlessness, chasing, and bird-to-bird contact. Even bonded pairs will be reluctant to touch each other; therefore, any contact between owls during introductions should be viewed as aggressive and the birds separated. Owls that are comfortable with each other do not appear nervous or restless, often sitting within a few feet of the cage mate. Make sure at least two feeding stations are provided during introductions to ensure food availability is appropriate for each animal.

Some species, such as pygmy owls, are naturally aggressive, in which case it is recommended that the female be introduced to the male in his aviary (i.e., his territory). With animals from the *Bubo* sp., the male can be introduced into the female's aviary (T. Warburton, personal communication). Housing individuals next door to each other (i.e., howdy opportunity) before introducing them might help ease the process along. However, howdy times will vary between individuals. Close attention should be paid to the way that the birds react to each other when perching, feeding, and vocalizing. The birds should not be introduced until they seem calm in each other's presence. Younger birds may be introduced to each other with greater ease, or at least more quickly.

As owls are both sight and sound hunters, it is important that introductions provide the birds with proper visual and auditory perspectives. The use of side-by-side stalls/exhibits has been quite successful for introducing birds to each other. Splitting existing exhibits in half may work as well, but care should be taken to prevent one bird being "footed" by another bird through the dividers.

Mixed-species introductions: In aviaries where different species or groups of birds are housed together, the introduction of new members to the group should be very carefully monitored for at least a few days, if not longer. Any individual being introduced should be of a suitable temperament. This means that it

adapts well to change, is less flighty, and has been housed successfully with other species/individuals before. Birds imprinted on human beings may not be suitable for this sort of exhibit because of inappropriate social behavior.

Generally, young owls should not be introduced to older, established owls. This may be different if the exhibit is a grouping of non-breeders/non-releasable rehabs. In this case, it would be important to monitor any introductions closely for the first few days for signs of territoriality and aggression.

Chapter 6. Nutrition

6.1 Nutritional Requirements

> **AZA Accreditation Standard**
>
> **(2.6.2)** The institution must follow a written nutrition program that meets the behavioral and nutritional needs of all species, individuals, and colonies/groups in the institution. Animal diets must be of a quality and quantity suitable for each animal's nutritional and psychological needs.

A formal nutrition program is required to meet the nutritional and behavioral needs of all species (AZA Accreditation Standard 2.6.2). Diets should be developed using the recommendations of nutritionists, the AZA Nutrition Scientific Advisory Group (NAG) feeding guidelines: (http://nagonline.net/guidelines-aza-institutions/feeding-guidelines/), and veterinarians as well as AZA Taxon Advisory Groups (TAGs), and Species Survival Plan® (SSP) Programs. Diet formulation criteria should address the animal's nutritional needs, feeding ecology, as well as individual and natural histories to ensure that species-specific feeding patterns and behaviors are stimulated.

Digestive system morphology and physiology: The gastrointestinal tract of owl species has not been well described. As carnivores, the diet is comprised of various invertebrate and vertebrate whole prey, based on the size of the owl. Because of this, their gastrointestinal tract is expected to resemble that of a generalist raptor (based on similarity of food sources; Stevens and Hume 1995, Figure 1). The crop is likely poorly developed (simply resembling an enlargement of the esophagus) or absent. The stomach is comprised of two parts, the proventriculus and ventriculus; the former responsible for initiation of enzymatic and acidic digestion and the latter responsible for some muscular digestion and "storage: of indigestible portions of the diet for later casting. Casts (pellets) are regurgitated compressed mats of indigestible parts (fur, teeth, bones, etc.). Because of the tubular shape of the gastrointestinal tract, owls cannot consume food once the casting process has started (the pellet blocks the tract until it is regurgitated). The remaining gastrointestinal tract is simple, with a vestigial cecum possibly present. Mean food retention time in carnivorous birds is reported to be 360-600 minutes (Klasing, 1998).

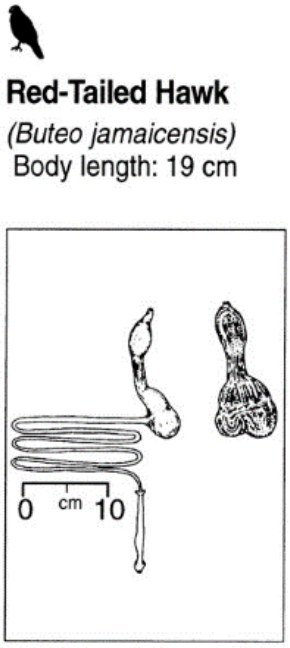

Figure 1. Gastrointestinal tract of the red-tailed hawk (*Buteo jamaicensis*) as a general model for an owl gastrointestinal tract (Stevens and Hume 1995).

Free-ranging diet composition: Owls have diverse diets, yet rodent species are the predominant food item. Owls are carnivorous, and generally swallow all but the largest prey items whole. The size of prey that a species takes will usually depend on the size of the hunting bird, but most owls are also opportunistic feeders, and most of the prey caught is surprisingly small. Prey can include insects and small mammals, reptiles, and even birds for the larger species. Minimal bone digestion occurs in the

stomachs of adult owls, and the indigestible parts of the food parcel (i.e., bones, skull, teeth, fur, and feathers) are regurgitated some hours after the meal in a compact pellet (Fowler, 1986; Burton, 1973), as previously mentioned.

Small owls (i.e., screech owls, pygmy owls, little owls, and the four tiny forest owls) rely mainly on insects and small mammals for their prey, but will also catch small reptiles, amphibians, bats, and birds (Billerman et al 2020). Eurasian little owls have even been recorded taking young rabbits. The small- to medium-sized owls (i.e., barn owls, hawk owls (*Surnia ulula*), and "eared" owls) are almost all reliant upon on a good supply of small mammals, particularly voles. These owls will also eat invertebrates, reptiles, amphibians, bats, and birds (Billerman et al 2020). The spectacled owl eats mainly vertebrates but is reported to exploit a wide range of prey including birds, caterpillars (snatched from leaves), as well as frogs and crabs when the birds live near water (Del Hoyo, 1999). Larger owls tend to eat correspondingly larger prey, although the bulk of what they eat is small rodents. However, eagle owls can catch rabbits, hares, deer fawns, young jackals, and foxes. Some are known to take snakes and even other owls (Billerman et al 2020).

The fishing and fish owls take fish with their feet, which are adapted with spiny scales to help hold their slippery prey. For example, Blakiston's fish owl (*Ketupa blakistoni*) wades in shallow streams hunting crayfish and frogs, as does its near relative the brown fish owl (*Ketupa zeylonensis*) (Billerman et al 2020).

Nutrient requirements: Nutrient requirements for owls are not available, but target nutrient ranges are suggested in Table 7. Because most owls consume whole prey, it would be expected that an otherwise healthy adult whole prey item would be capable of meeting their nutrient and energy needs. For the most part, this is assumed to be true, with the caveats indicated in the following section (commercially raised rodents, immature life stages, incomplete consumption, etc.). Target nutrient values below are based on extensively studied domestic avian species and carnivorous mammalian species. Ranges are provided to best describe the needs of the birds, lacking species-specific information and considering foraging strategy. Nutrient profiles of example whole prey items can be found in a variety of sources (Clum et al., 1996; Dierenfeld et al., 2002).

Table 7. Target nutrient ranges for owls (dry matter basis).

Nutrient	Target Nutrient Content[1]
Crude protein, %	12.5-30
Fat, %	9-15
Vitamin A, IU/g	1.67-7.5
Vitamin D, IU/g	0.25-1.0
Vitamin E, mg/kg	50-150
Calcium, %	0.29-2.5[2]
Phosphorus, %	0.26-0.76
Magnesium, %	0.04-0.07
Potassium, %	0.25-0.52
Sodium, %	0.068-0.17
Iron, mg/kg	67-130
Copper, mg/kg	4.4-8.9
Manganese, mg/kg	48-78
Zinc, mg/kg	40-80
Selenium, mg/kg	0.11-0.4

[1] Target nutrient values are based on a range of requirements for poultry (NRC 1994) and cats (NRC 2006), as well as literature available from raptors.

[2] The higher level may only be appropriate for laying females, but still may be high even considering that pellets contain undigested calcium sources.

Nutritional supplementation: It should not be necessary to supplement an owl's diet if a variety of healthy whole prey items of good quality are provided. The nutritional value of frozen food compared to fresh is not significantly different, providing it has been frozen and correctly stored such as in closable bags or containers (Crissey et al., 2001). The exceptions to this are Vitamin B1 (Thiamine) and Vitamin E which become depleted in thawed frozen fish. There are a few multivitamin supplements available on the market today; some are made specifically for birds, and some are specialized for birds of prey. All should be used with the advice of an experienced avian veterinarian/nutritionist according to the manufacturer's instructions. Vitamins have a limited shelf life and should not be used after the expiration date. Consult a nutritionist about using supplements, as there is debate regarding their effectiveness when the animal is

being fed whole prey items. Also, be aware that label values and guaranteed analyses are not necessarily representative of the nutrient profile of a supplement. Actual nutrient analysis of supplements by a reputable lab is recommended (along with systematic repetition to ensure consistency).

Calcium: Calcium requirements for maintenance of adult birds are about 0.5% dry matter of diet, while laying birds such as chickens need up to 3% calcium, and growing chicks between 0.7–1.3% (Kirkwood, 1979). Since owls produce a limited number of eggs, 3% is likely excessive and unnecessary. The amount of calcium provided with a whole prey-based diet should be sufficient for the calcium needs of egg-laying and chick growth without supplementation. Eating whole, adult, mammalian prey items provide 2.5–3% calcium, which should exceed requirements; even though not all of this is digested, it is comparable with wild intake. It is not advisable to feed a diet composed of flesh only, since it will be deficient in calcium (Cartron, 2000; Dierenfeld et al., 2002). If flesh is the only diet item offered, then a mineral supplement is essential. Additionally, the bones of day-old chicks are not fully formed and not as dense in calcium as whole mammalian food. Owls fed only chicks as food items are susceptible to nutritional deficiencies. For this reason, it is not recommended to feed growing owlets and egg-laying birds purely day-old chicks; some calcium supplementation or additional prey items (e.g., mice) would be necessary in this case.

There are several supplements available to increase the amount of calcium provided in the diet that can be given in the form of calcium carbonate, calcium phosphate, or bone meal (Cartron, 2000). However, excess supplementation can be detrimental, leading to calcium build-up in the body. The correct calcium:phosphorous ratio (1.2:1 to 2:1) should always be maintained (Scott, 1986). There are complex interactions between calcium, phosphorous, and vitamin D metabolism, and an experienced nutritionist or veterinarian should be consulted if supplementation is required.

Thiamin: Thiamin supplementation is recommended for birds that consume a diet that contains more than a third frozen/thawed fish. Many species of fish that are fed to raptors in zoos and aquariums (i.e., smelt and herring) contain an enzyme called thiaminase that is activated by cell death and destroys thiamin stores within the fish. If birds are fed high-fish content diets and not supplemented with thiamin, thiamin deficiency can result, causing neurologic symptoms. For owls that receive frozen-thawed fish on a regular basis, supplementation of thiamin at a dose rate of 25-30 mg thiamin per kg as-fed frozen fish should be sufficient to prevent thiamin deficiency.

Vitamin E: Vitamin E is destroyed over time in stored marine foods (Bernard and Allen 1997). However, vitamin E is a fat-soluble vitamin, and can become toxic if supplemented in too high of a dose. Supplementation should be done under the care of a nutritionist or veterinarian. It may be wise to supplement diets with vitamin E, especially those high in polyunsaturated fatty acids (PUFA) (e.g., diets in which fish is the primary food source; 100 IU per kg of frozen-thawed fish, as fed). For birds fed diets high in frozen-thawed fish, pilling fish remains an option as well as products available that provide premeasured amounts of both thiamin and vitamin E in the correct amounts per kg of fish.

A study by Cheeke and Dierenfeld (2010) found that peregrine falcons fed a quail-based diet had circulating vitamin E levels much lower than their wild counterparts and as a result, reproductive success was compromised. Supplementation with vitamin E returned circulating vitamin E levels in *ex situ* birds to levels observed in wild birds and increased reproductive success. Deficiency of vitamin E can manifest itself in a variety of ways, one of which is embryonic death. This is worth consideration for birds in a breeding program.

Studies by Douglas et al. (1994) and Clum et al. (1996), which investigated the vitamin content of feeder prey, reported average vitamin E levels for quail, rats, and mice that fall within the National Research Council (NRC, 2006) recommendations of vitamin E levels for adult cats at maintenance. However, as reported by Cheeke and Dierenfeld (2010), 220 IU/kg (~148 mg/kg) of vitamin E appeared to be a more appropriate level to support breeding in *ex situ* peregrine falcons, which may indicate that raptors have higher vitamin E requirements than cats. The vitamin E level of most vertebrate prey fed to *ex situ* owls may not be sufficient to support breeding requirements, or perhaps even those of maintenance.

As reported in Clum et al. (1996), vitamin E content of vertebrate prey raised on different diets ranged in vitamin E content as listed in Table 8.

Table 8. Vitamin E content of whole vertebrate prey*

Vertebrate prey items	Range of vitamin E
Quail	40–100 IU/kg
Rats	73–210 IU/kg
Mice	61–88 IU/kg

*(Clum et al., 1996)

Douglas et al. (1994) looked at the vitamin E content of rats and mice purchased from a supplier of vertebrate prey (prey diet was not a consideration) and found the average content of vitamin E in rats ranged from 158–205 IU/kg, and in mice ranged from 52–74 IU/kg. If the requirements of owls and raptors in general are higher than those of cats, the vitamin E levels present in whole prey items such as quail, mice, and even rats, may not be sufficient to meet those requirements.

Vitamin A: Vitamin A is found in the fat and liver of vertebrate prey, but not in the muscle. Rodents raised on commercial feeds by commercial producers have been found to have vitamin A levels significantly higher than those found in wild rodent populations (Douglas et al., 1994) and much higher than known requirements for carnivores.

Clum et al. (1996) found vitamin A content of prey items range from 11–37 µg/g in quail, 10–46 µg/g in rats, and 134–527µg/g in mice. Douglas et al. (1994) found that rats contained 13–100 µg/g of vitamin A, and mice contained 17–86 µg/g of vitamin A. The authors also found that vitamin A content is positively correlated to the size and age of the prey item. Thomas et al. (2004) found that wild mice contained 12–14 µg/g of vitamin A.

The vitamin A requirements of cats are based on metabolic body weight: 20µg/kg $BW^{-0.67}$ for an adult cat at maintenance, and 40µg/kg $BW^{-0.67}$ for breeding and growth (NRC, 2006). Using the requirements for cats as a guide, a 500 g (1.1 lb.) owl would require 12.5 µg of vitamin A at maintenance, and 26.2 µg for breeding and growth. An owl weighing 1.5 kg (3.3 lb) would have requirements of 25.1 µg and 52.5 µg of vitamin A for maintenance and breeding/growth, respectively. These requirements could be met easily by miniscule amounts of whole vertebrate prey.

For this reason, when feeding diets comprised largely of vertebrate prey, it is vital to ensure that additional supplementation of vitamin A is not offered to the birds to prevent incidence of vitamin A toxicity (many commercially available vitamin and mineral supplements designed for birds contain extremely high levels of vitamin A).

Nutritional needs of young: Young owls require the same food type as adult birds, but far more of it; plentiful supplies should be available to the adults rearing young during the breeding season. However, if too much food is provided, the parent birds may only feed the choicest meat to their young, rather than the whole food items that are essential to their healthy growth and development. This may lead to calcium deficiency. A general rule of thumb to follow regarding the quantity of food to provide for adults with young is if all the food is eaten, feed slightly more and a small amount left over is acceptable. (Sarro, pers communication)

Nutritional needs of adults: Smaller owls require a greater quantity of food per unit of body weight than larger ones. The bird dictates the actual amount of prey items to feed it. It is recommended that bird weights be recorded regularly, perhaps monthly. A good guide is feeding approximately 5% of the bird's weight daily for larger owl species while the smaller species may need 15–20% of their body weight. (Sarro, pers communication) This amount will vary depending on the energy requirements of the bird. Many owls will cache their uneaten food and keep it for later or save it around the nest for the chicks; however, great care should be taken to ensure that adult birds do not store food that will decompose. Check exhibit and nest, if possible, regularly for stored food items and remove them. See Chapter 6.2 for more details.

Energy requirements: Energy requirements are expressed in a variety of ways, not all of which are useful or practical for zoological management. Typically, the requirement is expressed as metabolizable energy (ME), which can be determined via direct calorimetry (measure of heat released from a bird), indirect calorimetry (rate of oxygen consumption), or empirically (measuring the actual energy consumed to perform specific functions – weight maintenance, growth, egg laying, etc.). For this reason (and others) routine body weight measurements are recommended.

Kirkwood and Thompson (1983) measured metabolic energy intakes of a few birds of prey housed in outdoor aviaries to range between 90-144 kcal/kg^0.68/day. Based on those values, a reasonable

estimate of maintenance metabolic energy requirements for birds of prey may be 110 kcal/kg 0.68/day (Kopcynski et al., 2000). More specifically, however, energetics of individual owl species has been examined by a variety of resources, yielding slightly different basal metabolic rate calculations (Table 8). Keep in mind that raptors may lose up to 25% of energy ingested due to casting and excretion, so metabolic energy calculations may only represent 75% of the total gross energy necessary to feed. Based on the energy content of the whole prey consumed by the owl and the change in measured body weight (or lack thereof), a seasonal energy need can be determined and adjusted as needed for management. An empirical approach to managing energy intake (i.e. – know the energy in the diet ingredients and regularly monitor body weight of the bird in question) remains a strong recommendation.

Table 9. Calculated basal metabolic rates (BMR) for selected owl species.

Species	Scientific Name	Sex	Mean Weight (g)[1]	BMR (kcal/d)	Source
Barn owl	*Tyto alba alba*	M	330	60	Wijnandts 1984 [2]
		F	370	64	Wijnandts 1984 [2]
Barn owl	*Tyto alba delicatual*	B	365	62	Wijnandts 1984 [2]
Barn owl	*Tyto alba prantincola*	M	474	73	Wijnandts 1984 [2]
		F	566	81	Wijnandts 1984 [2]
Burrowing owl	*Athena cunicularia hypugaea*	M	146	10-16	Ligon 1969[3], Smit et al 2008[4]
		F	156	11-17	Ligon 1969[3], Smit et al 2008[4]
Burrowing owl	*Athene cunicularia floridana*	B	150	10-17	Ligon 1969[3], Smit et al 2008[4]
Great-horned owl	*Bubo virginianus pallescens*	M	914	62-107	Wijnandts 1984[2],Ganey et al 1993[5]
		F	1142	78-122	Wijnandts 1984[2],Ganey et al 1993[5]
Great-horned owl	*Bubo virginianus virginianus*	M	1154	78-123	Wijnandts 1984[2],Ganey et al 1993[5]
		F	1555	106-146	Wijnandts 1984[2],Ganey et al 1993[5]
Snowy owl	*Bubo scandiaca*	M	1806	123-160	Wijnandts 1984[2],Gessaman, 1972[6]
		F	2279	155-183	Wijnandts 1984[2],Gessaman, 1972[6]
Eurasian eagle owl	*Bubo bobo*	M	2380	162-187	Wijnandts 1984[2],Gessaman, 1972[6]
		F	2992	203-214	Wijnandts 1984[2],Gessaman, 1972[6]
Verreaux's eagle owl	*Bubo lacteus*	M	1704	78-154	Wijnandts 1984[2],Gessaman, 1972[6]
		F	2625	121-198	Wijnandts 1984[2],Gessaman, 1972[6]
White-faced scops owl	*Ptilopsis granti*	M	213	13-23	Ligon 1969[3], Smit et al 2008[4]
		F	245	15-26	Ligon 1969[3], Smit et al 2008[4]
Spectacled owl	*Pulsatrix perspicillata*	M	757	52-97	Wijnandts 1984[2],Ganey et al 1993[5]
		F	908	62-107	Wijnandts 1984[2],Ganey et al 1993[5]

[1] Weights from Dunning 2008 and Duncan 2003.
[2] ME BMR 2.08(BWg)^0.58
[3] ME BMR 64.5(BWg)^0.71
[4] Assuming the energy equivalent of O_2 consumption is 4.8 cal/cc O_2, oxygen consumption in the thermoneutral zone is 0.6 cc O_2/g/hr, BMR is calculated as 69 kcal/kg/day. (Smit et al. 2008)
[5] Assuming the energy equivalent of O_2 consumption is 4.8 cal/cc O_2, oxygen consumption in the thermoneutral zone is 0.59cc O_2/g/hr, BMR is calculated as 68 kcal/kg/day. (Ganey et al. 1993)
[6] Assuming the energy equivalent of O_2 consumption is 4.8 cal/cc O_2, oxygen consumption in the thermoneutral zone is 0.4 cc O_2/g/hr, BMR is calculated as 46 kcal/kg/day. (Gessaman, 1972)

6.2 Diets

The formulation, preparation, and delivery of all diets must be of a quality and quantity suitable to meet the animal's nutritional and psychological needs (AZA Accreditation Standard 2.6.2). Food should be purchased from reliable, sustainable, and well-managed sources. The nutritional analysis of the food should be regularly conducted and recorded.

Owls are carnivores and readily take to a diet of frozen-thawed whole prey in zoos. A monotonous diet of just one food source is not recommended. A wide variety of foods will provide more interest for the birds, and less dependence on one food type, thus avoiding problems if that food type suddenly becomes unavailable. Quail, rats, mice, guinea pigs, hamsters, older chickens, and rabbits, can all be used to provide a good mixed diet. A balanced diet may include just one or two good quality prey items, or many prey items. Some facilities also feed a commercially manufactured meat diet with success. The nutrient

composition of several whole vertebrate prey items at different developmental stages can be found in Dierenfeld et al. (2002). Birds that are preparing to breed may be given additional amounts of prey items to encourage breeding. Small species such as European scops owls may occasionally be fed insects (e.g., locusts, crickets, mealworms, giant mealworms, and waxworms). When larger food items are used (day old chicks or adult mice), these may be cut in half for the smaller owls. The appetite of the bird dictates the actual amount of prey items to feed. It is recommended that bird weights be measured and recorded regularly. Generally, a bird will consume enough food to maintain its weight. A good guide is feeding approximately 5% of the bird's weight daily for larger owl species while the smaller species may need 15–20% of their body weight. This amount will vary depending on the energy requirements of the bird, due to behavior (breeding vs. non-breeding) and climate (winter vs. summer temperatures). Once again, a good rule of thumb will be to feed enough prey so that there is some left the next day.

Seasonal changes in nutritional needs: It is important to understand the needs of each species, and to work to meet and maintain these throughout the year. Seasonal changes are important for northern climate facilities that may hold temperate species, as well as southern facilities that house colder climate species. The natural history should be researched, and the diet adjusted accordingly. The food amount will vary depending on the energy requirements of the bird; this is another area where more research is needed. In general, owls should leave a small amount of food items each day. This ensures healthy owls are being fed adequate amounts to supply required caloric needs.

The biggest reason for a seasonal change in body condition is most likely associated with the breeding season. There may be an increase in body weight during the colder months, and a subsequent decrease during the warmer months. It is recommended to assist the birds in thermal regulation during the colder months by increasing their available dietary intake. Body weight increase can also be associated with the breeding season as the birds prepare for egg laying and incubation.

As with most animals, it is important to know the activity levels of the owls being exhibited and adjust diets accordingly. Seasonal and reproductive changes should be anticipated and planned for. For breeding pairs, care should be taken to ensure that there is enough food so that each bird has plenty of access to the food, and to prevent one bird from dominating the resources. Owls are generally sedentary if they are satiated. Hungry owls will be more active and may explore the exhibit looking for food. Most owls are sedentary when not hunting, protecting a territory, courting, or raising chicks.

Food preparations note: Some facilities will gut their domestic rabbits, rats, and quail for cleanliness. Many of the B vitamins are synthesized by gut bacteria and removing the gut can mean that these vitamins are not available to the owls. Halliwell and Graham (1978) report of thiamin deficiencies in raptors fed exclusively on day old chicks or eviscerated prey items. Cutting the wings and feet off dead quail, the feet from rabbits, and the tails from rats assists in keeping enclosures clean. Of note, when insects comprise most of the diet, they should be appropriately supplemented with a calcium source. This supplementation should be via an effective gut-loading procedure and can be augmented by dusting the insects prior to offering.

Food presentation: Food should be presented on a ledge, drawer, or tree stump. Any of these types of raised feeding areas will help with the overall hygiene of the enclosure because it keeps food off the floor, allows old food items to be easily found for removal (assisting with intake monitoring), and allows the area to be cleaned with minimal disturbance to the birds. Raised feeding areas should be positioned where they are protected from the weather and easily accessible. All food areas need to be cleaned frequently and old food items removed to prevent the growth of bacteria such as *Salmonella* and *Escherichia coli*. Old food should be removed daily without disturbing the owls, especially in hot weather when the food will spoil at a faster rate than in cool temperatures. Food that is dropped onto enclosure floors encourages vermin, can be lost in snowy winter conditions, and can be time consuming for keepers to clean up. Uneaten food should be removed except where there are growing young present. Also, situating food and water areas under a roof decreases the risk of disease contamination by wild bird feces.

If several individuals share the enclosure, it is important to distribute food in different places throughout the enclosure in order for each individual to gain access to food. This way, young owls will only see food arrive when delivered by parents, and parent birds are encouraged to work a little harder collecting food as they would in the wild (Parry-Jones, 1998).

Species-appropriate foraging and feeding: If kept in naturally vegetated enclosures, owls will sometimes catch items such as moths and craneflies for themselves. To encourage this hunting behavior,

live crickets and mealworms have been given to pygmy owls (T. Warburton, personal communication). White-faced scops owls and burrowing owls that have been given live insects also eventually chased and caught them (A. Ferguson, personal communication). While the examples above illustrate that owl can catch live prey, it is not advisable to feed live vertebrate prey to owls for two main reasons. First, live prey items can and have been known to injure the predator. A live mouse or rat can inflict bite wounds which can become infected in an owl that is not skilled at killing. Second, seeing a prey item killed by a predator may have far-reaching, detrimental implications in the public eye for the zoological facility.

Feeding schedules: Owls should be fed once daily, as this mimics their wild schedule. Each facility should consider if they want the public to see the birds eating or not, before deciding on the time of feeding. Due to their crepuscular habits, it is better to feed owls toward the end of the day, otherwise food not picked up until after dark may freeze in winter and fester in summer. In very cold weather, it may be advisable to feed smaller owls twice a day, or last thing in the day, so food consumed at night is less likely to get frozen. Some species that are more active during the daylight, such as burrowing owls, may be fed anytime during the day, and will be accustomed to feeding as soon as prey is added.

During courtship, smaller feeds given at more frequent intervals can lead to more food passes between the male and female, and the possibility of better breeding and bonding. Once young have hatched, feeding at least twice a day is advisable.

When owls are used as program animals, it may be necessary to feed them as part of their training/condition regime. In these cases, it is even more valuable to measure and record body weight regularly, in comparison to energy intake and behavioral observations (Kopcynski et al 2000).

Food safety: The use of any avian-derived foods increases the risk of food-borne infection when compared to feeding mammalian foods. It is necessary to ensure correct handling of all food (fresh and frozen) to prevent nutrient loss and limit microbial load (Crissey et al., 2001). For example, pigeons are hosts for several avian diseases, and so are not recommended diet items as they may carry the risk of trichomoniasis. If the food has been shot, there is a risk of lead poisoning through ingestion of the lead shot. It is advised that facilities limit feed items to those that are commercially available from reputable sources.

AZA Accreditation Standard

(2.6.1) Animal food preparation and storage must meet all applicable laws and/or regulations.

Due to the minimal digestion of bones in the owl stomach, it is important to consider the size of the bones the owls will ingest. If larger animals, such as rabbits, are used in the diet then fracturing the long bones will help to prevent impactions and blockages, should parents feed too large a mouthful to their chicks (J. Parry-Jones, personal communication).

AZA Accreditation Standard

(2.6.3) If the institution uses browse plants as part of the diet or as enrichment items for its animals, the items must be identified and reviewed for safety prior to use.

Food preparation must be performed in accordance with all relevant federal, state, or local laws and/or regulations (AZA Accreditation Standard 2.6.1). It is paramount that meat processed on site is processed following all USDA standards. The appropriate hazard analysis and critical control points (HACCP) food safety protocols for the diet ingredients, diet preparation, and diet administration should be established for owls. Diet preparation staff should remain current on food recalls, updates, and regulations per USDA/FDA. Remove food within a maximum of 24 hours of being offered, unless state or federal regulations specify otherwise, and dispose of per USDA guidelines.

If browse plants are used within the animal's diet or for enrichment, all plants must be identified and assessed for safety prior to use (AZA Accreditation Standard 2.6.3). The responsibility for approval of plants and oversight of the program must be assigned to at least one qualified individual (AZA Accreditation Standard 2.6.3.1). The program should identify if the plants have been treated with any chemicals or near any point sources of pollution and if the plants are safe for the species. The institution's animal care program must address the potential risks of animals being exposed to toxic plants growing around or near their exhibit space, and exhibits should be checked regularly during the growing season (AZA Accreditation Standard 2.6.3.2).

AZA Accreditation Standard

(2.6.3.1) The institution must assign at least one qualified paid or unpaid staff member to oversee appropriate browse material for the animals (including aquatic animals).

AZA Accreditation Standard

(2.6.3.2) The institution's animal care program must address the potential risks of animals (including aquatic animals) being exposed to toxic plants growing in or near their exhibit space. Exhibits should be checked regularly during the growing season.

Owls do not require browse and having potentially toxic plants

including conifers will not be detrimental, as owls will generally not eat any toxic or non-toxic vegetation. Discuss the plant species that are planted in or planned for your exhibit with your veterinary staff to determine if they are acceptable for inclusion in the exhibit.

6.3 Nutritional Evaluations

Ill birds should be removed from enclosures and housed in specifically designed convalescent cages or pens, where they can be given heat and fed accordingly. In cases where birds are so ill, they cannot hold down solid food, it might be necessary to force-feed with a special liquid, tube-fed diet. With veterinary supervision, care, and experience, a crop tube can be inserted and the liquid fed, providing the bird with nutrition until it is able to return to a solid diet. It is important to calculate the estimated stomach volume prior to tube feeding an owl (based on body weight). In addition, it is also helpful to pair this information with the caloric need of the bird in question (based on body weight) and the caloric density of the tube feeding formula per unit volume. Keep in mind that it is often difficult to meet a bird's minimal energy needs (let alone energy needed for growth or healing) via a tube-feeding formula. The formula may serve to maintain gastrointestinal tract motility, provide some additional hydration, and/or provide a fraction of needed energy. Long-term use isn't recommended unless caloric needs can be met (keeping in mind the increased stress of handling).

With all animals, it is useful to get periodic body weight measurements. For owls, it may be best to take these measurements regularly until an annual body weight pattern (based on season, behavior, etc.) is established. Thereafter weights can be less frequent to confirm the existing trend or troubleshoot a consumption or behavioral issue. Some example species weights are included in Table 9.

Some facilities utilize a body-scoring index when assessing the overall condition of a bird. The scale is generally from 1–9 (or can be 1-4 or 1-5), where one is emaciated and nine is obese. Consult your nutritionist or veterinarian to discover if they have a scoring index specifically for owls. Additional research is needed in body scoring and fecal scoring for fully flighted owls (Chang & Wiebe, 2016), as well as non-flighted, rehabilitated owls, which will have reduced pectoral muscling.

Chapter 7. Veterinary Care

7.1 Veterinary Services

Veterinary services are a vital component of excellent animal care practices. A full-time staff veterinarian is recommended; however, in cases where this is not necessary, a consulting/part-time veterinarian must be under contract to make at least twice monthly inspections of the animal collection and to respond to any emergencies (AZA Accreditation Standard 2.1.1). In some instances, because of their size or nature, exceptions may be made to the twice-monthly inspection requirement for certain institutions (e.g., insects only, etc.). Veterinary coverage must also be always available so that any indications of disease, injury, or stress may be responded to in a timely manner (AZA Accreditation Standard 2.1.2). All AZA-accredited institutions should adopt the guidelines for medical programs developed by the American Association of Zoo Veterinarians (AAZV), available at the AAZV website under "Publications", at https://cdn.ymaws.com/www.aazv.org/resource/resmgr/files/aazvveterinaryguidelines2016.pdf (AZA Accreditation Standard 2.0.1).

The AZA Raptor TAG has Veterinary Advisors knowledgeable about veterinary care and management specifically applicable to owls, as well as any additional veterinary research that is still needed to address current knowledge gaps. Generally, no specific training programs are necessary for veterinarians planning to work with owls, as most general avian principles apply. However, it may be beneficial for veterinarians working with the species for the first time to contact the AZA TAG Veterinary Advisor or another experienced raptor veterinarian with any questions prior to performing a procedure. The current Veterinary Advisors can be found on the AAZV website: (VSAG TAG & SSP Vet Advisors List (last edit 6.18.22) - Google Sheets Animal keeper staff should make daily assessments of activity, attitude, appetite, fecal output, and any additional observations. No unique equipment or technologies are necessary for performing routine health assessments in owls. Additionally, monthly regular body weights should be obtained to enable more sensitive monitoring for possible disease. Routine veterinary health assessments should be performed at least every 2–3 years for everyone, or when otherwise indicated by signs of illness. These assessments may include but are not limited to physical examination, blood collection for a complete blood cell count, chemistry panel and plasma/serum banking, radiographs, and fecal parasite screen.

AZA Accreditation Standard

(2.1.1) A full-time staff veterinarian is recommended. In cases where such is not necessary because of the number and/or nature of the animals residing there, a consulting/part-time veterinarian must be under written contract to make at least twice monthly inspections of the animals and to respond as soon as possible to any emergencies.

AZA Accreditation Standard

(2.1.2) So that indications of disease, injury, or stress may be dealt with promptly, veterinary coverage must be available to the animals 24 hours a day, 7 days a week.

AZA Accreditation Standard

(2.0.1) The institution should adopt the *Guidelines for Zoo and Aquarium Veterinary Medical Programs and Veterinary Hospitals,* and policies developed or supported by the American Association of Zoo Veterinarians (AAZV). The most recent edition of the medical programs and hospitals booklet is available at the AAZV website, under "Publications", at https://cdn.ymaws.com/www.aazv.org/resource/resmgr/files/aazvveterinaryguidelines2016.pdf and can also be obtained in PDF format by contacting AZA staff.

AZA Accreditation Standard

(2.2.1) Written, formal procedures must be available to paid and unpaid animal care staff for the use of animal drugs for veterinary purposes, and appropriate security of the drugs must be provided.

Protocols for the use and security of drugs used for veterinary purposes must be formally written and available to paid and unpaid animal care staff (AZA Accreditation Standard 2.2.1). Procedures should include but are not limited to a list of persons authorized to administer animal drugs, situations in which they are to be utilized, location of animal drugs and those persons with access to them, and emergency procedures in the event of accidental human exposure.

A wide variety of common anthelmintics, anesthetics, antibiotics, and analgesics are commonly used by veterinarians treating owls. An institution's veterinary staff should be familiar with storage, handling, and use of these agents.

- Several medications are safely used to treat various issues (bacterial and parasite infections, analgesia, and arthritis). Institutions should consult with their veterinarian(s) if concerns arise about the safety and hazards of medications prescribed for their owls.
- Veterinarian(s) should follow all state and federal regulations as they pertain to the use and dispensing of medications for treatment of various conditions.

Veterinary recordkeeping is an important element of animal care and ensures that information about individual animals and their treatment is always available. Complete medical records must be maintained on all animals in the collection that have received veterinary attention (AZA Accreditation Standard 2.0.4). A designated staff member should be responsible for maintaining accurate animal veterinary record keeping.

AZA Accreditation Standard

(2.0.4) Complete medical records must be maintained on all animals in the collection that have received veterinary attention. [See 1.4.7 for animal records.]

- In addition to daily observations of each bird, the following health related factors should be included in everyone's daily records: weight, daily consumption, response to training/enrichment, quality of molting behavior, feces quality and quantity, urate production, and number of casts present. These conditions should be charted, so that comparisons can be made if concerns are observed.
- There are no healthy related record keeping laws for the USDA or the endangered species act as it pertains to owls.
- Key daily information associated with veterinary care that should be recorded is: attitude, appetite, behavior, fecal and urate appearance and quantity.

7.2 Transfer Examination and Diagnostic Testing Recommendations

The transfer of animals between AZA-accredited institutions or certified related facilities due to AZA Animal Program recommendations occurs often as part of a concerted effort to preserve these species. These transfers should be done as altruistically as possible, and the costs associated with specific examination and diagnostic testing for determining the health of these animals should be considered.

Pre-shipment and transfer requirements are at the discretion of the receiving institution's veterinary staff, but can include the following: physical examination, blood collection for a complete blood cell count with blood smear exam for hemoparasites, chemistry panel and plasma/serum banking, radiographs, fecal parasite screen, fecal enteric culture, and vaccination history for West Nile virus. Results from a preshipment exam should be evaluated by the receiving institution's veterinary staff to confirm that the owl is healthy to receive from the sending institution.

- Normal health parameters for complete blood counts and chemistry panels have been established for the most exhibited owl species, and are currently on the medical resource's module on ZIMS/Species 360

7.3 Quarantine

AZA institutions must have holding facilities or procedures for the quarantine of newly arrived animals and isolation facilities or procedures for the treatment of sick/injured animals. Quarantine duration should be assessed and determined by the pathogen risk and best practice for animal welfare (AZA Accreditation Standard 2.7.1). All quarantine, hospital, and isolation areas should follow AZA standards/guidelines (AZA Accreditation Standard 2.7.3; Appendix E). All quarantine procedures should be supervised by a veterinarian, formally written and available to paid and unpaid staff working with quarantined animals (AZA Accreditation Standard 2.7.2). If a specific quarantine facility is not present, then newly acquired animals should be kept separate from the established collection to prohibit physical contact, prevent disease transmission, and avoid aerosol and drainage contamination. If the receiving institution lacks appropriate facilities for quarantine, pre-shipment quarantine at an AZA or American Association for Laboratory Animal Science (AALAS) accredited institution may be applicable. Local, state, or federal regulations that are more stringent than AZA Standards and recommendation have precedence.

AZA Accreditation Standard

(2.7.1) The institution must have holding facilities or procedures for the quarantine of newly arrived animals and isolation facilities or procedures for the treatment of sick/injured animals. Quarantine duration should be assessed and determined by the pathogen risk and best practice for animal welfare.

AZA Accreditation Standard

(2.7.3) Quarantine, hospital, and isolation areas should be in compliance with standards/guidelines contained within the Guidelines for Zoo and Aquarium Veterinary Medical Programs and Veterinary Hospitals developed by the American Association of Zoo Veterinarians (AAZV), which can be obtained at: www.aazv.org/resource/resmgr/files/aazv veterinaryguidelines2016.pdf

AZA Accreditation Standard

(2.7.2) Written, formal procedures for quarantine must be available and familiar to all paid and unpaid staff working with quarantined animals.

The quarantine facility should have an independent air-handling capability, be species-sized appropriate (a minimum of 2x the height of the bird, by 2x the wingspan for both width and length of the enclosure) and have adequate perching opportunities for all birds.

If quarantine facilities are not available at the receiving institution, strict biosecurity is to be followed. Such biosecurity practices should include, but are not limited to, cleaning and servicing all owls in quarantine, which should be performed after all main collection birds have been completed or by dedicated quarantine staff. Morning checks are vitally important as early each day as possible. The individual doing those checks should wear (quarantine) separate clothing, footwear, and gloves. When birds are serviced, keepers should wear separate clothing, footwear, and gloves, and use specific tools just for those birds during daily routine care (cleaning, feeding, training and enrichment) during the quarantine period. During the quarantine, an examination should be performed by a veterinarian to determine the bird's health status and confirm that it is healthy and there is no infectious disease risk to the current collection.

AZA Accreditation Standard

(11.1.2) Training and procedures must be in place regarding zoonotic diseases.

AZA institutions must have zoonotic disease prevention procedures and training protocols established to minimize the risk of transferable diseases (AZA Accreditation Standard 11.1.2) with all animals, including those newly acquired in quarantine. Keepers should be designated to care only for quarantined animals if possible. If keepers must care for both quarantined and resident animals of the same class, they should care for the quarantined animals only after caring for the resident animals. Care should be taken to ensure that these keepers are "decontaminated" before caring for the healthy resident animals again. Equipment used to feed, care for, and enrich animals in quarantine should be used only with these animals. If this is not possible, then all items must be appropriately disinfected, as designated by the veterinarian supervising quarantine before use with resident animals.

A footbath containing disinfectant should be placed at the entrance to the enclosure, and keeper staff should wear a mask and gloves when servicing the area. Clothing should be changed in between servicing the quarantined animal and moving back on grounds. If clothing cannot be changed, a gown should be worn on top of clothing and removed at the conclusion of servicing.

Effective measures that help prevent the transmission of diseases between animals include (as designated by veterinarians at each institution): (1) washing hands between and after handling animals, feces and urates, other bodily fluids or secretions, or animal diets; (2) wearing gloves, goggles, and a mask when cleaning animal enclosures; and (3) wearing gloves when handling any animal tissues.

Disinfection protocols should take into consideration the material to be disinfected, and should ensure that disinfectants are thoroughly rinsed off or neutralized before the equipment or enrichment item is used again with the birds.

There are specific zoonotic disease risks for individuals when working with owls. These diseases include *Chlamydia psittaci*, *Mycobacteria avium*, Clostridial toxemia, and salmonellosis. Keepers should practice good hygiene when working with owls. Hygiene practices should include hand washing, the use of foot baths during quarantine, and wearing gloves when cleaning, feeding, and handling of birds.

Quarantine philosophy has changed in the past few years from a strict 30-day period to a risk-based assessment to determine the length of quarantine and the testing required. Veterinarians from both sending and receiving institutions should be consulted for institution-specific quarantine testing requirements.

During the quarantine period, specific diagnostic tests should be conducted with each animal if possible or from a representative sample of a larger population (e.g., birds in an aviary or frogs in a terrarium) (see Appendix E). A complete physical should be performed. Animals should be evaluated for ectoparasites and treated accordingly. Blood should be collected, analyzed and the plasma banked in either a -80 °C (-94 °F) freezer or a frost-free -20 °C (-4 °F) freezer for retrospective evaluation. Fecal samples should be collected and analyzed for gastrointestinal parasites and the animals should be treated accordingly. Vaccinations should be updated as appropriate, and if the vaccination history is not known, the animal should be treated as immunologically naive and given the appropriate series of vaccinations.

Endoparasites can be treated with pyrantel, ivermectin, fenbendazole, among other medications. Ectoparasites can be treated with dilute pyrethrin spray topically or systemic ivermectin or other effective medication. A fecal culture and cytology are also recommended to evaluate for enteric bacterial pathogens such as *Salmonella, Mycobacterium,* and *Clostridium*. Vaccinations, such as the West Nile virus vaccination, should be updated as appropriate. Survey radiographs should be strongly considered,

to act as a baseline for the individual, as well as an additional tool with which to screen for disease. Depending on the disease and history of the animals, testing protocols for animals may vary from an initial quarantine test to regular repetitions of diagnostic tests as determined by the veterinarian.

In general, fecal floatation for endoparasites, visual exam for ectoparasites, standard complete blood cell counts, and clinical chemistries are recommended. It is not uncommon to find blood parasites such as *Plasmodium* and *Haemoproteus* in owls, and a veterinarian should be consulted in order to determine whether treatment is necessary. Parasitic diseases of owls include myiasis, coccidiosis, trichomoniasis, cestodiasis, trypanosomiasis, trematodiasis, and nematodiasis. Depending on the disease and history of the animals, testing protocols for animals may vary from an initial quarantine test to yearly repetitions of diagnostic tests as determined by the veterinarian.

Social isolation: It is acceptable to keep owls singly while they are in quarantine or being treated for medical concerns. If an owl from a bonded pair is separated, the birds may need to be howdy-caged or within visual/auditory contact before being reintroduced. This will often be determined by the owls' temperament before the separation. Watch for aggression at the mesh. "Fly-by" behavior can indicate the birds are not comfortable with each other yet. If behavior concerns are observed during isolation, there are a few approaches that can be taken to assist with this. Providing the bird with a range of enrichment initiatives (e.g., plantings) upon which it can focus will help, and will provide opportunities for the bird to perform species-appropriate behaviors. Providing two perches at slightly different heights within the enclosure may also help.

Animals should be permanently identified by a transponder, a leg band, their natural markings or, if necessary, marked when anesthetized or restrained (e.g., patagial tag, or microchip). Medical records for each animal should be accurately maintained and easily available during the quarantine period.

There are no known social or behavioral problems that have been described in owl species during the quarantine period, but training and enrichment should be provided to help prevent any instances of these behaviors. Remember to be flexible in changes to the enclosure depending on the individual.

If an animal should die in quarantine, a necropsy should be performed on it to determine cause of death in order to strengthen the program of veterinary care and meet SSP-related requests (AZA Accreditation Standard 2.5.1). The institution should have an area dedicated to performing necropsies, and the subsequent disposal of the body must be done in accordance with any local or federal laws (AZA Accreditation Standards 2.5.2 and 2.5.3). If the animal is on loan from another facility, the loan agreement should be consulted as to the owner's wishes for disposition of the carcass; if nothing is stated, the owner should be consulted. Necropsies should include a detailed external and internal gross morphological examination and representative tissue samples from the body organs should be submitted for histopathological examination (see Chapter 7.6).

AZA Accreditation Standard

(2.5.1) Deceased animals should be necropsied to determine the cause of death for tracking morbidity and mortality trends to strengthen the program of veterinary care and meet SSP-related requests.

AZA Accreditation Standard

(2.5.2) The institution should have an area dedicated to performing necropsies.

AZA Accreditation Standard

(2.5.3) Cadavers must be kept in a dedicated storage area before and after necropsy. Remains must be disposed of in accordance with local/federal laws.

AZA Accreditation Standard

(2.0.2) The veterinary care program must emphasize disease prevention.

AZA Accreditation Standard

(2.0.3) Institutions should be aware of and prepared for periodic disease outbreaks in wild or other domestic or exotic animal populations that might affect the institution's animals (ex – Avian Influenza, Eastern Equine Encephalitis Virus, etc.). Plans should be developed that outline steps to be taken to protect the institution's animals in these situations.

7.4 Preventive Medicine

AZA-accredited institutions should have an extensive veterinary program that must emphasize disease prevention (AZA Accreditation Standard 2.0.2). AZA institutions should be aware of and prepared for periodic disease outbreaks in other animal populations that might affect the institution's animals and should develop plans to protect the institution's animals in these situations (AZA Accreditation Standard 2.0.3). The American Association of Zoo Veterinarians (AAZV) has developed an outline of an effective preventative veterinary medicine program that should be implemented to ensure proactive veterinary care for all animals:(www.aazv.org/associations).

Routine assessments: Physical examinations should be periodically scheduled as per the attending veterinarian, in autumn or winter, so that they occur prior to the breeding season. During the physical exam, deworming, weighing, and any necessary overgrown beak or nail clipping should be performed as a preventive measure. The band/ID numbers should also be checked for accuracy as well as correct fit. Generally, a hands-on physical will include taking a blood sample for analysis for CBC, biochemistry, and hemoparasites. Scale training for owls may be done with ambassador birds and regular weight measurements would be best practices, either monthly or more often if not too stressful. Regular recording of weights is a method to gauge the bird's overall condition; dramatic loss or gain of weight (> 10%) may indicate a health concern and warrant further evaluation under anesthesia.

Medical management of neonates: Some chicks will have a more difficult time hatching than others. 'Assisted' chicks are usually weaker in the first few days of rearing, and may need extra care, fluids, and possibly a course of antibiotics. Generally, a newly hatched chick will do well if left with the parents. The medical staff can examine hand-raised owlets at any time if there is a concern. Watch for lethargy, appetite loss, and dehydration. If the owlet continues to decline, medical care and perhaps hand-rearing will need to be started. See Parry-Jones & Ferguson (2003) and Sarro (2004) for more details about problem hatching.

Medical management of molt: All birds molt or replace their old worn feathers to grow new ones. Owls often have an annual period of heavier molting, but the feathers are not replaced all at once, so thermoregulation and flight are not adversely affected. Monitoring the molting pattern of birds is an important husbandry technique, especially for full-flighted birds. An unexpected molt or sudden change in feather condition can be a sign of elevated stress or illness. Broken feathers can result when birds fly in exhibits, but this can be minimized by placing perches away from walls. Regular exams of owls during the non-breeding season are a good way to monitor feather condition and overall health.

Medical management of geriatrics: Geriatric owls are at risk of typical maladies associated with old age in animals, such as arthritis, organ failure, reduced vision and hearing, and cancer. Routine examinations are the best method to monitor for these health issues and diagnose them at an early stage when treatment may be most effective.

Animal Ambassadors: Animals that are taken off zoo/aquarium grounds for any purpose have the potential to be exposed to infectious agents that could spread to the rest of the institution's healthy population. AZA-accredited institutions must have adequate protocols in place to avoid this (AZA Accreditation Standard 1.5.5).

When ambassador animals are housed at zoological institutions, these birds should generally be kept in separate enclosures and only designated, trained individuals should work them. Unless a significant zoonotic infectious concern arises during an examination of a bird offsite, birds are allowed to return to the institution without the need for quarantine procedure. If an infectious disease is suspected, birds should be isolated, tested, and treated.

AZA Accreditation Standard

(1.5.5) For animals used in offsite programs and for educational purposes, the institution must have adequate protocols in place to protect the rest of the animals at the institution from exposure to infectious agents.

AZA Accreditation Standard

(11.1.3) A tuberculin (TB) testing/surveillance program must be established for appropriate paid and unpaid staff in order to assure the health of both the paid and unpaid staff and the animals.

A tuberculin testing and surveillance program must be established for paid and unpaid animal care staff, as appropriate, to protect the health of both staff and animals (AZA Accreditation Standard 11.1.3). Depending on the disease and history of the animals, testing protocols for animals may vary from an initial quarantine test to annual repetitions of diagnostic tests as determined by the veterinarian. There is not a vaccination for mycobacteriosis

While avian species are not typically tested for tuberculosis, there is a human risk of acquiring an atypical mycobacterial infection from avian species, especially in immuno-compromised individuals. While the purified protein derivative test in humans is usually negative in cases of atypical mycobacteriosis, it may catch some cases. More in depth testing of asymptomatic individuals is not indicated.

The most commonly used vaccination for owls is the West Nile Virus vaccination. Its efficacy has yet to be determined, and it may offer limited protection for some species such as snowy owls.

7.5 Capture, Restraint, and Immobilization

The need for capturing, restraining and/or immobilizing an animal for normal or emergency husbandry procedures may be required. All capture equipment must be always in good working order and available to authorized and trained animal care staff (AZA Accreditation Standard 2.3.1).

AZA Accreditation Standard

(2.3.1) Capture equipment must be in good working order and available to authorized, trained personnel at all times.

Capture: Birds should be caught up as quickly and as safely as possible. It is recommended that the more nervous bird of a pair should be caught up first, to avoid that bird injuring itself. All birds that need to be captured should be caught up before any birds are released back into the aviary.

The easiest, quickest, and safest way to catch up birds is with a large, deep net made from soft material with a soft but firm rim. If the net is too shallow, the birds will bounce out of it. Several manufacturers make these in a variety of sizes and handle lengths. One design incorporates a telescopic handle that is useful for catching birds in high enclosures. Collections should have several nets of different sizes available at all times. The birds can be caught quickly, with minimal stress, and then handled out of the net. Only one person is needed to catch most of the medium to small birds, although two (with a net each) will make the job quicker if more than one bird is to be caught. The larger owls often require two people to help each other. In this case, the owl is netted by one person, who restrains the bird in the net. The second person will carefully grasp the feet and head of the owl and help extract the bird from the net (see below). Owls are dangerous birds and should always be handled with care.

Restraint: The feet of an owl should be restrained first, as the talons are the most dangerous part of the animal. When holding the legs, one finger should be placed between the legs so that any pressure can be felt on the finger, thus avoiding too much pressure that may accidentally break a bird's leg. The wings need to be restrained next and held close against the body in order to immobilize the bird and prevent it from hurting itself. As owls will bite to protect themselves, care should be taken to ensure hands and other body parts are not within reach of the beak. Some owl managers will always use heavy leather gloves to protect themselves, while others carefully use bare hands.

Birds should preferably be held upright, or on their fronts or sides, to allow them to breathe correctly. They should not be held on their backs for extended periods unless being examined by an experienced veterinarian. This is especially important if the bird has respiratory problems.

Flight restraint: Pinioning or wing clipping is generally unacceptable for any of the Strigiformes, which use flight as their main method of locomotion. There may be husbandry needs for feather clipping to minimize flight capability to lessen aggression between birds. Owls that are under the care of a veterinarian may need to be temporarily flight restricted to facilitate healing. This may be done in the short-term with wing brails, bandage wraps, or primary feather clipping. These methods are to be used as temporary measures only.

AZA Accreditation Standard

(2.1.3) Paid and unpaid animal care staff should be trained to assess welfare and recognize abnormal behavior and clinical signs of illness and have knowledge of the diets, husbandry (including enrichment items and strategies), and restraint procedures required for the animals under their care. However, animal care staff (paid and unpaid) must not diagnose illnesses nor prescribe treatment.

Anesthesia: There are various chemicals and protocols for owl anesthesia. Consult your veterinarian for information (see Miller et al., 2018 for additional information).

AZA Accreditation Standard

(2.3.2) Institution facilities must have radiographic equipment or have access to radiographic services.

To perform an adequate physical exam on an owl, birds are to be physically restrained to prevent injury to the veterinarian. During restraint, keeper staff will control the talons, head, and wings. Operant training can be performed to get owls used to restraint via jesses, but owls will still need to be casted for the exam to be performed. Awake exams should be limited to 10 minutes to prevent overheating.

7.6 Management of Diseases, Disorders, Injuries and/or Isolation

AZA-accredited institutions should have an extensive veterinary program that manages animal diseases, disorders, or injuries and can isolate these animals in a hospital setting for treatment if necessary. The owner of an animal on loan at a facility is to be consulted prior to any elective invasive procedures, including permanent contraception.

Owl care staff should be trained in meeting the animal's dietary, husbandry, and enrichment needs, as well as in restraint techniques. Staff should also be trained to assess animal welfare and recognize behavioral indicators animals may display if their health becomes compromised; however, animal care staff should not diagnose illnesses nor prescribe treatment (AZA Accreditation Standard 2.1.3). Protocols should be established for reporting these observations to the veterinary department. Hospital facilities for owls must have radiographic equipment or access to radiographic services (AZA Accreditation Standard 2.3.2), contain appropriate equipment and supplies on hand for treatment of diseases, disorders or injuries, and have staff available that are trained to address health issues, manage short- and long-term medical treatments and control for zoonotic disease transmission.

Owls that are ill will hide their infirmity as long as possible. Be keenly aware of any variation in the individual owl's behavior or routine. Watch for fluffed feathers and shivering. Keeping periodic weight records will facilitate determining anorexia and potential pathology. Any bird that is ill should receive a physical exam and have blood drawn as a routine procedure. The cell blood count (CBC) and plasma chemistry will help determine the illness and subsequent treatment. Care should be taken to ensure that the stress of capture, restraint, and sample collection does not exacerbate the health issue. The vein used for phlebotomy is often a wing vein or right jugular vein, but leg or toe veins are occasionally used.

Common diseases: The following list describes some of the most common diseases and disorders experienced by *ex situ* owl species.

Bumblefoot: One of the most common physical problems is bumblefoot, which results from inflammation and bacterial infection of plantar aspects of the foot tissue. In most situations, bumblefoot is caused by provision of inappropriate or insufficient perching. In severe cases, the tissue can become devitalized and necrotic. It is difficult to treat once it takes hold, and often reoccurs.

The clinical signs of bumblefoot include tenderness, reluctance to place weight on a foot, abnormal swelling, and redness of the footpad. Birds displaying any of these signs should be removed from the enclosure. A sample of the material in the swelling may be taken for culture and sensitivity, to determine if antibiotic treatment is indicated. The bird may need antibiotics, dressings, and intensive treatment quickly if the disease is to be controlled. Non-responsive lesions may require surgery or furthermore intensive treatment modalities. There are a number of husbandry options to assist in limiting this malady such as using multiple substrates and perching textures (i.e.: bark, vet-wrap, rope, etc)

Salmonella: Salmonellosis infection can be caused by contaminated food (usually of avian origin), and signs such as generalized lethargy and reduced appetite are often difficult to spot in time. This infection can be fatal and is difficult to avoid but providing a non-avian diet can minimize the risk. It is a significant, but relatively infrequent, problem that can be largely controlled by use of quality food, correct food storage, and good hygiene.

Aspergillosis: Aspergillosis is a fungal infection affecting the respiratory tract. It is a common illness in certain species such as the snowy owl and is often associated with stress. Clinical signs are varied, and can include loss of appetite, increased respiratory rate or effort, listlessness, loss of condition, anemia, yellowing of the feces, and a respiratory rattle. Poor ventilation and large numbers of fungal spores released into the environment from moist, rotting/decomposing vegetation (e.g., compost heaps, wood chip bark, hay, and straw) can contribute to disease outbreak as the owls inhale during normal respiration. Aspergillosis is not usually contagious and can be treated if caught early in the disease process. During high-stress times such as shipping a bird, prophylactic antifungal treatment may be advised for a period before the shipment. However, prognosis is poor for any established infection.

Malaria: Avian malaria (*Plasmodium* spp.) is a concern in owls, especially in those species originating from colder climates (e.g., snowy owls). These more northern species have not evolved resistance in the same way as the more southern species. There are different species of *Plasmodium* in North America, and each has its own virulence. Loss of appetite, change in behaviors such as perching location or vocalizations, and general lethargy may be signs of malaria. Diagnosis is based on observation of the organism in stained peripheral blood smears or PCR testing.

Trichomoniasis: Trichomoniasis is a common infection in raptors that is acquired via direct contact with, or through, infected food or water. Infection is usually limited to the oropharynx, esophagus, crop, and trachea, and is visible as sticky, creamy, white, caseous deposits. Infections can become systemic and show generalized signs of disease or can also be asymptomatic. Diagnosis is based on identification of

mobile trophozoites on direct saline smears of material taken from lesions. Treatment for low level infections is not typically necessary, although heavy infections in more sensitive species (e.g., snowy owl) may be indicated, especially if other stressors are present.

Viruses: West Nile virus (WNV) is a disease transmitted by mosquitoes and can affect owl species, with snowy owls being very susceptible. The current WNV vaccine was originally created for equines and may be of limited effectiveness with owls. Adenovirus infection, thought to be introduced through the feeding of avian food, may affect some island species of owls. Once the virus is in an environment, it is almost impossible to eradicate. Other viral diseases that affect *ex situ* owls include owl herpesvirus, paramyxovirus, avian influenza, and avian leukosis virus.

AZA Accreditation Standard

(1.5.0) The institution must have a process for assessing animal welfare and wellness.

AZA Accreditation Standard

(1.5.8) The institution must develop and implement a clear and transparent process for identifying, communicating, and addressing animal welfare concerns from paid or unpaid staff within the institution in a timely manner, and without retribution.

Injuries and trauma: Physical injuries may occur in birds, usually because of trauma from capture and restraint or conspecific aggression. Impact with the outer containment barriers of the aviary can lead to injuries of the eyes, beak, and cere. These should be treated immediately, and severe injuries will require experienced veterinary care. Some beak injuries may be treated with acrylic materials. Care should be taken to use adequate ventilation during this procedure because of the toxic fumes released during the "curing process" of acrylic. Most owl species will do well when isolated for short or long periods of time. The author is unaware of any major concerns with this practice, which is commonly done with ambassador or show birds.

AZA-accredited institutions must have a clear and transparent process for assessing animal welfare and wellness, as well as for identifying and addressing owls' welfare concerns within the institution (AZA Accreditation Standards 1.5.0 and 1.5.8) and should have an established Institutional Animal Welfare Committee. This process should identify the protocols needed for animal care staff members to communicate animal welfare questions or concerns to their supervisors, their Institutional Animal Welfare Committee or if necessary, the AZA Animal Welfare Committee. Protocols should be in place to document the training of staff about animal welfare issues, identification of any animal welfare issues, coordination and implementation of appropriate responses to these issues, evaluation (and adjustment of these responses if necessary) of the outcome of these responses, and the dissemination of the knowledge gained from these issues.

If welfare concerns arise when working with owls these concerns should be addressed in the appropriate chain of command. Many facilities now have protocols in place where these concerns can be addressed anonymously. After concerns are made, a full inquiry should be conducted to evaluate if any welfare concerns are seen and then addressed accordingly with husbandry and veterinary staff. After resolution of those welfare concerns a full report should be made and allowed to be reviewed by all pertinent staff.

AZA-accredited zoos and aquariums provide superior daily care and husbandry routines, high quality diets, and regular veterinary care, to support owl longevity. In the occurrence of death however, information obtained from necropsies is added to a database of information that assists researchers and veterinarians in zoos and aquariums to enhance the lives of owls both in their care and in the wild. As stated earlier, necropsies should be conducted on deceased owls to determine their cause of death, and the subsequent disposal of the body must be done in accordance with local, state, or federal laws (AZA Accreditation Standard 2.5.1 and 2.5.3). If the animal is on loan from another facility, the loan agreement should be consulted as to the owner's wishes for disposition of the carcass; if nothing is stated, the owner should be consulted. Necropsies should include a detailed external and internal gross morphological examination and representative tissue samples from the body organs should be submitted for histopathologic examination. Many facilities utilize private laboratories, partner with universities, or have their own in-house pathology department to analyze these samples. The AZA and American Association of Zoo Veterinarians (AAZV) website should be checked for any AZA Owl SSP Program approved active research requests that could be filled from a necropsy.

Full gross necropsy examinations should be performed on all owls that die. Examination should include a critical evaluation with pictures of all external injuries and internal organs. Representative samples of all organs (eye, brain, skin, muscle, esophagus, trachea, thyroid glands, parathyroid glands, thymus, air sacs, lung, heart, major blood vessels, liver, spleen proventriculus, ventriculus, duodenum, small intestines, adrenal glands, kidneys, reproductive organs, cloaca and ischiosciatic nerves) should be taken and preserved in 10% formalin for histopathologic evaluation. Histopathology should be reviewed by a pathologist familiar with diseases of owls.

Chapter 8. Reproduction

8.1 Reproductive Physiology and Behavior

It is important to have a comprehensive understanding of the reproductive physiology and behaviors of the animals in our care. This knowledge facilitates all aspects of reproduction, artificial insemination, birthing, rearing, and even contraception efforts that AZA-accredited zoos and aquariums strive to achieve.

In the wild, owls breed at different times of the year depending on the species, food availability, altitude, and weather conditions. The same occurs in institutions, with different species coming into breeding condition at often unexpected times of the year. For example, Indian eagle owls (*Bubo bubo bengalensis*) and brown fish owls (*Bubo zeylonensis*) can be very early layers, beginning in December or even earlier. Monitoring of paired birds should continue throughout the year until individual breeding seasons are established. Widely separated races of the same species might also have different breeding seasons, which might affect successful breeding.

Breeding age: Owl species mature at different ages. In general, most of the smaller owls will breed in their first year, while the larger owls take several years to reach sexual maturity. Some of the large eagle owls can take four or more years to reach breeding age. An exception to this is the snowy owl, which can breed at 1 year old (T. Warburton, personal communication). Favorable conditions in zoos and aquariums are likely to promote earlier breeding by placing younger birds with older birds. This can bring younger birds to breeding condition earlier than if young birds are paired together. Pairing experienced breeder owls with less experienced breeders has a better chance of producing young, but this is not always doable following AZA SSP recommended pairings.

Breeding behavior: The breeding season begins with the male claiming his territory and prospecting for potential nest sites. The male usually acquires this territory by calling, patrolling, and defending it against intruders; thereafter; both partners will be involved in defending their territory, which serves to strengthen the pair bond (Kemp & Calburn, 1987).

In courtship, the males must prove their fitness to feed young by gathering food for the female in the weeks prior to egg laying. There is much calling, food passing, and showing of the potential nest site. The male will repeatedly fly over to where he considers the female should lay the eggs and will continually call from the potential nest-site to encourage her to inspect his choice.

In the first few days after hatching, the male/sire provides the female/dam with food. The female then feeds the chicks with torn off pieces. Once the owlets have their secondary down, they can thermo-regulate, and both parents will then hunt to satisfy the demands of the growing brood. At this stage, the male also begins to help with the feeding of the young.

Incubation is mainly carried out by females, although males do sometimes share the task for short periods. See Table 10 for incubation periods for a sample of owl species.

Table 10. Incubation periods for owl species*

Species	Incubation period (days)
Barn owl	33
Oriental bay owl	Unknown
Saw-whet owl	21–28
Short-eared owl	26
Long-eared owl	26–28
Burrowing owl	28
Eurasian eagle owl	35
Verreaux's eagle owl	38
Snowy owls	30–32
Great-horned owls	26–30
Elf owl	14–16
Boobook owl	33
White-faced scops owl	24–25
Spectacled owl	34–37
Tawny owl	28
Great gray owl	30
Spotted owl	36–30
Ural owl	27–28
Barred owl	28
Northern pygmy owl	28
Pearl-spotted owl	28
Ferruginous pygmy owl	28
Eastern screech owl	21–30
Western screech owls	21–30

*(Burton, 1973)

Separation of sexes/young: As egg-laying approaches, the female stops going to collect her own food and relies on the male for food, often remaining at or near the chosen nest site. She may call to him or even chase him, begging for food. If he is unresponsive, she may snatch food from him. If the male remains unresponsive, the female may start to behave aggressively, chasing, injuring, or even killing him. If a male is found to be showing signs of fear, injury, or unacceptable levels of stress, such as fluffed feathers, aggressive postures, restlessness, and chaotic flights, he should be removed immediately. Although the female is usually the more aggressive of the two because of her larger size, it does not always follow that the female is dominant. Sometimes she can be the one showing signs of stress and may need to be removed or separated from the male. In such cases, a reasonable amount of knowledge and experience with breeding birds is needed to find out which of the pair is unsuitable for breeding, or if the problem is simply a case of the pair not being compatible.

Exactly how long wild young owls are dependent on parents after fledging is not well documented and is variable between species. In the wild, chicks of some species, such as the eagle owl, remain with their parents for many months after fledging; but, for other species, the young birds disperse soon after fledging. In zoos and aquariums, however, juvenile birds can be left in a group until they reach adult plumage (and sometimes for longer), although the group should be monitored for any signs of stress or aggression. In many cases, juvenile owls have been observed to remain with their parents for prolonged periods after fledging, although this is dependent on the species (Fosco, 2007). The presence of a juvenile is likely to deter further breeding from the adult pair.

Changes in social dynamics of adult owls in zoos have been observed. Young from one breeding season that are still in the area at the next breeding season should be removed. It is recommended that the young be removed prior to the start of the next season if reproduction is wanted every season. Young birds may need to be removed once they are fully fledged if there is aggression form the parents, and either moved to new homes or put in groups in another suitable enclosure. Relocating juveniles to exhibits within visual or auditory contact of the parents may be acceptable, but the stress levels of both the juveniles and parents should be carefully monitored.

8.2 Assisted Reproductive Technology

The practical use of artificial insemination (AI) with animals was developed during the early 1900s to replicate desirable livestock characteristics to more progeny. Over the last decade or so, AZA-accredited zoos and aquariums have begun using AI processes more often with many of the animals residing in their

care. AZA Studbooks are designed to help manage animal populations by providing detailed genetic and demographic analyses to promote genetic diversity with breeding pair decisions within and between our institutions. While these decisions are based upon sound biological reasoning, the efforts needed to ensure that transports and introductions are done properly to facilitate breeding between the animals are often quite complex, exhaustive, and expensive, and conception is not guaranteed.

AI has become an increasingly popular technology that is being used to meet the needs identified in the AZA Studbooks without having to re-locate animals. Males are trained to voluntarily produce semen samples and females are being trained for voluntary insemination and pregnancy monitoring procedures such as blood and urine hormone measurements and ultrasound evaluations. Techniques used to preserve and freeze semen have been achieved with a variety of, but not all, species and should be investigated further.

Besides physical issues, AI procedures also bring issues of ownership of semen and/or the animal being inseminated. Very often, semen from multiple animals may be used. As with any natural (physical) breeding, the rights of the owners of all materials and animals involved must be considered. Appropriate transaction documents (and loan agreements, if appropriate) must be fully completed before AI is attempted.

Presently, artificial insemination is not used in owl husbandry. Great strides have been made with other avian species including falcons and cranes, and many of these same techniques may be applied to owls when needed.

8.3 Pregnancy and Egg-laying

It is extremely important to understand the physiological and behavioral changes that occur throughout an animal's pregnancy. Owls, depending on the species, will lay anywhere between one to more than 10 eggs during one nesting period.

Female owls can often look ill or uncomfortable prior to laying eggs, a condition known as "egg lethargy." However, care should be taken to ensure that the females are not experiencing actual difficulties during egg laying. In some cases, females suffer from "egg binding," which is when the bird cannot expel the egg from her body due to some obstruction or impaction of the oviduct or cloaca (Reece, 1987). If females are sitting on the ground for an unusual period, rather than perched or on the nest area, they should be caught up and checked. This needs to be done very carefully. If it is a case of egg binding or imminent egg laying, breaking the egg in the oviduct can lead to severe shock, infection, and death of the bird. Sudden bouts of cold weather can cause egg binding, particularly in enclosures facing into chilling winds. If a bird is thought to be egg bound, immediate veterinary attention is needed.

8.4 Hatching Facilities

As parturition approaches, animal care staff should ensure that the mother is comfortable in the area where the birth will take place, and that this area is "baby-proofed."

Nesting in the wild: Most owls do not build a nest. A few species use the abandoned nests of other species, such as raptors or corvids, but most owls prefer to use holes in trees, caves, roots of trees, and even burrows in the ground. Some owls have been known to embellish their nests with occasional items of material such as plant fibers and animal dung (e.g., burrowing owls), and small amounts of vegetation (e.g., Verreaux's eagle owls). The smaller owls almost always nest in cavities of some sort. The very large owls find this more difficult because of their size and will use old nests of other birds or nest within recesses on the ground, or amongst rocks. Short-eared, grass, and marsh owls all nest in shallow depressions amongst the grass of their open habitat. The snowy owl chooses a raised site on the ground, giving it a better view to detect the approach of potential predators.

Nesting in zoological facilities: The following are recommendations for owl nesting sites within a zoological facility, based on the species' wild preferences whenever possible, and on the best practices used by zoos successful in breeding and raising owls.

Nest size, type, and location: The size of the nest area provided to owls is important, and allowances should be made for maximum brood production. The available areas should be able to hold both parents, and allow the developing young to grow, practice wing flapping, and play. As a guide for open nesting owls such as eagle owls, target a size that is two times longer than they are from beak to tail tip and two – three times as wide as the owls are wide. For cavity nesting owls such as screech owls, use the same

guidelines for the inside of the box. These are guidelines as a starting point, and you may need to modify depending on your owls and their preferences. Too small an area will lead to overcrowding, dirty young, and stressed birds. Nest areas should be easily accessible by animal care staff to facilitate monitoring with minimal disturbance to the owls. Positioning the nest sites against the back wall of the aviary allows for spy holes, one-way glass, or painted glass windows to be incorporated, as well as access doors for the removal/replacement of eggs/young, banding of young birds, and other management procedures. All stages of breeding can be monitored effectively with the use of close circuit television monitors. A small camera can be easily incorporated into the roof of a nest box, thus allowing keepers to observe the birds closely with no disturbance. The nest area should be accessible to keepers for a thorough clean at the end of the season.

Large owls of the genus *Bubo* prefer deep tray nest sites, high enough to hide most of the incubating female, yet allowing her to peer over the edge at approaching danger. A side or lip of 10.2–15.2 cm (4–6 in.) is appropriate. If such sites are situated on the ground, they should be raised to prevent nests from becoming damp or flooded. Owls also have individual preferences, so it is best to experiment with different nest box designs and sites. The nest box should be weatherproof, large, safely attached, and situated away from disturbance. Providing multiple nest sites within an exhibit will allow the owls to choose a site with which they feel the most comfortable.

Nest entrance: The size and shape of the entrance hole is an important factor for some of the cavity nesting species. Males of the genus *Otus* frequently sit in the opening, completely blocking the entrance to the nest. This could be connected to thermoregulation of the interior or be a means of hiding the 'give away' darkness of the nest hole from predators or rivals. It is recommended that a pear-shaped entrance hole be provided, which coincides with the body shape of the owls. Other species (e.g., tawny owls [*Strix aluco*] and Ural owls [*Strix uralensis*]) prefer an oblong box with the top third open.

Nesting substrate: As eggs are fragile, it is advisable to have a soft substrate material on nest ledges and in nest boxes. Owls tend to dig a scrape in the substrate and lay their eggs in the hollow. As some individuals can dig quite a deep scrape, the substrate needs to be at least 15–20 cm (6–8 in.) deep. Sand mixed with a small amount of pea gravel is a suitable material. Sand is not too dusty, absorbs droppings, and can be swallowed in small amounts without too detrimental an effect. However, sand is heavy, requiring nest boxes and ledges to be hardy and capable of supporting the load. Wood chips can be used, but may harbor fungal spores and are able to be swallowed by chicks. Wood chips (not wood shavings) should be of the highest quality, and should be changed after each nesting event, or twice per year. Peat can also be used, but is dusty and can cause gut impaction if ingested by young birds. Gravel is acceptable for some species, but once the nest areas get dirty during incubation, the stones stick together forming a hard base, which can result in broken eggs.

Nesting management: For owls to breed successfully in zoos and aquariums, a certain amount of privacy is needed. Cleaning enclosures daily can cause disturbance, and may stop birds from feeling as though they have their own territory, which can lead to breeding failure. Once egg-laying commences, it may be prudent to delay cleaning until young have hatched. Once the chicks are vocalizing to the parents, quick cleaning of the exhibit may be resumed. Some breeding pairs are used to routines and will allow daily cleaning. Only time will tell if owls tolerate daily disturbance while nesting. This may include reluctance to go back into the nest box or back to the open nest.

During the incubation period, when the female is in the nest, both the male and female will become more territorial. It is advised that during this period, an alternative method for feeding and watering the birds be used. Alternative methods may include a water feature that is serviced from outside the exhibit or a food platform that uses a door to place food in the exhibit. If this is not possible, doing quick and calm cleaning and feeding will be important for safety reasons.

During natural incubation, nests should be monitored daily to check that incubating birds are well and eggs are not broken. Some birds are very loath to leave the nest, so checking at feeding times when birds might move off the nest will facilitate monitoring. The minimum recommended monitoring is to check that eggs are fertile after the first 10 days of incubation using a good candler. If eggs are infertile, they can be removed, thus encouraging the female to lay a second clutch.

8.5 Assisted Rearing

Although mothers may successfully give birth, there are times when they are not able to properly care for their offspring, both in the wild and in *ex situ* populations. Fortunately, animal care staff in AZA-accredited institutions can assist with the rearing of these offspring when deemed necessary.

Artificial incubation: Established and experienced pairs of birds are capable of incubating, hatching, and rearing without assistance. Young or inexperienced pairs may need some assistance in the first few seasons. With endangered or valuable species, it is not advisable to leave the whole process to inexperienced parents, as many things can go wrong. However, the decision to interfere and remove eggs should be taken with due consideration to the facilities available and the experience of the animal care staff members.

Some birds seem naturally clumsy with eggs. If a pair shows a propensity for breaking eggs, then an examination of the nest area should be performed only after ascertaining that it is not through disturbance from over-zealous monitoring that was the causal factor to begin with. If no obvious cause can be found, the decision should be made whether to remove the remaining eggs for artificial incubation, and then whether to hand-rear the chicks or put the chicks back with the adults. If the eggs are taken for artificial incubation, they should be substituted with dummy eggs, so the parent birds continue to incubate.

Artificial incubation is expensive and time consuming. If it is to be attempted, adequate resources should be provided to have any chance of success. Artificially incubated eggs of all species have a higher hatching percentage if they have some natural incubation in the first 7–10 days, which is the critical time for embryo development (Anderson Brown, 1979; Harvey, 1990). This incubation does not necessarily have to be by the parent bird. Well-kept and well-handled broody hens will successfully incubate all but the smallest of eggs. The hens should be kept in very clean, dry conditions, and be comfortable with being handled during incubation. Broody hens should not be allowed to hatch owl chicks (see below).

Egg retrieval: Two people should be present when eggs are removed from a nest. One person with a net should gently fend off or remove the incubating female from the nest. A rubber garbage can lid can be used as a protective shield to prevent injury to both keeper and bird. The female will tend to be the more aggressive bird during incubation. Care should be taken to make sure that in defending the nest, the female does not damage her own eggs. Keepers should wear good quality falconry gloves to protect themselves. Goggles and motorcycle helmets are advisable with the larger aggressive owls. The second person, guarded by the first, should be wearing disposable surgical gloves for handling the eggs.

A good technique is to pick up each egg in turn and gently turn the rubber glove inside out over it and place it into a clean, lined container. If the eggs are to be removed for more than a few minutes (e.g., for candling), then dummy eggs should be left in the nest. Dummy eggs can be made of wood, gypsum plaster, or sand-filled natural eggs. Owl eggs are white, so it is best to use a white or light-colored egg. Leaving the birds with no eggs will not stimulate a second attempt at breeding, and the owls will no longer incubate the eggs or accept the young once the eggs have hatched.

Returning eggs to the nest should be done in the same manner, with two people, one to concentrate on the birds and one to manage the eggs. Once eggs have been returned, the enclosure should be left alone to give the birds time to settle. This process is best achieved in the absence of the public.

Egg handling: It is vital that all keepers thoroughly cleanse their hands before either collecting eggs or handling them during incubation. During handling or candling, eggs should be turned slowly and gently; quick, sharp movements can damage the embryo inside. If disinfecting eggs, the temperature of the fluid should be slightly higher than that of the egg to avoid contraction of the egg contents, which would draw bacteria in through the shell (Anderson Brown, 1987). Very dirty eggs can be carefully scraped clean with a sterile scalpel blade prior to dipping. Dipping agents are obtainable as commercially made egg disinfectant used in the poultry industry (D. Le Mesurier, personal communication). Ultraviolet light can also be used to sterilize the egg surface (Anderson Brown, 1987).

Incubation equipment and parameters: Incubators need to be turned on at least 1 week before they are required to hold eggs, as they take at least 48 hours to stabilize at the right temperature and humidity. Thermometers and hygrometers should be calibrated regularly, and positioned so they can be read without having to open the incubator. It is beneficial to have moving air within the incubator to prevent the build-up of hot or cold spots, and to facilitate gaseous exchange at the eggs surface. The incubator room, incubators, thermometers, and hygrometers should all be sterilized prior to the breeding season, and always kept as clean as possible. The incubator room, incubators, and hatchers can be fumigated with an

oxidizing disinfectant such as Virkon S or formaldehyde gas (Anderson Brown, 1987). See Parry-Jones & Ferguson (2003) and Sarro (2004) for more details and safety precautions.

Incubators should be kept in a room with a stable ambient temperature and humidity, ideally 25 °C (77 °F) and 50% relative humidity (Turk, 1997). If there are any windows in the room where the incubator is being held, blinds need to be fitted to ensure that direct sunlight does not fall on the incubators at any time, as this will cause them to overheat. The room needs to be well ventilated with a fresh air supply.

It is recommended to have several incubators running at the same time during the breeding season. Each incubator can be run at a different humidity, thus allowing eggs to be moved from one environment to another to achieve the desired weight loss. Humidity needs to be measured in relation to weight loss (i.e., more weight loss generally means less humidity). If eggs are found to be infertile or have stopped developing, they should be removed from the incubator to prevent cross infection to viable eggs. Having an incubator solely for 'suspect' eggs is also recommended. All the incubators should be able to deal with every size of owl egg, and it is generally not recommended to mix eggs from birds of different orders (e.g., water birds with owls), as the chances of cross infection are much higher if this is done.

Incubation protocol: Eggs can be incubated on their end, with the pointed end down (i.e., air cell at the top), or lie naturally on their side; the latter is more common. Eggs need to be turned to prevent the embryo from sticking to its surrounding membranes, and to allow it to come into contact with fresh areas of yolk (Turk, 1997). Eggs should only be turned 180° and back again, and should be turned at least 3 times daily, more if possible (Anderson Brown, 1979). See Parry-Jones & Ferguson (2003) and Sarro (2004) for specific incubation details.

The optimal temperature to artificially incubate chicken eggs is 37.5 °C (99.5 °F); however, little work has been done on other species, and more research is recommended (Anderson Brown, 1979). The relative humidity level in the incubator is manipulated to influence weight loss of the egg (Weaver & Cade, 1983). The most used weight loss aimed for is 15% of the fresh egg weight by the time the egg has internally pipped (Ar et al., 1979). Fresh egg weight can be estimated by using Hoyt's formula (Hoyt, 1979). See Parry-Jones & Ferguson (2003) and Sarro (2004) for more details on calculating weight loss and incubation humidity.

The majority of owl eggs hatch between 22 days to 38 days, depending on the species (Kemp & Calburn, 1987). It is recommended that all eggs thought to be viable be allowed to continue incubation at least one week over the known incubation period.

A useful tool to aid egg incubation is the development of computer software programs such as the Artificial Incubation Management System (AIMS) (http://www.avianmanagement.com). When data are entered, the program checks the weight loss required, the current weight loss, the suggested correct weight loss, and the right humidity to achieve that weight loss.

Return of eggs/young: If double-clutching is required to produce more offspring of an endangered species, the first clutch can be removed for artificial rearing or rearing with foster birds, and the owls will hopefully recycle. After the second clutch has hatched, the clutches will be at least two weeks apart and this age difference is too great to allow owlets from both clutches in the same nest at the same time. It is useful to have spare pairs of birds to act as foster parents. Ideally the foster parents should be of the same species, but this is not always an option. Keeping the eggs under a foster pair that is in the same genera is the next, best option.

Breeding birds should be left on dummy eggs if young are to be returned; owls will not accept young if they have not been sitting on eggs. Eggs that have been incubated artificially, or by foster birds or broody hens, can be returned to the parents (or foster parents) at the pipping stage if the owlets are to be naturally reared. Broody hens should not be allowed to hatch eggs, as they are liable to kill the young owls when they do not respond like chickens.

Alternatively, once hatched, young can be hand-reared for a few days before returning to the parents or foster parents. A slightly older, stronger, and more experienced owlet is easier for an inexperienced parent bird to manage. Young from a suitable, less vital species can even be used as foster young to see how inexperienced adults cope. If coping well, the correct youngster can be substituted or even added to the clutch, depending on the species.

When young are returned to their parents (or foster parents), the parent birds should be closely monitored because assessing their first reaction is important. The most common response is for the two adults to sit away from the nest and watch the new young. Fresh food should be left on the side of the nest in advance to encourage feeding. Eventually, most parent birds will show some reaction to the

chicks. It is rare for birds to completely ignore the young, or refuse to sit on or try to feed the young. If the chicks are ignored, a decision should be taken whether to leave the young in the nest overnight. This is always a much more difficult decision with owls than with the diurnal birds of prey, as the owls are more likely to be active at night. If the opposite situation arises where a young bird is picked up or grabbed by either of the adults, it is recommended that animal care staff should intervene and rescue the young.

Hand-rearing: The hand-rearing of owlets is a time-intensive and challenging endeavor. Birds that are imprinted on humans may be aggressive. This should be looked at on a case-by-case basis as to the eventual use for the owl (i.e.: breeding vs ambassador vs both).

Temporary periods of hand-rearing: When owls have clutches of two or more chicks, the youngest owlet may have trouble competing with the other siblings for food. Where this leads to health concerns, removing the largest chick and hand feeding it for a few days should solve the problem. If the parents will tolerate it, adding appropriately sized food items into the nest can be performed daily with the owls at the nest if the owlets are old enough to pick up food items. If the smaller sibling is unable to pick up food items or continues to be failing to grow, hand-rearing may be the only option. However, whenever working around the nest, care should be taken if the parents are especially aggressive, as they may injure the chicks.

Hand-rearing protocol: All methods of hand-rearing should consider the following: hygiene, temperature, surfaces, diet, and behavior. It is not advisable to have young chicks in the same room as incubating eggs due to the risk of cross infection. Once incubated eggs begin to hatch (see Parry-Jones & Ferguson [2003] and Sarro [2004] for specific details), they can be moved from the incubator into the hatcher (approximately 1–2 days before hatching). In the hatcher, turning ceases and the egg is placed so that the pip is uppermost. The hatcher should be run at the same temperature as the incubator (or 1 °F cooler), and the relative humidity raised to at least 60%, and higher if possible (Weaver & Cade, 1983). Once the chick has hatched, the navel can be swabbed with an iodine-based disinfectant that should be administered with a cotton-ball or clean tissue, never with a propelled spray as this may potentially get in non-target areas of the owlet. The hatched chick should be left in the hatcher until dry, and then moved to a brooder.

A constant temperature in the brooder room will assist the chicks with temperature control. Still air brooders are recommended, especially for the first few days of life, and for problem young. For larger and older birds, washable plastic containers with either overhead heat lamps, or low heat plastic veterinary recovery pads underneath, are suitable, if the chicks can move to or away from the heat source (Burnham, 1983). Newly hatched owl chicks should be placed in a still air brooder running from 35–36.5 °C (95–97.7 °F). The brooder temperature can be reduced daily to allow for this transition. A guide would be to reduce the temperature by 0.5 °F a day until the young birds are able to thermo-regulate at room temperature.

Owlets that are too cold will huddle together and cry. Young that are too hot will pant, spread out away from one another, get very pink skin, and cry, but in a different manner than owlets that are too cold. Overheating is more likely to lead to weak and sick young and can kill very quickly, so a reliable, calibrated thermometer should be readily utilized, and temperature readings always taken close to the young. With all but the smallest of species, supplemental heating should not be required after 14 days if the brooder room is at 21.1 °C (70 °F) (Weaver & Cade, 1983). Care should be taken that the humidity is adequate to prevent the chicks from becoming dehydrated, as indicated by dry-looking skin and lethargy. If water containers are used to increase humidity, these should be covered to prevent the chicks from drowning in them.

Newly hatched birds should be put in containers that are designed to hold legs neatly tucked under the body. If birds are kept on a non-grip surface, then splayed legs can result. A plastic ½ gallon ice cream or margarine container, with at least 5 cm (2 in.) of sand or similar substrate formed into a hollow and covered in two pieces of kitchen towel (or other non-slip surface such as rubber, AstroTurf®, or twigs) makes a suitable substitute nest. This should be placed in the brooder approximately 24 hours before needed to provide a warm nest cup for young birds. The surface used should be cleaned regularly to prevent the buildup of feces.

As the owlets get older, they will need more room for playing and exercise. They will want to explore the boundaries of their surroundings, and so it is best to house them in an enclosed brooder box or temperature-controlled pen (a pen with a heat-lamp for a warming spot works well; care should be taken

to keep the lamp 30.4 cm [12 in.] from the top of the owlet's head). The owlet will walk around the pen, so the size of the pen needs to be species-sized appropriate (a minimum of 2x the height of the bird by 2x the wingspan from both length and width) and have adequate perching opportunities for all birds. Providing some low perching will assist with correct development of their feet.

Handfeeding: More young owls are killed by overfeeding than by any other cause (J. Parry-Jones, personal communication). Unless dealing with tiny young (weighing less than 10 g at hatch, such as pearl-spotted owlets *Glaucidium perlatum*), it is best to leave the first feed for up to 12 hours, or longer if the chick is showing no signs of hunger. During this time, the chick is absorbing nutrients from the egg yolk. Newly hatched chicks that look distended with fluid should be left without food until the stomach is flaccid and soft to the touch.

A mixed diet of finely minced or chopped meat is suitable for most species. All food used should be of good quality. Domestic rabbit, rats, and mice (skinned and gutted, with feet, head, and tail removed), day old chicks (skinned with yolk sac, gizzard, head, and feet removed), all put through a grinder, make excellent food for young owls. Too high a protein diet (e.g., quail) may cause problems in some of the larger, fast-growing owls, as too much fast muscle growth puts strain on the tendons, which can result in leg deformities (T. Sainsbury, personal communication). Roughage (fur, feathers, and larger bones) allows the young bird to form pellets for regurgitation. This can be introduced to the food at about 10–14 days. Casting material, such as hair and bones, should be introduced in small quantities initially by leaving a varying proportion of skin on the chicks and mice in the diet.

Since bones are removed from the diet during the first few days, it is necessary to supplement the diet with calcium to meet the high calcium requirement of growing chicks, and ensure the correct calcium: phosphorous ratio (2:1) is provided. Bones should be included in the diet after the first few days to provide a balanced mineral intake. If multi-vitamins are used to supplement the diet, the recommended doses should not be exceeded. A probiotic supplement that supplies a balanced microbial gut flora may be added to the feed for young chicks, as this may help to improve the chicks' health and growth (J. Parry-Jones, personal communication).

Apart from the smallest of young (<10 g hatch weight), four feeds per day is sufficient to give good weight gain and growth rate (Parry-Jones, 1987). Chicks less than 10 g should be fed 6–8 times per day around the clock for the first week, before reducing the frequency. Make sure the owlet is defecating regularly and always has a good feeding response. Chicks should be weighed daily to keep a check on their health and growth; taking this weight before the first morning feeding maintains consistency. Weighing birds before and after every feed provides a good measure of food intake. Most owl species will learn to pick up food for themselves at about 15–20 days old. Information on the recommended methods that can be used to feed diet items to chicks can be found in Parry-Jones & Ferguson (2003) and Sarro (2004).

Young owls do not drink until they have left the nest and can reach water for themselves. However, they obtain water not only from the meat they eat, but also from the oral secretion that the parents drip onto the food while feeding the young. Prior to feeding the chicks, moistening the food with warm water or a saline solution will prevent dehydration and assist healthy growth of young.

Imprinting: If foster parents are used to brood eggs or rear chicks, it is recommended to use the same family of owls (e.g., barn owls with barn owls, eagle owls with eagle owls). When other options are exhausted, and the decision is made to hand-rear the chicks, either temporarily or until fledging, then care should be taken to prevent the chicks from imprinting on humans. It is possible to use puppets during the feedings to minimize imprinting. This can have definite management and husbandry ramifications for the entire lifetime of the birds, which is why it is always best to let an owl do the raising. There has been success with hand-rearing owls, including eagle owls, with the offspring being very comfortable around people. This imprinting is a viable option in working with owls, especially if the owl is used in an ambassador program. There is the possibility that imprinting will result in aggressive behavior toward the caretakers but with weight managed owls, the chance may be worth it.

Visual contact between chicks and humans should also be limited as much as possible. Chicks should be encouraged to feed themselves as soon as possible to limit the amount of human exposure required during rearing. Once young birds are healthy, eating well, and have been identified (i.e., banded, fitted with a transponder, etc.), they should be returned to the parents or foster parents as soon as possible. At 10–12 days old, it is recommended that chicks be returned to the nest if this is still an option.

After about 14 days, there is a greater chance of the young retaining some human imprinting, and they will be mobile enough to try to get out of the nest in fear when they first meet their parents.

If it is not possible to return the chicks, then all through the rearing process the young should have as little contact with and handling by humans as possible. Puppets shaped and colored like an adult owl can be used to assist in avoiding any severe imprinting on keepers. In addition, wearing a mask that completely covers the face, such as a hunters mask or balaclava, as well as keeping speaking to a minimum when working with chicks can be beneficial for preventing imprinting. Rearing in groups (crèche rearing) can also prevent imprinting. Single-bird rearing should be avoided where possible.

Record keeping: There are many gaps in the data on egg dimensions, incubation times, and breeding seasons for owl species. The AZA Raptor TAG recommends that breeders record as much information as possible on their eggs and incubation procedures, as the more data that can be collated the greater the chance of breeding success. Nest sites should be monitored for some time before egg-laying occurs, as this habituates the birds to keepers near the nest site. If possible, marking the eggs as they are laid will assist in gaining knowledge on incubation periods and fertility. Chinagraph pencils or wax-based pens can be used to mark eggs, but spirit-based pens should not be used as these are toxic to the developing embryo (D. Le Mesurier, personal communication).

8.6 Contraception

Many animals cared for in AZA-accredited institutions breed so successfully that contraception techniques are implemented to ensure that the population remains at a healthy size. In the case of an animal on loan from another facility, consult the loan agreement or owner regarding authority to contracept. In the case of permanent contraception, prior permission of the animal's owner must be obtained.

Currently there is no managed form of contraception within owls. Any type of management for reproduction is generally done with the removal of fresh eggs, and replacement with "dummy" eggs. This is a management tool for maintaining the behavior of breeding and incubating without the birth of chicks. Usually, the dummy eggs are placed and eventually removed when the normal fertile eggs would have hatched, giving the female the feeling of going through the process. There is a very good chance that the female will lay another clutch when eggs are removed. However, having a female constantly producing new clutches may be detrimental to her health. The female may not replace the calcium quickly enough to address the demands of egg-laying. Some species will lay only a few eggs yet others such as snowy owls and barn owls may lay more than 5 eggs in a clutch. Keepers should inspect the nest regularly (every other day) and remove any new eggs found and replace with dummy eggs. Pulling eggs is up to the aviary manager and is subjective and is determined by the needs of the aviary and population management program.

Egg embryo euthanasia: As with all birds, contraception is a lesser concern as eggs, fertile or infertile, may be pulled before hatching. Fertile eggs may be humanely euthanized with techniques approved by the AVMA. Table 11 lists the recommended egg disposition methods that can be used for owl eggs based on the percentage of incubation time (i.e., total incubation period) that eggs have undergone.

Table 11. Recommended methods of humane egg disposition before internal pip

% of incubation time	Disposition methods
0–15	Broken out or blown out
15–65	Refrigerated at 4.4 °C (40 °F) for 72 hours
15–99 (before internal pip)	CO_2 gas in air-tight container for 24 hours

Chapter 9. Behavior Management

9.1 Animal Training

Classical and operant conditioning techniques have been used to train animals for over a century. Classical conditioning is a form of associative learning demonstrated by Ivan Pavlov. Classical conditioning involves the presentation of a neutral stimulus that will be conditioned (CS) along with an unconditioned stimulus (US) that evokes an innate, often reflexive, response. If the CS and the US are repeatedly paired, eventually the two stimuli become associated, and the animal will begin to produce a conditioned behavioral response to the CS.

Operant conditioning uses the consequences of a behavior to modify the occurrence and form of that behavior. Reinforcement and punishment are the core tools of operant conditioning. Positive reinforcement occurs when a behavior is followed by a favorable stimulus to increase the frequency of that behavior. Negative reinforcement occurs when a behavior is followed by the removal of an aversive stimulus to also increase the frequency of that behavior. Positive punishment occurs when a behavior is followed by an aversive stimulus to decrease the frequency of that behavior. Negative punishment occurs when a behavior is followed by the removal of a favorable stimulus also to decrease the frequency of that behavior.

AZA-accredited institutions are expected to utilize reinforcing conditioning techniques to facilitate husbandry procedures and behavioral research investigations. Institutions should follow a formal written animal training program that facilitates husbandry, science, and veterinary procedures and enhances the health and well-being of the animals (AZA Accreditation Standard 1.6.4).

AZA Accreditation Standard

(1.6.4) The institution should follow a formal written animal training program that facilitates husbandry, science, and veterinary procedures and enhances the overall health and well-being of the animals.

Behavioral management: Appropriate types of routine behavioral management varies by species, breeding pair, non-breeding birds, show/ambassador birds, and what each individual institution feels is warranted for its collection. The AZA Raptor TAG recommends that if the birds are not part of a bird show or ambassador animal program, that they be regularly examined as per the recommendations of the attending veterinarian, for general health assessment. If they are show or ambassador birds, then they should be examined once a year because of their contact with visitors. Refer to Chapter 6.4 for proper handling techniques when performing veterinary exams on owls.

Training programs for stationing and scale training are potentially very useful for the daily management of owls, especially for ambassador or outreach birds. Weight management and traditional falconry protocols are effectively used with ambassador animal program owls for simple routines such as flying from point A to point B. Weight management is basic to falconry training and involves weighing the bird each day. Training this behavior can begin by feeding a bird in one location to allow him or her to have that one spot as their “base” location within the exhibit. Other than this behavior, each institution will need to determine which behaviors can be trained as part of their routine behavioral management program. There are on-line options for guidance including ABMA. In addition to what has been described within this manual, it will be important for animal care staff members to follow each institution’s guidelines for behavioral husbandry and training. Approaches and techniques vary between institutions, and are based on the goals and objectives for individual institutions.

Recall signals vary but an elevated gloved hand with a two-finger wave behind is often used to cue the owl to fly. Whistles are also used as a cue. In other birds, behavioral training has been utilized for taking blood samples from the wing, feather trimming, nail, and general hands-on exams.

9.2 Environmental Enrichment

Environmental enrichment, also called behavioral enrichment, refers to the practice of providing a variety of stimuli to the animal’s environment, or changing the environment itself to increase physical activity, stimulate cognition, and promote natural behaviors. Stimuli, including natural and artificial objects, scents, and sounds are presented in a safe way for the owls to interact with. Some suggestions include providing food in a variety of ways (i.e., frozen in ice or in a manner that requires an animal to solve simple puzzles to obtain it), using the presence or scent/sounds of other animals of the same or different species, and incorporating an animal training (husbandry or behavioral research) regime in the daily schedule.

Enrichment programs for owls should consider the natural history of the species, individual needs of the animals, and facility constraints. The owl enrichment plan should include the following elements: goal setting, planning and approval process, implementation, documentation/record-keeping, evaluation, and subsequent program refinement. The owl enrichment program should ensure that all environmental enrichment devices (EEDs) are "owl" safe and are presented on a variable schedule to prevent habituation. AZA-accredited institutions must have a formal written enrichment program that promotes owl-appropriate behavioral opportunities (AZA Accreditation Standard 1.6.1). Enrichment activities must be documented and evaluated, and the program should be refined based on the results, if appropriate. Records must be kept current (AZA Accreditation Standard 1.6.3).

Owl enrichment programs should be integrated with veterinary care, nutrition, and animal training programs to maximize the effectiveness and quality of animal care provided. AZA-accredited institutions must have a specific paid staff member(s) assigned to oversee, implement, assess, and coordinate interdepartmental enrichment programs (AZA Accreditation Standard 1.6.2).

AZA Accreditation Standard

(1.6.1) The institution must follow a formal written enrichment program that promotes species-appropriate behavioral opportunities.

AZA Accreditation Standard

(1.6.3) Enrichment activities must be documented and evaluated, and program refinements should be made based on the results, if appropriate. Records must be kept current.

AZA Accreditation Standard

(1.6.2) The institution must have a specific paid staff member(s) or committee assigned for enrichment program oversight, implementation, assessment, and interdepartmental coordination of enrichment efforts.

Although there appear to be no published reports of owls exhibiting abnormal stereotypic behavior, there are still concerns of poor health and undue stress related to un-enriched habitats. Enrichment is undoubtedly an area where there is much potential for future research, and this animal care program should be factored into the management routine.

It is argued that behavior training is enrichment and to a degree, this is correct. Training sessions stimulate the reflexes and mental attention of the owls, providing routine and unique experiences, especially during newly trained behaviors.

9.3 Staff and Animal Interactions

Animal training and environmental enrichment protocols and techniques should be based on interactions that promote safety for all involved.

Generally, most owls will maneuver to get away from humans rather than attack them. See Chapter 2.2 for recommended containment barriers to prevent interactions between owls and the public.

As with most birds, it is usually during the breeding season when owls are more likely to be aggressive towards their keepers. Protective clothing/equipment should be provided when necessary. To maximize safety, it is recommended that some form of head protection be worn whenever animal care staff members are in an owl's enclosure. Hard hats and goggles should be used for individuals known to be aggressive. Keepers should wear heavy coats and good quality falconry type gloves, as most owls can inflict powerful bites and have an even more powerful grip with their feet. Owls are unlikely to inflict major damage to keepers if handled correctly and if the appropriate precautions are taken. Great care should be taken when catching and handling female birds prior to or during the egg-laying period, as poor handling can cause severe internal damage to the bird and even death. Since some bites and scratches are inevitable when handling owls, keepers should make sure that they are up to date with any inoculations such as tetanus, and that any cuts are properly cleaned and covered as soon as possible.

Many owls are nervous when their enclosures are entered, and so enclosures should only be entered when necessary. Aviaries should be entered with great care, and feeding should be done carefully if a pair is showing territorial or breeding behavior. Creating water and feeding systems that can be serviced from outside the enclosure is a top priority, as it will allow for service of the exhibit during times of breeding and incubation.

9.4 Staff Skills and Training

Owl staff members should be trained in all areas of owl behavior management. Funding should be provided for AZA continuing education courses, related meetings, conference participation, and other professional opportunities. A reference library appropriate to the size and complexity of the institution

should be available to all staff and volunteers to provide them with accurate information on the behavioral needs of the animals with which they work.

As with any species, the ability to understand the husbandry needs and natural history of the species, including dietary and reproductive needs, is a necessity. When working with owls, an understanding of proper handling and restraint is essential, as it may be needed at any time. Observation skills are also important, as owls will mask any physical issues to avoid predation, and an experienced observer is always an asset.

There are groups in place that can assist in training. The International Association of Avian Trainers and Educators (IAATE) (www.iaate.org) and Animal Behavior Management Alliance (ABMA) (www.theabma.org) are very good organizations that are worthwhile to join. There are also private individuals and companies that are knowledgeable in the zoo/aquarium animal care field that teach training techniques for the industry.

Chapter 10. Ambassador Animals

AZA recognizes many public education and conservation benefits from ambassador animal presentations. AZA's Conservation Education Committee's Ambassador (previously called Program) Animal Position Statement (Appendix A) summarizes the value of ambassador animal presentations. For the purpose of this policy, an ambassador animal is described as an animal presented either within or outside of its normal exhibit or holding area that is intended to have regular proximity to or physical contact with trainers, handlers, the public, or will be part of an ongoing conservation education/outreach program.

Ambassador animal presentations bring a host of responsibilities, including the welfare of the animals involved, the safety of the animal handler and public, and accountability for the take-home, educational messages received by the audience. Therefore, AZA requires all accredited institutions that give ambassador animal presentations to develop an institutional ambassador animal policy that clearly identifies and justifies those species and individuals approved as ambassador animals and details their long-term management plan and educational program objectives. The policy must incorporate the elements contained in AZA's "Recommendations for Developing an Institutional Ambassador Animal Policy". If an animal on loan from another facility is used as an ambassador animal, the owner's permission is to be obtained prior to program use.

AZA Accreditation Standard

(1.5.3) If animal demonstrations are a part of the institution's programs, an educational/conservation message must be an integral component.

AZA Accreditation Standard

(1.5.4) If ambassador animals are used, a written policy on the use of live animals in programs must be followed and incorporate the elements contained in AZA's "Recommendations for Developing an Institutional Ambassador Animal Policy" (see policy in the current edition of the Accreditation Standards and Related Policies booklet). An education, conservation, and welfare message must be an integral component of all programs. Animals in education programs must be maintained and cared for by paid and/or unpaid trained staff, and housing conditions must meet standards required for the remainder of the animals in the institution. While outside their primary enclosure, although the conditions may be different, animal safety and welfare need to be assured at all times.

Institutional Ambassador Animal Plans

AZA's policy on the presentation of animals is as follows: AZA is dedicated to excellence in animal care and welfare, conservation, education, research, and the presentation of animals in ways that inspire respect for wildlife and nature. AZA's position is that animals should always be presented in adherence to the following core principles:

- Animal and human health, safety, and welfare are never compromised.
- Education and a meaningful conservation message are integral components of the presentation.
- The individual animals involved are consistently maintained in a manner that meets their social, physical, behavioral, and nutritional needs.

AZA-accredited institutions that have designated ambassador animals are required to develop their own Institutional Ambassador Animal Policy that articulates and evaluates the program benefits (see Appendix G for recommendations). Ambassador animals should be consistently maintained in a manner that meets their social, physical, behavioral, and nutritional needs. Education and conservation messaging must be an integral component of any ambassador animal demonstration (AZA Accreditation Standard 1.5.3).

10.1 Husbandry

AZA's accreditation standards require that the conditions and treatment of animals in ambassador animal programs must meet standards set for the remainder of the animal collection, including species-appropriate shelter, exercise, sound and environmental enrichment, access to veterinary care, nutrition, and other related standards (AZA Accreditation Standard 1.5.4). All record-keeping requirements noted previously apply to ambassador animals (AZA Accreditation Standards 1.4.1, 1.4.2, 1.4.3, 1.4.4, 1.4.5, 1.4.6, 1.4.7, and 1.4.10). AZA standards also require that a process is in place to assess welfare and wellness (AZA Accreditation Standard 1.5.0). The 2019 AZA Accreditation Standards defines welfare as an animal's (or group of animals) collective physical and mental states over a period of time, and measured on a continuum from good to poor.

Welfare assessment of ambassadors should include evaluation of all aspects of each individual's life including veterinary care, diet, housing, enrichment, safety, usage for programming, training plans and relationships with handlers. Owls should be provided the opportunity to choose among a variety of conditions in their environment, including both in the enclosure and when participating in programs (AZA Accreditation Standard 1.5.2.2). Assessment for individuals should evaluate whether individuals are consistently maintained in a manner that meets or exceeds their social, physical, behavioral, and nutritional needs (AZA's Policy on the Presentation of Animals).

Recommended measurements for welfare include *The Five Opportunities to Thrive* from San Diego Zoo Global and the Chicago Zoological Society (*Vicino, & Miller, 2015)*:

- Opportunity for a well-balanced diet
- Opportunity to self-maintain
- Opportunity for optimal health
- Opportunity to express species-specific behavior
- Opportunities for choice and control

Additional evaluations for ambassador owl welfare may include:

- Evaluation of overall appearance and condition, such as: body condition scores, including keel scores; feather condition; foot health
- Evaluation of provision of choice within an environment and exhibit/housing space usage
- Evaluation of enrichment programs
- Evaluation of training program to ensure owls have control over outcomes
- Assessment of comfort behaviors during interaction
- Assessment of ability to successfully use escape/avoidance behaviors to alleviate stressful situations
- Social housing needs
- Flight restriction (e.g., clipping, tethering)
- Caretaker relationships & handler training
- Usage parameters (time and type of usage)

Housing

Providing ambassador animals with options to choose among a variety of conditions within their environment is essential to ensuring effective care, welfare, and management (AZA Accreditation Standard 1.5.2.2). Some of these requirements can be met outside of the primary exhibit enclosure while the animal is involved in a program or is being transported. Under these circumstances, housing may be reduced in size compared to a primary enclosure if the animal's physical and psychological needs are being met during the program; upon return to the facility the animal should be returned to its species-appropriate housing as described above.

Careful consideration must be given to the design and size of all ambassador animal enclosures, including exhibit, off-exhibit holding, hospital, quarantine, and isolation areas, such that the physical, social, behavioral, and psychological needs of the species are met, and species-appropriate behaviors are facilitated (AZA Accreditation Standard 10.3.3, 1.5.2, 1.5.2.1). Ambassador owls should be housed in a manner that allows for full range of movement, access to water, and choices of varied perching areas. Additionally, they should have full access to sun and shelter from inclement weather. Owls have been successfully managed in both behind-the-scenes areas as well as in an exhibit space for the public to view; there is no evidence that one is better than the other.

Housing for ambassador owls may also vary depending on if the owls are free-lofted or tethered. Full time housing may be smaller than typical exhibit housing when birds are given frequent opportunity to exercise outside of the enclosure. This is a tried-and-true technique in falconry. Additionally, some ambassador owls are non-releasable, rehabilitated animals that are non-flighted; therefore, space for flight might be reasonably limited but perching should be evaluated and placed appropriately to accommodate any restrictions. Species of owls working in ambassador roles vary tremendously in size, from small owls such as screech, burrowing, and saw-whet to very large owls such as the eagle-owl species. Size of housing should be appropriately large for the species in question, at minimum it should adhere to USFWS regulations for similarly sized species.

Though housing specific environmental conditions will vary (for more information, consult the Animal Care Manuals or Ambassador Animal Guidelines based on the species), all ambassador owls should have the following:

- Varied natural substrate, such as grass, dirt, or pea gravel.
- Mixed perching of varied diameter (appropriate for foot size), location, stability, and texture. Stumps, platforms, and grass locations may be favored by some owls, and high/medium/low perching should be offered as appropriate to the owl species. To maximize foot health, perches should be regularly maintained and changed when showing signs of wear.
- Enclosures should provide a variety of opportunities for perching away from rain/poor weather, exposure to light/natural light, opportunities for retreat. (AZA Accreditation Standards 1.5.2.2, 1.5.7). Enclosures should offer shelter (i.e., nest box, burrow) that is species appropriate.
- In order to prevent damage to flight and tail feathers, perch placement should avoid tight corners or other locations where the owl might rub/bump its tail/wings.
- The enclosure should be constructed with materials that reduce the possibility of damage to the feathers or to the owl itself, and care should be taken to place objects in locations that mitigate chance of injury or deterioration of feathers on enclosure materials.
- Enclosures should contain a bath pan of minimum dimensions necessary to allow the individual to submerge and bathe freely without bumping its wings on the sides of the pan. Bath pans should be kept full, to within one inch of the top, for easy bathing access. It is also appropriate to provide misters in enclosures, particularly in climates that get hot during periods of the year.

Diet

A formal nutrition program is recommended to meet the nutritional and behavioral needs of any species (AZA Accreditation Standard 2.6.2). Diets should be developed using the recommendations of nutritionists, including the Nutrition Scientific Advisory Group (NAG) feeding guidelines, veterinarians, AZA Taxon Advisory Groups (TAGs), and Species Survival Plan® (SSP) Programs. Diet formulation criteria should address the animal's nutritional needs, feeding ecology, as well as individual and natural histories to ensure that species-specific feeding patterns and behaviors are stimulated.

All owls are carnivores, but prey consumed may vary depending upon species. The diet offered to ambassador owls should be nutritionally complete while also replacing the average wild diet as closely as possible with commercially available substitutes. Though ambassador owls are frequently on a managed diet for training purposes, which may involve food being divided into small pieces, it is also beneficial to provide prey whole as both enrichment and to assist with beak maintenance.

Diet amounts and food presentation may vary depending on the bird, always keeping in mind an appropriate weight for that individual and healthy body condition. Regular checks by trained keepers and/or veterinary staff to evaluate body condition should be used in conjunction with behavior to determine if diet amounts need adjustment. Weights should be taken frequently enough to provide useful information to trainers, vet staff, and keepers in order to monitor the animal's health and training needs. Intake and leftover food should be monitored to ensure appropriate amounts are being consumed.

Because every bird is an individual and metabolic rate and healthy weight range can vary dramatically between one individual and the next, it is not good practice to suggest a one-size-fits-all diet for any ambassador owl species. A general weight range guide might be developed for an average diet amount based on the owl's working history, size, body condition, age, and other factors.

Many owl species experience natural, seasonal weight fluctuations, and tend towards heavier average body weights during winter regardless of whether they are on a managed diet. Ideally, this normal fluctuation should be allowed in ambassador owls whenever possible. Body condition should be maintained in a healthy manner year-round. Please note that this seasonal fluctuation in appetite and weight may disrupt motivation for food reinforcers. In these cases, institutions should consider suspending program use of the individual owl for the season if training using positive reinforcement is hindered.

Two strategies that are often used to create motivation when training owls are food management and weight management. Managing when and how food is delivered, what food items are offered, and the ratio of food items offered can create desire to present behaviors. This practice is referred to as food management.

Weight management refers to the practice of monitoring a bird's weight and appetite in regard to its motivation to present desired behaviors. This practice involves identifying a target weight range for an individual based upon some combination of behavior, body condition, and weight. These ranges are a

moving target and require adept trainers with close relationships with their birds to identify small changes in behavior or motivation to adjust diets accordingly.

Using food and/or weight management as part of a good behavioral management program facilitates training by creating a learning environment in which owls want to participate. Training strategies that involve reducing food offered to the point of compromising the health of the bird are considered unacceptable. Food management and weight management practices that are safe for the owl and trainers, provide for the health and welfare of the owl, and facilitate training are recommended.

Enrichment

AZA defines enrichment as, "A process to ensure that the behavioral and physical needs of an animal are being met by providing opportunities for species-appropriate behaviors and choices (2019 AZA Accreditation Standards)." AZA standards require that institutions follow a formal written enrichment program that promotes species-appropriate behavioral opportunities (AZA Accreditation Standard 1.6.1.).

Owls may be naturally more secretive than some other animals, and may wait until they are not being observed to react or interact with enrichment. This may lead to the misconception that it is hard to enrich them. While visible, active responses to enrichment may vary, all are important for ambassador owls to experience regularly. Before leaving an owl with new enrichment, it is suggested to monitor the individual to watch for ingestion or entanglement, such as head or talons.

While there is some variation in the different species of owls, all will benefit from hunting opportunities and exploring novel items. The most successful environmental enrichment devices appear to be items that can be footed and shredded, such as paper products, cardboard boxes, lettuce, melons, squash or other produce. These items can be provided alone or stuffed with prey or diet, although owls should be monitored for ingestion of foreign objects if food is delivered with a novel item. Other successful items include tennis balls, and canvas dog toys, which present opportunities for seizing, grabbing, mock "killing," and mantling.

Training for shows or public interactions is a form of enrichment and provides an opportunity for the bird to engage in both cognitive and physical activity. Training with opportunities to free fly or otherwise voluntarily participate in programs provides owls with the ability to get additional exercise and conditioning. Manipulating the environment, including changing out perching, rotating birds in mews, the addition of live plants/browse, water or dust pans, and misting can all provide an enriching environment for owls. AZA's Raptor TAG has a comprehensive list of raptor-appropriate enrichment as well as other suggestions on raptor enrichment programs on their website.

Social grouping

Due to the high variability between species natural history (social, pairs, solitary), housing of ambassador owls should be taken on a case-by-case basis, maximizing the welfare of the individual and the safety of both owls and handlers.

It is possible to have ambassador owls participate in educational programming outside of breeding season and also be allowed to breed, with owl pairs successfully returning into an ambassador program after the breeding season. Even with owls not participating directly in a breeding program, it should be noted some individuals may demonstrate a change in behavior during breeding season. Usage during breeding season should be treated as any other programming time and remain voluntary for participation.

Hand-rearing is an option for most species of ambassador owls; the SSP coordinator will provide information on hand-rearing when relevant as part of recommended breeding. For many owl species, hand-rearing (alone or when associated with humans) exposes the owl to a variety of conditions from an early age while it is at the optimal stage to learn these stimuli are non-threatening. Human-reared owls may display more comfort behaviors when being used for programs, such as rousing and feeding in the presence of people; participate willingly in training; and generally present fewer escape/avoidance behaviors. It should be noted however, every animal is an individual and exceptions to generalizations do occur, for example a parent-reared owl brought into an ambassador training program during its first year may adapt in ways like a human-reared owl under the care of experienced trainers. However, experience has shown time and again that parent-reared owls do not catch up to their human-reared counterparts in terms of the necessary or desired husbandry, medical, and program behaviors. Parent-reared owls tend to persistently show behaviors that may indicate a welfare concern (bating or trying to fly off the glove, concealment posture/sitting tall with feathers slicked, beak clacking, hissing, flying away from or at trainers, ducking and flinching, flaring wings, raising hackles) and are overall less successful learning with contingency-shaping procedures. As a result, getting a parent-reared owl on the glove, into a crate for

transport, and presentation-ready in novel locations often involves a level of intrusiveness, force, and coercion that exceeds current standards of ethical training and welfare.

Signs of stress

Stress in owls may be caused by heat, over-stimulation, or distress from being placed in a position that causes fear or loss of control. Some of the signs of stress may include, but are not limited to, tight grip on the perch surface, biting, dilating pupils, loose stools and/or watery mutes, feathers pulled in tight to the body or fluffed, wrists held slightly away from body and wings dropping, “whiny” call, gular flutter or panting, escape and avoidance behaviors – such as quick darting looks, and bating.

When these signs are observed, all environmental factors (e.g., an owl’s proximity to activity and his or her noise levels) should be assessed to determine causes for any deleterious changes in behavior. If activity in the area is causing high levels of stress (e.g., a construction project), and the bird’s physical reactions are likely to result in injury to the owl, staff, or public, then action should be taken to calm the bird.

If stress is due to heat, move the bird into a location that is cool and provide water to drink and bathe in as soon as possible. If able, return to familiar enclosure. For stress that appears to be from over-stimulation or other distress, remove bird from the current situation and return to travel crate or familiar enclosure. Counter-conditioning training techniques should be used before the owl encounters that same stress-inducing situation. Supervisory staff should be notified in all cases and, if warranted, medical staff should be contacted for heat stress.

One of the most serious and easily observable signs of discomfort during handling of ambassador owls is bating. Bating off the glove is not something that should be accepted as normal when working with ambassador owls. Bating off the glove, i.e., an attempt by the owl to fly off the glove that results in it flapping rapidly or even, in extreme cases, hanging upside down from the glove, is an attempt by the individual to escape a situation or stimulus with which it is uncomfortable. For the welfare of the bird, if it is bating, it is the responsibility of the handler to remove it from the situation with which it is uncomfortable.

10.2 Programs

Program types

Institutions using ambassador owls must have a written policy which follows AZA’s “Recommendations for Developing an Institutional Ambassador Animal Policy” (AZA Accreditation Standard 1.5.4). Ambassador owls are utilized in many ways and in many settings to engage, educate and create connections with zoo visitors. Utilizing charismatic species like owls in ambassador programs provides an invaluable opportunity to engage visitors while spreading important avian conservation messages and demonstrates how these dynamic animals can be successful in a wide variety of situations.

Almost any of the species of owls may be utilized for programs. Ambassador owls can be presented both on and off-grounds in formal (captive audience) and informal (casual walk-by programs, chats or displays) programs. They can be successfully presented both indoor and outside, on glove, perch, or in free-flight programs with proper training and attention to the safety of the animals. Free-flight programs afford larger audiences the opportunity to see owls in action, making them a popular addition to amphitheater-style shows.

Temperature Guidelines

Owls are found in a wide variety of climates. When planning temperature guidelines for ambassador owls, special considerations should be made for environmental conditions when transporting and using the animal for programs, based on the needs and temperature tolerance of the species. The natural history combined with local acclimations, including whether the owl is housed indoors or outside, should be taken into consideration when determining temperature guidelines. Time spent indoors in the winter should be minimized to prevent overheating, especially for birds that are housed outdoors.

When transporting owls from site to site, it is recommended to use a vehicle if extreme weather conditions exist. If the program takes place in a space without temperature regulation, options for altering the physical environment (shade, portable heat, ice blocks) can be utilized to maintain the safety of the owl. The vehicle should be maintained at temperatures appropriate for the species to ensure comfort while traveling.

Transport

Consideration should be given to the means in which an animal will be transported for both on-grounds and off-grounds programs. Animal transportation must be conducted in a manner that is lawful, safe, well planned, and coordinated, and minimizes risk to the animal(s), employees, and public (AZA Accreditation Standard 1.5.11).

Ambassador owls can be trained to voluntarily enter a transport carrier, to "step up" and be placed in the carrier to go to educational programing events, or voluntarily enter/exit their enclosure for a free-flight show. Deciding which method to use will depend on the bird, the program needs, and equipment. Birds naive to a transport crate should be trained using approximations and positive reinforcement. The bird should not be forced, chased, or netted to enter the crate in lieu of training except in an emergency. When transporting a bird in a carrier, handlers should handle the crate with sensitivity and balance to prevent unnecessary jostling and discomfort to the bird.

Two primary options are available for transport, a crate with a perch and a perch-less crate. Depending on the bird, they may prefer to ride flat on the floor of the crate rather than on a perch. Perches should be installed parallel to the door and should be high enough so that the bird's tail will not be damaged by meeting the floor but low enough that the bird is not crouching when inside. Providing a substrate of indoor-outdoor carpet or AstroTurf will give a perch-less crate some traction during transport and is a good consideration even for perched crates. If perching is used, it should be of appropriate thickness so the bird can perch securely and can be natural wood or wrapped with AstroTurf, depending on the individual bird's preference.

A variety of transport options will work equally well based on individual preference, institutional policies, and available resources. Transport carriers may vary from commercial pet carries such as VariKennels or Sky kennels, to custom wooden or coroplast boxes. Transport carriers should be large enough for the bird to stand at full height, turn around comfortably, and be designed for ease of entry and exit.

Transport carrier size, perching, and substrate will vary according to the species and preferences of each individual owl. Some owls may prefer to be in covered kennels, while others may do better in transport with the option to see out of their crate via either windows or door. As with any animal, finding the perfect transport set-up can take time, evaluation, and tweaking. It is therefore difficult to recommend hard and fast transport parameters as they can be very dependent on individual preference.

When placing the transport crate in a vehicle, it is recommended crates with perches should be placed so that the perch is parallel to the direction of motion/vehicle travel, i.e., the perch faces the side of the vehicle rather than the front. This allows the bird to grip more sturdily and "surf" in response to vehicle acceleration and deceleration, prevents being thrown off the perch, and is a more stable configuration in case of bumps or other unexpected hazards on the road.

The use of chemical sanitation is important for all transport carriers, presentation surfaces, and maintenance tools. There are a variety of sanitation chemicals available for proper hygiene. Consult with your animal management team and/or veterinary staff to identify the best chemicals for your situation. In most instances, protocols used to sanitize carriers used for carnivorous birds will be sufficient. Abrasive chemicals should be avoided to avoid irritation to the feet.

At outreach events, all efforts should be made to prevent exposure to birds or other animals from other institutions/facilities. Additionally, at all events, indoor or outdoor, it is recommended that the ambassador birds have dedicated carriers to hold them anytime they are not needed for a presentation. These carriers should be kept away from visitors, other animals, and disturbances.

Display options

Careful consideration should be given to the presentation of ambassador animals, including safety of the animal, handler, and public, as well as the messages associated with the visual display of the animal. Owls can be displayed via free-flight programs or on the glove or a perch with or without the use of falconry equipment. *The Raptor TAG does not recommend pinioning or clipping flight feathers to restrain flight.* During programs, birds should be given the choice to exit at any time into a safe environment. The bird's threshold for program involvement should be determined based on behavior, and may have seasonal variations.

Positive Reinforcement Training

Training using positive reinforcement is the predominant type of formal training in zoos today (Westlund, 2014). AZA Accreditation Standard 1.5.2.2 also requires providing animals with choice in their

environment as a matter of good welfare. Several common behaviors trained amongst institutions include scale, crate, step up onto a perch/glove, standing calmly on glove/perch for presentations, stationing, and free flight. Providing opportunities for choice and control in training and programming starts with training for voluntary behaviors. Many institutions choose to train voluntary behaviors for husbandry and medical management such as voluntary tactile, nail trims, and insertion/removal of jesses. It is important to note, for safety reasons, procedures such as coping and blood-draws should not be attempted as voluntary trained behaviors, as the risk of injury to the bird in such cases is great.

Positive reinforcement training can also provide opportunities for animals under human care to use their senses and adaptations, like their wild counterparts, to obtain food or other primary reinforcers. It empowers them to make decisions and experience the consequences of their actions, giving them choice and control over their everyday lives and interactions. The need for control is a biological imperative for survival, and therefore control is also a primary reinforcer (Friedman, 2019 IAATE Annual Conference Proceedings) and should be utilized as a common training reinforcer, just as food is, during training as well to increase overall welfare. AZA Accreditation Standard 1.5.2.2 also requires providing animals with choice in their environment as a matter of good welfare. Providing opportunities for choice and control in training and programming starts with training for voluntary behaviors.

Due to the long lifespan of many owl species, a lifetime commitment should be made to ensure that the staff training and environment is conducive to long term, successful management of the individual.

Falconry Equipment

Equipment used for owls is based mostly on trainer and institution preference. Permanent or removable anklets can be used, depending on the individual bird's preferences, wear on leg feathers, and the training program. The material most popular for anklets is kangaroo leather, but some institutions also use bison leather or biothane. Should a facility use removable equipment (anklets only, or jess/anklet combos) on birds, a training program to voluntarily attach equipment should be in place to maximize cooperation in training and programming. Jesses can be used either connected to a paracord leash (with a swivel or with a swivel-less setup) or simply held during demonstrations. Careful consideration should be used when using jesses on owls during a flight display and it is recommended to either remove the jesses before flight or use flying jesses.

Any time jesses and anklets are employed with ambassador owls, trainers should be mindful of their use only as a safety tool and not as a means for restraint or as a training tool. Institutions may opt to work owls without jesses or not holding jesses during programs, which requires a much higher level of training and staff competency to work with these birds safely. Best practices for presentation should strive for owls voluntarily participating in programs using trained behaviors.

If using jesses on an owl, handlers are to be aware that bating (an attempt by the owl to fly off the glove) is a serious and easily observable sign of discomfort. Bating is an attempt by the animal to escape a situation, and it is the responsibility of the handler to remove it or otherwise eliminate the source of stress. This may mean ending a training program or returning a bird to the enclosure. Unsuccessful attempts to escape due to being restrained on a glove falls into positive punishment and not only can have detrimental effects on the relationship between bird and handler, but also result in learned helplessness and/or reduce the bird's willingness to participate in future programming. Ideally, handlers will be in tune with less obvious signs of discomfort in their individual and remove it from situations before a bate occurs.

Outdoor Free-flight Programs

Careful consideration should be taken when flying birds in an outdoor program. Hazards include proximity of roads, buildings, other exhibits, and native raptors in the area. The layout or direction of a behavior involving free flight near or over members of the public should provide a safe end/landing point that encourages the bird to successfully complete the flight without interacting with the public. A written fly-off protocol should be in place before a flight program is established, and should include:

- A plan for communication between trainers and facility staff.
- Clearly defined roles, including emergency response coordination and decision-making.
- Established communication methods for both internal and external communications as needed.
- Plans for recovery or recall of the owl from a variety of conditions, including on or off-site, inside another enclosure, etc.
- A schedule of practice drills.

Telemetry is also recommended when using owls during flight displays outdoors. Telemetry should be attached in a way that can be properly monitored and does not irritate the owl or restrict their movement in any way. Telemetry protocol should include:

- Species appropriate telemetry selection.
- Plan for training voluntary attachment and operation of a transmitter.
- Testing the batteries, transmitter, and receiver prior to each use.
- Scheduled practice in the use of telemetry.

Tethering

When tethering an owl to a perch, place the bird in an area away from dangerous environmental factors within reach of the perch. The bird should be placed in an area where it will be protected from native wildlife and should have the availability to seek shelter and a bath pan.

It is important to remember that jesses are a safety measure and not a training tool. Owls presented with jesses should still be trained to participate voluntarily using positive reinforcement. When using equipment to safely manage owls, be sensitive to signs of stress and respond accordingly to avoid escape/avoidance behaviors and side-effects of the punishment of bating. When working with an owl for presentation on glove, it is recommended to do all initial work in a confined space without the use of jesses so the owl may make choices during this training period.

Visitor Management

It is recommended that the handler of owls be always aware of visitor behaviors. Food and beverage consumption for the handlers should be limited to non-animal areas. Monitoring visitor behavior and proximity to the animal, as well as knowing the personality of the owl will help ensure a positive interaction for everyone.

It is not recommended to allow direct public contact with ambassador owls, such as petting or feeding the owl. However, some facilities do allow members of the public to hold owls on a glove. Facilities that choose to offer this opportunity should include a risk management assessment, as per AZA Standard 11.4.1 that addresses public contact.

Ambassador animals that are taken off zoo or aquarium grounds for any purpose have the potential to be exposed to infectious agents that could spread to the rest of the institution's healthy population. AZA-accredited institutions must have adequate protocols in place to avoid this situation (AZA Accreditation Standard 1.5.5). Animals leaving the facility for off-site programming should be fully protected from interaction with non-collection animals. Furniture and all diet items should be brought from the home facility.

AZA Accreditation Standard

(1.5.5) For animals used in offsite programs and for educational purposes, the institution must have adequate protocols in place to protect the rest of the animals at the institution from exposure to infectious agents.

Messaging

AZA's policy on the presentation of animals is as follows: AZA is dedicated to excellence in animal care and welfare, conservation, education, research, and the presentation of animals in ways that inspire respect for wildlife and nature. Education and conservation messaging must be an integral component of any ambassador animal demonstration (AZA Accreditation Standard 1.5.3).

The Conservation Education Committee recommends that facilities design educational experiences with ambassador animals with one or more of the following outcomes in mind:

1. Species information: Understanding of the species natural history, role in the ecosystem, and/or status in the wild.
2. Animals in human care: Understanding of the commitment of AZA facilities to excellence in animal care and conservation and appropriate pet choices, where applicable.
3. Empathy development: Foster a sense of empathy and wonder by connecting visitors and audiences to the individual animal.
4. Conservation action: Empower audiences and visitors to take action to protect the species and wildlife in general.

Owls presented in an educational setting provide an opportunity to achieve these outcomes in a number of specific ways. Recommendations for messaging with owls are listed below.

Outcome 1: Taxon information

- Information in this section will vary widely by species, please refer to the appropriate AAG or the Ambassador Animal Resource and Information Center (www.aaric.org) for species-specific information. Some widely applicable messages are listed below.
- Owls are important predators that help to control pest populations and reduce the spread of disease.
- There are many myths and misperceptions about owls, for example, the idea that they are bad omens. In fact, owls are remarkable animals that are important to their ecosystems and should inspire wonder and curiosity!

Outcome 2: Animals in human care

- Presenters should discuss the importance of training, proper handling methods, and the dedicated work put in to building relationships to ensure the birds are comfortable.
- It is important to stress the difference between wild bird behaviors versus those under human care, which also provides an opportunity to discuss life history traits.

Outcome 3: Empathy development

- Setting visitor or audience expectations before presenting a bird (in its exhibit or on the glove), is an opportunity to foster the development of empathy. The presenter should let the audience know what to expect from the interaction with the owl(s), whether they will be able to hold or touch the owl and how the owl might react to an audience.
- The presenter can also provide direction on how visitors or program participants should behave in the presence of the animal. This time can be an opportunity to help the audience connect emotionally with the owl. If traveling with an owl, it is recommended that this be done before bringing the bird out of its enclosure/secure area.
- For more information on fostering the development of Empathy, see Seattle Aquarium's "https://www.seattleaquarium.org/blog/inspiring-conservation-empathy"

Outcome 4: Conservation action

Wild owl populations face a multitude of threats; fortunately, there are a number of individual and community-level actions that people can take to help to protect owls in the wild. Some examples are listed below.

<u>Pesticide and Rodenticide use:</u>

- As predators of rodents, all raptors, including owls, are incredibly vulnerable to rodenticide poisoning. Encourage responsibly use and properly manage rodenticides.
- Owls are also susceptible to pesticide biomagnification and mercury poisoning. Encourage people to avoid using pesticides on their lawns, and instead rely on native plantings or other environmentally responsible methods of pest management.

<u>Human-Wildlife Interactions</u>

- Roadside litter is a threat to many owl species. Rodents are attracted to the litter, and a low-flying owl in pursuit of a rodent is vulnerable to a vehicular collision. Encourage visitors to dispose of their trash in an appropriate receptacle, not on the roadside, even if it is biodegradable.
- Owls are also susceptible to death through barbed wire or electrocution from power lines. We can help by supporting man-made barriers that keep birds away from high-electricity areas.
- Owls are highly sensitive nesters, and even slight disturbances can lead to abandonment. We can help by reducing activity in known nesting areas and avoiding owl nests when trimming trees or in forestry management.

<u>Habitat Loss</u>

- Habitat loss, removal of old growth forests, and tree crags affects owl populations not only due to loss of nesting sites, but also due to decline in prey availability. Protecting habitat and supporting conservation organizations can help to protect populations of both predator and prey species.

<u>Climate Change</u>

- Like so many species, owls are negatively impacted by climate change. Individual and community level actions to help curb climate change by reducing our carbon footprint are critical to save owls and other wildlife.

Evaluation: It is strongly recommended that programs and experiences with ambassador owls be evaluated to measure the impact of the programs' education and conservation messaging on visitor knowledge, attitudes, and/or behavior. Recommended methods include pre-post surveys, delayed surveys, participant observation, and participant interviews.

10.3 Handling and Staff Training

Handling Limits

Consideration should be given as to appropriate times for handling ambassador owls during presentations, and rest breaks scheduled accordingly. It is important to note all birds are individuals, and only some owls may be comfortable and willing to participate. Program handlers should maintain the owl's basic husbandry needs and a medical protocol should be in place in case concerns arise.

AZA Accreditation Standard

(1.5.12) Paid and/or unpaid staff assigned to handle animals during demonstrations or educational programs must be trained in accordance with the institution's written animal handling protocols. Such training must take place before handling may occur.

Most owls appear to demonstrate comfort for programming on glove up to 30 minutes, some up to one hour. Many institutions have been successful working with ambassador owls regularly for to 2-4 hours per day, with rest periods in between programs. Many owls travel well, and overnight outreaches are acceptable as long as the owl's basic husbandry needs are addressed, and a medical protocol is in place in case of concerns.

Handlers and Handler Training

Animal care and education staff should be trained in ambassador animal-specific handling protocols, conservation, and education messaging techniques, and public interaction procedures. Paid and/or unpaid staff assigned to handle animals during demonstrations or educational programs must be trained in accordance with the institution's written animal handling protocols. Such training must take place before handling may occur (Accreditation Standard 1.5.12). These staff members should be competent in recognizing stress or discomfort behaviors exhibited by the ambassador animals and be able to address any safety issues that arise. (AZA Accreditation Standard 1.5.13).

AZA Accreditation Standard

(1.5.13) When in operation, animal contact areas (petting zoos, touch tanks, etc.) must be supervised by trained, paid and/or unpaid staff.

Training staff and volunteers to properly handle owls is one of the most critical elements in providing good welfare. It should be noted that owls require skilled handlers to maximize welfare and their success as ambassador birds. Regardless of institutional variables, such as staff size, program demands, and size of ambassador animal collection, to ensure safety of handlers and welfare of birds, attention to the skill level of the handler should not be overlooked. While many owls demonstrate generalized comfort behavior on glove between multiple handlers, some individuals do demonstrate discrimination and are more suited to a limited number of handlers with whom they have a strong relationship.

Institutions may decide to have different levels for handlers, such as onsite versus offsite or stationary on-glove versus free-flight programming. At minimum, anyone handling the owl should demonstrate a comprehensive understanding of:

- The species natural history and the individual's preferences
- Signs of distress and discomfort for both the species and the individual owl.
- Protocols for maintaining voluntary participation and safe handling of the owl during ambassador programs, and options to end a program if the owl is stressed or uncomfortable.
- Institutional protocol for dealing with human or animal injury.
- The institution's handling certification process and consequences of failing to demonstrate competency in any of the above.

In order to set both the owl and trainee handlers up for success, the training/certification process for new handlers should begin each phase with observational learning in a variety of conditions. Additionally, progression through the training and certification process for handling the owl should be determined by the demonstrated comfort of both owl and trainee handler, rather than on a designated timeline.

Handler Certification

Each institution should create an ambassador animal handling policy and staff training plan that conforms to AZA guidelines as well as any local legislation. The program, including species/individual animals, program types/messaging, and all handlers, should be reviewed regularly. Handler competency should be evaluated, and concerns with training performance should be addressed.

Only individuals that have received all the appropriate and relevant training should be allowed to participate in any public demonstrations involving the owl. Specific protocols should be developed and implemented to ensure that anyone handling owls remains safe and focused on the owl during any demonstrations as well as consistent in handling technique. Individuals certified to handle owls should be competent in recognizing stress or discomfort behaviors exhibited by any owl used in programs/demonstrations, and be able to communicate these issues effectively using institution-specific animal care protocols so that welfare or safety concerns can be addressed.

It is recommended that certification exist for each individual owl. Recognizing that each bird is an individual is important during the handler certification process to ensure maximum welfare and safety.
It is recommended that presentation and handling guidelines and protocols should be re-evaluated annually or bi-annually. All individuals involved in the program should have access to these guidelines and be provided with updates as needed. All new potential handlers should be signed off on receiving and reading the standards and protocols during orientation and before commencing work in the area.

To be certified to handle an owl unsupervised, an individual should demonstrate competency in ALL categories of the handling training protocols, and to maintain certification said individual should be evaluated periodically for consistency. Failure to demonstrate competency in any of the requirements for handling an individual owl should result in retraining before being allowed to handle the owl unsupervised.

Protocols should be clear and expectations consistent for all staff. Incidents should be reported to management and any violations of protocols should be dealt with through verbal and/or written disciplinary measures. Repeated violation of protocols that have the potential for or result in the endangerment of animals, staff, or public health and/or safety should be dealt with by management.

Chapter 11. Research

11.1 Known Methodologies

> **AZA Accreditation Standard**
>
> **(5.3)** The institution should maximize the generation and dissemination of scientific knowledge gained. This might be achieved by participating in AZA TAG/SSP sponsored studies when applicable, conducting and publishing original research projects, affiliating with local universities, and/or employing staff with scientific credentials.

> **AZA Accreditation Standard**
>
> **(5.0)** The institution must have a demonstrated commitment to scientific study that is in proportion to the size and scope of its facilities, staff (paid and unpaid), and animals.

AZA believes that contemporary owl management, husbandry, veterinary care, and conservation practices should be based in science, and that a commitment to scientific research, both basic and applied, is a trademark of the modern zoological park and aquarium. AZA-accredited institutions have the invaluable opportunity, and are expected, to conduct or facilitate research both in *in situ* and *ex situ* settings to advance scientific knowledge of the animals in our care and enhance the conservation of wild populations. Participating in AZA Taxon Advisory Group (TAG) or Species Survival Plan® (SSP) Program sponsored research when applicable, conducting and publishing original research projects, affiliating with local universities, and/or employing staff with scientific credentials could help achieve this (AZA Accreditation Standard 5.3). An AZA institution must demonstrate a commitment to scientific study that is in proportion to the size and scope of its facilities, staff, and animals (AZA Accreditation Standard 5.0). For owls, this knowledge can be achieved in part by participating in the AZA Raptor TAG or one of the Conservation Program sponsored research projects.

All record-keeping requirements noted previously apply to most research animals, especially those which are part of the exhibit collection. When an animal on loan to a facility is subject to an invasive research procedure, including when done as part of a routine health exam, the owner's prior permission is to be obtained. Research is always important and needed to continue learning about owls. The benefits are tangible in preserving species (IE: the impact of Barred Owls on the endangered Northern Spotted Owl) as well as learning more about the adaptations of owls (IE: eyesight vs. hearing). As these predators come under more pressure from urban sprawl, population data will be even more important in their survival.

Research investigations, whether observational, behavioral, physiological, or genetically based, should have a clear scientific purpose with the reasonable expectation that they will increase our understanding of the species being investigated and may provide results which benefit the health or welfare of animals in wild populations. Many AZA-accredited institutions incorporate superior positive reinforcement training programs into their routine schedules to facilitate sensory, cognitive, and physiological research investigations and these types of programs are strongly encouraged by the AZA.

Keeper research: Keepers are in a great position to contribute to owl management and husbandry advances, as they work with the species on a daily basis. Some areas where keepers can help include:

- Instituting scale training and crate training so that birds can be routinely weighed and to make moving animals safer
- Documenting physical development of chicks, including data collection on weight, specific diet ingredient intake (weighed amounts), morphometrics, and plumage changes
- Weighing and measuring all eggs (fresh weight and length/width)
- Collecting data on activity budgets of adults and chicks
- Determining food preferences of females when feeding chicks
- Documenting molt patterns
- Determining exhibit usage preferences
- Incorporating successful nest box designs

AZA-accredited institutions are required to follow a clearly written research policy that includes a process for the evaluation of project proposals and identifies the types of research being conducted, methods used, staff involved, evaluations of the projects, animals included, and guidelines for the reporting or publication of any findings (AZA Accreditation Standard 5.2).Institutions must designate a qualified staff member or committee to oversee and direct its research program (AZA Accreditation Standard 5.1).

An Institutional Animal Care and Use Committee (IACUC) should be established within the institution if animals are included in research or instructional programs. The IACUC should be responsible for reviewing all research protocols and conducting evaluations of the institution's animal care and use.

If institutions are not able to conduct in-house research investigations, they are strongly encouraged to provide financial, personnel, logistical, and other support for priority research and conservation initiatives identified by AZA Taxon Advisory Groups (TAGs) or Species Survival Plans® (SSP) Programs.

AZA Accreditation Standard

(5.2) The institution must follow a formal written policy that includes a process for the evaluation and approval of scientific project proposals, and outlines the type of studies it conducts, methods, staff (paid and unpaid) involvement, evaluations, animals that may be involved, and

AZA Accreditation Standard

(5.1) Scientific studies must be under the direction of a paid or unpaid staff member or committee qualified to make informed decisions.

11.2 Future Research Needs

This Animal Care Manual is a dynamic document that will need to be updated as new information is acquired. Knowledge gaps have been identified throughout the Manual and are included in this section to promote future research investigations. Knowledge gained from these areas will maximize AZA-accredited institutions' capacity for excellence in animal care and welfare as well as enhance conservation initiatives for the species.

Chapter 1. Ambient Environment

Section 1.1 Temperature and humidity: More research is needed to determine appropriate humidity ranges for owls, and to determine what influence different levels of rainfall can have on reproduction in certain species. The reproductive success of owl species in *ex situ* conditions with varying levels of seasonal humidity at different AZA institutions can be assessed to determine whether this environmental factor has an important influence on breeding.

Section 1.2 Light**:** Additional research is needed regarding whether daily changes in the duration of the light cycle are essential to stimulate reproduction of the more unique owl species found in zoological collections.

Section 1.4 Sound and vibration: Little is known about the hearing sensitivity of owls, and additional research on hearing and sound sensitivity would provide some guidance for creating more objective recommendations for managing sound stimuli for these species.

Chapter 2. Habitat Design and Containment

Section 2.1 Space and complexity: Additional research on grass species that are adapted for slow, low growth to prevent birds, specifically young birds who are not strong flyers, from getting into undergrowth, getting wet, becoming tangled, and unable to get off the damp floor during wet, cold weather.

Chapter 5. Social Environment

Section 5.1 Group structure and size: Some species of owls, such as spectacled owls and burrowing owls, may be housed in single-sexed groups. This option to house surplus animals needs more experimentation to determine if single-sexed groups are successful. Institutions housing owl species in single-sexed groups should carefully monitor the success of this approach, and document behavioral and physical issues associated with this social grouping.

Section 5.2 Influence of other species and conspecifics: Increased research in regard to how far apart exhibits should be built when dealing with closely related species is needed in order to gain better knowledge on the stress levels of owls housed in exhibits in close proximity.

Chapter 6. Nutrition

Section 6.1 Nutritional requirements: Additional research that focuses on exact daily food intake and energy expenditure for this species, and that covers all life stages (e.g., chick, juvenile, reproductive adult, senescent adult), will be important to perform so that more specific nutritional requirements and recommendations can be developed for owls.

Section 6.3 Nutritional evaluations: A grading system for overall body condition that takes into account the entire body of the bird has been created by the AZA Nutrition Advisory Group (NAG) and is a 1/9 scale. Please contact AZA's NAG for more information via the AZA website.

Chapter 7. Veterinary Care

Section 7.6 Management of diseases, disorders, injuries and/or isolation: More research is required to establish appropriate pre-shipment testing recommendations, euthanasia protocols, necropsy protocols, and parasite control treatments for owl species.

Chapter 8. Reproduction

Section 8.1 Reproductive Physiology and Behavior

Hormone evaluation: Currently, there are no studies using any type of hormone evaluation in regard to owl reproduction. This could be an interesting future avenue for research for species where reproduction in zoos and aquariums has not been very successful, such as short-eared and long-eared owls.

Separation of sexes/young: Additional research needs to be conducted to determine the specific time periods young owls are dependent on their parents after fledging. Does the time differ dramatically between species or is it universal? In what ways would young owls rely on their parents after fledging?

Section 8.2 Assisted Reproductive Technology: Further research is needed to determine appropriate protocols for the use of artificial insemination with owl species. General information on semen collection, artificial insemination, and cryopreservation of semen in non-domestic bird species is provided by Gee et al. (2004).

Section 8.5 Assisted Rearing: There are many gaps in the data on egg dimensions, incubation times, and breeding seasons for owl species. The AZA Raptor TAG recommends that breeders record as much information as possible on their eggs and incubation procedures, as the more data that can be collated the greater the chance of breeding success. Documenting physical development of chicks, including data collection on weight, specific diet ingredient intake (weighed amounts), morphometrics, and plumage changes, will also prove useful.

Incubation temperatures: The optimal temperature to artificially incubate chicken eggs is 37.5 °C (99.5 °F); however, little work has been done on other species, and more research is recommended.

Chapter 9. Behavior

Section 9.2 Environmental Enrichment: Most zoos employ some form of enrichment for their animals. Research is needed to determine the efficacy of the enrichment as well as the required frequency.

Chapter 12. Other Considerations

12.1 Surplus Animals

All AZA SSP species held by institutions should be reported to the SSP Program Leaders. The AZA SSP Program Leader should be responsible for making the decision as to whether specific animals are to be included in the managed population (e.g., over-represented animals or animals beyond reproductive age). Those animals not included in the managed population should be considered surplus to the managed population, but records still must be maintained on them to the same degree as those in the managed population.

There are rarely surplus animals in the AZA population. Most of these, when available, are non-releasable rehabilitation owls that need new homes due to renovations of their zoo exhibits or a refocus to other species. For those SSP species, the coordinator must be notified of the need to move an owl or owls. There are many owls in the hands of private facilities and/or individuals, especially bird trainers. Some of these birds have come from AZA or the Canadian Association of Zoos and Aquariums (CAZA) institutions and the owners may or may not wish to participate in SSP recommended plans. The important task is to keep these birds identified and included in the studbook. This will guard the potential of a privately-owned bird making it into the SSP managed population as an unknown or founder bird.

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Appendix A: Accreditation Standards by Chapter

The following specific standards of care relevant to owls are taken from the AZA Accreditation Standards and Related Policies (AZA, 2022) and are referenced fully within the chapters of this animal care manual:

General Information

(1.1.1) The institution must comply with all relevant local, state/provincial, and federal wildlife laws and/or regulations. It is understood that, in some cases, AZA accreditation standards are more stringent than existing laws and/or regulations. In these cases, the AZA standard must be met.

Chapter 1

(1.5.7) The animals must be protected or provided accommodation from weather or other conditions clearly known to be detrimental to their health or welfare.

(10.2.1) Critical life-support systems for the animals, including but not limited to plumbing, heating, cooling, aeration, and filtration, must be equipped with a warning mechanism, and emergency backup systems must be available. Warning mechanisms and emergency backup systems must be tested periodically.

(1.5.9) The institution must have a regular program of monitoring water quality for fish, marine mammals, and other aquatic animals. A written record must be maintained to document long-term water quality results and chemical additions.

Chapter 2

(1.5.1) All animals must be well cared for and presented in a manner reflecting modern zoological practices and philosophies, exhibit design, balancing animals' welfare requirements with aesthetic and educational considerations.

(1.5.2) All animals must be housed in enclosures which are safe for the animals and meet their physical and psychological needs.

(1.5.2.1) All animals must be kept in appropriate groupings which meet their social and welfare needs.

(1.5.2.2) All animals should be provided the opportunity to choose among a variety of conditions within their environment.

(10.3.3) All animal enclosures (exhibits, holding areas, hospital, and quarantine/isolation) must be of a size and complexity sufficient to provide for the animal's physical, social, and psychological well-being. AZA housing guidelines outlined in the Animal Care Manuals should be followed.

(10.3.4) When sunlight is likely to cause overheating of or discomfort to the animals, sufficient shade (in addition to shelter structures) must be provided by natural or artificial means to allow all animals kept outdoors to protect themselves from direct sunlight.

(11.3.3) Special attention must be given to free-ranging animals so that no undue threat is posed to either the institution's animals, the free-ranging animals, or the visiting public. Animals maintained where they will be in contact with the visiting public must be carefully monitored, and treated humanely at all times.

(11.3.1) All animal exhibits and holding areas must be secured to prevent unintentional animal egress.

(1.5.15) All animal exhibit and holding area air and water inflows and outflows must be securely protected to prevent animal injury or egress.

(2.8.1) Pest control management programs must be administered in such a manner that the animals, paid and unpaid staff, the public, and wildlife are not threatened by the pests, contamination from pests, or the control methods used.

(11.3.6) There must be barriers in place (for example, guardrails, fences, walls, etc.) of sufficient strength and/or design to deter public entry into animal exhibits or holding areas, and to deter public contact with animals in all areas where such contact is not intended.

(11.2.4) All emergency procedures must be written and provided to appropriate paid and unpaid staff. Appropriate emergency procedures must be readily available for reference in the event of an actual emergency.

(11.2.5) Live-action emergency drills (functional exercises) must be conducted at least once annually for each of the four basic types of emergencies (fire; weather or other environmental emergency appropriate to the region; injury to visitor or paid/unpaid staff; and animal escape). Four separate drills are required. These drills must be recorded, and results evaluated for compliance with emergency procedures, efficacy of paid/unpaid staff training, aspects of the emergency response that are deemed adequate are reinforced, and those requiring improvement are identified and modified. (See 11.5.2 and 11.7.4 for other required drills).

(11.6.2) Security personnel, whether employed by the institution, or a provided and/or contracted service, must be trained to handle all emergencies in full accordance with the policies and procedures of the institution. In some cases, it is recognized that Security personnel may be in charge of the respective emergency (i.e. shooting teams).

(11.2.6) The institution must have a communication system that can be quickly accessed in case of an emergency.

(11.2.0) A paid staff member or a committee must be designated as responsible for ensuring that all required emergency drills are conducted, recorded, and evaluated in accordance with AZA accreditation standards (see 11.2.5, 11.5.2, and 11.7.4 for required drills).

(11.2.7) A written protocol should be developed involving local police or other emergency agencies and include response times to emergencies.

(11.5.3) Institutions maintaining potentially dangerous animals must have appropriate safety procedures in place to prevent attacks and injuries by these animals. Appropriate response procedures must also be in place to deal with an attack resulting in an injury. These procedures must be practiced routinely per the emergency drill requirements contained in these standards 11.2.5, 11.5.2, and 11.7.4. Whenever injuries result from these incidents, a written account outlining the cause of the incident, how the injury was handled, and a description of any resulting changes to either the safety procedures or the physical facility must be provided to AZA staff, and maintained on file at the institution for five years from the date of the incident.

(11.5.2) Institutions maintaining venomous animals must have emergency alarm systems and/or protocols in place specifically addressing animal bite injury, attack, or escape from enclosure. All areas housing venomous animals must be equipped with appropriate alarm systems, and/or have protocols in place to notify paid and unpaid staff in the event of a venomous animal emergency. These systems and/or protocols must be routinely checked to assure proper functionality. Live action envenomation drills must be conducted at least annually to assess emergency alarm systems and/or protocols. The live action envenomation drill is in addition to the emergency drills required in 11.2.5 and 11.7.4 and the drill should be recorded and evaluated in the same manner as other emergency drills. (See 11.2.5 and 11.7.4 for other required drills).

(11.5.1) Institutions maintaining venomous animals must have appropriate antivenin readily available, and its location must be known by all paid and unpaid staff working in those areas. An individual must be responsible for inventory, disposal/replacement, and storage of antivenin.

Chapter 3

(1.4.0) The institution must show evidence of having a zoological records management program for managing animal records, veterinary records, and other relevant information.

(1.4.6) The institution should develop a records retention schedule and policy for its animal and veterinary records to make certain they are created, managed, and appropriately preserved or otherwise disposed of according to minimum legal, administrative, and historical values. [See 2.0.4 for veterinary records.]

(1.4.10) Animal records must be kept current.

(1.4.7) A paid staff member must be designated as being responsible for the institution's zoological records management system. That person must be charged with establishing and managing the

institution's animal records, as well as with keeping all paid and unpaid animal care staff members apprised of relevant laws and regulations regarding the institution's animals.

(1.4.4) Animal records and veterinary records, whether in electronic or paper form, must be duplicated and stored in a separate location. Animal and veterinary records are defined as data, regardless of physical form or medium, providing information about individual animals, or samples or parts thereof, or groups of animals. Digital systems are preferable. A disaster preparedness and business continuity plan should be in place for vital animal and veterinary records, and those that have long-term or permanent retention requirements.

(1.4.5) At least one set of the institution's historical animal and veterinary records must be stored and protected. The institution should be able to demonstrate how it provides security, protection, and long-term access for vital animal and veterinary records that have enduring legal, research, or reference value, including, but not limited to permits, titles, declaration forms, and other pertinent information.

(1.4.1) An animal inventory must be compiled at least once a year and include data regarding animals added and removed from the institution's collection whether by birth, transfer, death, or introduction to the wild.

(1.4.2) The inventory must include all species owned by the institution and those on loan to and from the institution.

(1.4.3) Animals must be identifiable, whenever practical, and have corresponding ID numbers. For animals maintained in colonies/groups or other animals not considered readily identifiable, the institution must provide a statement explaining how record keeping is maintained.

Chapter 4

(1.5.11) Animal transportation must be conducted in a manner that is safe, well-planned and coordinated, and minimizes risk to the animal(s), employees, and general public. All applicable laws and/or regulations must be adhered to.

(1.5.10) Temporary, seasonal and traveling live animal exhibits, programs, or presentations (regardless of ownership or contractual arrangements) must be maintained at the same level of care as the institution's permanent resident animals, with foremost attention to animal welfare considerations, both onsite and at the location where the animals are permanently housed.

Chapter 6

(2.6.2) The institution must follow a written nutrition program that meets the behavioral and nutritional needs of all species, individuals, and colonies/groups in the institution. Animal diets must be of a quality and quantity suitable for each animal's nutritional and psychological needs.

(2.6.1) Animal food preparation and storage must meet all applicable laws and/or regulations.

(2.6.3) If the institution uses browse plants as part of the diet or as enrichment items for its animals, the items must be identified and reviewed for safety prior to use.

(2.6.3.1) The institution must assign at least one qualified paid or unpaid staff member to oversee appropriate browse material for the animals (including aquatic animals).

(2.6.3.2) The institution's animal care program must address the potential risks of animals (including aquatic animals) being exposed to toxic plants growing in or near their exhibit space. Exhibits should be checked regularly during the growing season.

Chapter 7

(2.1.1) A full-time staff veterinarian is recommended. In cases where such is not necessary because of the number and/or nature of the animals residing there, a consulting/part-time veterinarian must be under written contract to make at least twice monthly inspections of the animals and to respond as soon as possible to any emergencies.

(2.1.2) So that indications of disease, injury, or stress may be dealt with promptly, veterinary coverage must be available to the animals 24 hours a day, 7 days a week.

(2.0.1) The institution should adopt the Guidelines for Zoo and Aquarium Veterinary Medical Programs and Veterinary Hospitals, and policies developed or supported by the American Association of Zoo Veterinarians (AAZV). The most recent edition of the medical programs and hospitals booklet is available at the AAZV website, under "Publications", at https://cdn.ymaws.com/www.aazv.org/resource/resmgr/files/aazvveterinaryguidelines2016.pdf, and can also be obtained in PDF format by contacting AZA staff.

(2.2.1) Written, formal procedures must be available to paid and unpaid animal care staff for the use of animal drugs for veterinary purposes, and appropriate security of the drugs must be provided.

(2.0.4) Complete medical records must be maintained on all animals in the collection that have received veterinary attention. [See 1.4.7 for animal records.]

(2.7.1) The institution must have holding facilities or procedures for the quarantine of newly arrived animals and isolation facilities or procedures for the treatment of sick/injured animals. Quarantine duration should be assessed and determined by the pathogen risk and best practice for animal welfare.

(2.7.3) Quarantine, hospital, and isolation areas should be in compliance with standards/guidelines contained within the Guidelines for Zoo and Aquarium Veterinary Medical Programs and Veterinary Hospitals developed by the American Association of Zoo Veterinarians (AAZV), which can be obtained at: www.aazv.org/resource/resmgr/files/aazvveterinaryguidelines2016.pdf.

(2.7.2) Written, formal procedures for quarantine must be available and familiar to all paid and unpaid staff working with quarantined animals.

(11.1.2) Training and procedures must be in place regarding zoonotic diseases.

(2.5.1) Deceased animals should be necropsied to determine the cause of death for tracking morbidity and mortality trends to strengthen the program of veterinary care and meet SSP-related requests.

(2.5.2) The institution should have an area dedicated to performing necropsies.

(2.5.3) Cadavers must be kept in a dedicated storage area before and after necropsy. Remains must be disposed of in accordance with local/federal laws.

(2.0.2) The veterinary care program must emphasize disease prevention.

(2.0.3) Institutions should be aware of and prepared for periodic disease outbreaks in wild or other domestic or exotic animal populations that might affect the institution's animals (ex – Avian Influenza, Eastern Equine Encephalitis Virus, etc.). Plans should be developed that outline steps to be taken to protect the institution's animals in these situations.

(1.5.5) For animals used in offsite programs and for educational purposes, the institution must have adequate protocols in place to protect the rest of the animals at the institution from exposure to infectious agents.

(11.1.3) A tuberculin (TB) testing/surveillance program must be established for appropriate paid and unpaid staff to assure the health of both the paid and unpaid staff and the animals.

(2.3.1) Capture equipment must be in good working order and available to authorized, trained personnel at all times.

(2.4.2) Paid and unpaid animal care staff should be trained to assess welfare and recognize abnormal behavior and clinical signs of illness and have knowledge of the diets, husbandry (including enrichment items and strategies), and restraint procedures required for the animals under their care. However, animal care staff (paid and unpaid) must not diagnose illnesses nor prescribe treatment.

(2.3.2) Institution facilities must have radiographic equipment or have access to radiographic services.

(1.5.0) The institution must have a process for assessing animal welfare and wellness.

(1.5.8) The institution must develop and implement a clear and transparent process for identifying, communicating, and addressing animal welfare concerns from paid or unpaid staff within the institution in a timely manner, and without retribution.

(1.6.4) The institution should follow a formal written animal training program that facilitates husbandry, science, and veterinary procedures and enhances the overall health and well-being of the animals.

(1.6.1) The institution must follow a formal written enrichment program that promotes species-appropriate behavioral opportunities.

(1.6.3) Enrichment activities must be documented and evaluated, and program refinements should be made based on the results, if appropriate. Records must be kept current.

(1.6.2) The institution must have a specific paid staff member(s) or committee assigned for enrichment program oversight, implementation, assessment, and interdepartmental coordination of enrichment efforts.

Chapter 10

(1.5.4) If ambassador animals are used, a written policy on the use of live animals in programs must be followed and incorporate the elements contained in AZA's "Recommendations for Developing an Institutional Ambassador Animal Policy" (see policy in the current edition of the Accreditation Standards and Related Policies booklet). An education, conservation, and welfare message must be an integral component of all programs. Animals in education programs must be maintained and cared for by paid and/or unpaid trained staff, and housing conditions must meet standards required for the remainder of the animals in the institution. While outside their primary enclosure, although the conditions may be different, animal safety and welfare need to be assured at all times.

(1.5.3) If animal demonstrations are a part of the institution's programs, an educational/conservation message must be an integral component.

(1.5.12) Paid and/or unpaid staff assigned to handle animals during demonstrations or educational programs must be trained in accordance with the institution's written animal handling protocols. Such training must take place before handling may occur.

(1.5.13) When in operation, animal contact areas (petting zoos, touch tanks, etc.) must be supervised by trained, paid and/or unpaid staff.

Chapter 11

(5.3) The institution should maximize the generation and dissemination of scientific knowledge gained. This might be achieved by participating in AZA TAG/SSP sponsored studies when applicable, conducting and publishing original research projects, affiliating with local universities, and/or employing staff with scientific credentials.

(5.0) The institution must have a demonstrated commitment to scientific study that is in proportion to the size and scope of its facilities, staff (paid and unpaid), and animals.

(5.2) The institution must follow a formal written policy that includes a process for the evaluation and approval of scientific project proposals, and outlines the type of studies it conducts, methods, staff (paid and unpaid) involvement, evaluations, animals that may be involved, and guidelines for publication of findings.

(5.1) Scientific studies must be under the direction of a paid or unpaid staff member or committee qualified to make informed decisions.

Appendix B: Recordkeeping Guidelines for Group Accessions

Developed by the AZA Institutional Data Management Scientific Advisory Group
Published 23 May 2014
Edited to replace the document entitled "Updated Data Entry for Groups" published 16 December 2002

Animals can be accessioned into a collection as either individuals or as part of a group. The term "group" has many definitions when used in zoos and aquariums, and is usually defined by its application, such as a social group or animals grouped for husbandry purposes. To provide a consistent language that can be used throughout the Association of Zoos and Aquariums (AZA), the term "group accession", as defined by the AZA Institutional Data Management Scientific Advisory Group (IDMAG), contains multiple animals of the same species or subspecies, which cannot be differentiated from one another, either physically (there are no scars or color pattern differences), artificially (they are not tagged or transpondered), or spatially (they are not held in separate enclosures), and are cared for.

Thus, no individually accessioned animals are included in a group accession and no individually *identifiable* animals are included in a group accession. As soon as an animal becomes individually identifiable, it is recommended that it be split from the group record and accessioned as an individual. For example, large clutches of amphibian tadpoles should first be accessioned as a group; then as individuals become identifiable, they should be removed from the group record and accessioned as individuals. Otherwise, information about an individual animal that could otherwise be tracked through the animal's life will be lost in the group record. An exception to this occurs occasionally when a group member is removed and temporarily held separately for medical treatment, with the expectation that it will be returned to the group when treatment ends. In this case, the animal remains part of the group even though separated from it. As with individual records, group record accession numbers should not duplicate any other accession number, and once a group accession number has been assigned, it should not be changed.

Group accession provides less information on specific individuals than does individual accession. Group records make information less retrievable, and often need more clarifying comments than individual records. Whenever information applies to only part of the group, notes should be used to indicate which animal(s) the information applies to. It is of utmost importance that these notes be thorough and clear so future readers can easily understand them. Examples of information needing additional notations in group records include, but are not limited to, parentage when not every member of the group is identified. Thus, though it is preferable to accession animals as individuals, a group accession can capture considerable information when individual accession is not appropriate.

Although colonies are often confused with groups, the term "colony" should be used to designate truly colonial organisms: those that must live and function as an intact unit, such as corals and eusocial insects. Individuals within a colony are components of a single entity rather than separate members of a group. Also, colony members generally cannot be counted, and true census data is not possible, so for the purposes of inventory, a colony is a singular unit while a group is composed of a number of individuals. However, for accessioning purposes, colonies are treated in the same manner as are groups.

Examples of Appropriate Group Accessions

- A group of animals that are not individually identifiable and are the same species or subspecies.

  Your institution receives 50 Puerto Rican crested toad tadpoles to rear. Unless each tadpole is raised in a separate numbered tank, there is no way to tell one tadpole from another. All tadpoles housed together are accessioned as one group.
- Colonial species, such as coral or eusocial insects (e.g., some species of bees or ants).

  Your institution receives a piece of coral. Since the coral is in one piece, you accession it as a group of one. You make a note of the dimensions or mass of the piece to give an estimate of colony size, since it is not possible to count individual animals in the colony. In the inventory, the colony counts as one animal. When a section of the coral breaks off, you accession that new piece as a new colony.
- A self-sustaining, breeding group of small rodents or insects.

Your institution has many Cairo spiny mice. No daily count is made, though births and deaths increase and decrease the count. A census is taken periodically, and the new count is recorded by sex and life stage. Exact counts are made whenever possible – for example, when the group is moved to a new enclosure.

- Young born to several females of the same species or subspecies and raised together without means of identifying which offspring were born to which mother.

  A flock of 3.6 peafowl raise 25 chicks this year. Identity of the hens incubating each nest, hatch dates, and number of chicks hatched from each nest can be determined and recorded. However, unless the chicks are caught and banded at hatching, once the mothers and chicks join the main flock, it is no longer possible to tell which chicks belong to which females. All chicks in the flock have the same possible parents: all the peacocks and those peahens that incubated the nests. The chicks are accessioned as a group and are split out only when they are banded or tagged (and are thus individually identifiable).
- Historical records for a species or subspecies for which there is insufficient information to attribute events to specific individuals.

  Some of your historical records are found as simple lists of events. Though there are dates for all transactions, and maybe even specified vendors or recipients for those events, you cannot create individual records for any of these animals without additional information: there is nothing connecting any specific individual to both acquisition and disposition information. If additional information is uncovered that makes this connection, then that individual can be removed from the group accession and given an individual record.

Managing Group Records

Maintaining Group Records - As with individual records, group records should also be maintained and updated. Addition of animals through births or transactions such as loans, purchases, donations, or trades are entered as acquisitions. Subtraction of animals through deaths or transactions such as loans, sales, donations, or trades are entered as dispositions.

Weights and lengths can be entered into a group record even if that data cannot be attributed to a specific individual. This information is still useful in describing the overall condition of group members, although care should be given to describe the animal that the measurement came from. For example, is the animal a juvenile or a breeding adult? Is it healthy, or sickly? Alternatively, average and/or median measurements can be entered into the record to give an indication of what size a "normal" individual might be. In this case, notes should include the maximum and minimum measurements, and how many animals were measured to calculate the average or median.

Censuses - Groups should be censused at regular intervals - ideally, no longer than one inter-birth interval. Institutions should establish and follow a census schedule for each group. An inventory must be done at least once yearly (AZA Accreditation Standard 1.4.1) but the frequency at which a group is censused depends on species biology, husbandry protocols, and animal welfare. For species in which births/hatches and deaths tend to go undetected, or for species that have high fecundity and mortality (which makes counting every animal very difficult or impossible), census data should be obtained more frequently than for species with longer inter-birth intervals. These more frequent censuses should not be undertaken when intrusion on the group has a negative effect on the welfare of the group, e.g., disruption of maternal care.

Censuses should provide as much detail as possible by recording numbers in distinctive life stages (such as newborn, immature, adult) and/or sex ratio (such as male, female, unknown/undetermined). If the census count is estimated, the estimation method and (when possible) the accuracy of the estimate should be included. When updating the sex ratio, who sexed the animals and how they were sexed should also be recorded.

Splitting And Combining (Merging) Groups - Splitting animals from groups and combining groups together are realities of group management. Animals may be removed to create additional groups, or perhaps new animals are received from another institution. When new groups are created, new group records also need to be created. However, if the entire group moves to a new location (such as a different tank), it retains the same accession number, and notation of the change in location is made.

When a single group is split into two or more groups, one of the new groups keeps the original accession number and the others are assigned new accession numbers. This is also true if a portion of a group is sent to another institution: the subgroup making the transfer must have an accession number distinct from that of the main group. The accession number(s) for the new group(s) should follow institutional procedures for the assignment of new accession numbers. Note of the new group accession number(s) should appear in the originating group record, and the new group accession record(s) should contain the originating group number. The reason for the split should be entered into both the originating and new group records.

When two or more groups combine to form a larger group, all but one of the groups are deaccessioned and their counts brought to zero. Notes in all the group records should indicate why the groups were merged, as well as the accession numbers of all groups involved – both the closed (empty) groups and the remaining group.

In all cases of splits and merges, the date of creation of the new record should be the same as the date of removal from the previous group or individual. Detailed notes should explain the reasons for all splits and merges.

Merging Individuals into Groups and Splitting Individuals from Groups - Good husbandry dictates the use of identification methods that allow animals to be tracked as individuals whenever possible (AZA Accreditation Standard 1.4.3). Thus, most institutions initially accession newly acquired animals as individual animals with individual identifiers.

Despite the best intentions, individual identification sometimes becomes impossible. For example, birds in large aviaries lose their bands; small frogs in a large terrarium die and decompose without being noticed. When individual identification of several of the animals in the group is lost and can't be resolved in a reasonable amount of time, it is best to move all potentially unidentifiable animals to a group record, by either creating a new group or merging them into an existing group. As with splitting and merging groups, the group record should contain the identities of the originating individuals and the individual records should show the new group identity. If the animals in the group ever become individually identifiable again, they can be split back to individual records to better capture demographic information. If this occurs, new accession numbers are generally needed for the new individual records since it is rarely possible to know which old individual record would apply to the newly identifiable group member.

Conversely, if one or more group members become identifiable, for example, the previously unbanded young of the year are caught up and banded, they should be split from the group record and given individual accessions. The group record should include the individual numbers assigned, and the records of all individuals should show the number of the originating group. In the case of new individual records, information particular to the animal being given the individual record (if known) should be transferred to the individual record. This includes birth date, origin, parent identification, etc. As in the cases of splitting and merging groups, the date of creation of the new record is the same as the date of removal from the previous group or individual, and detailed notes should explain the reasons for all changes in accession type.

Transfers Between Institutions - When accessioning several animals that were received from another institution, the new animals should be accessioned using the same type of record that the sending institution used, regardless of how the animals will ultimately be managed. If a group is received but the members will be managed as individuals, they should be accessioned as a group first, then split out as individuals. Similarly, if several individuals are received but the plan is to manage them as a group, they should be accessioned as individuals, then merged into a group. Although this is an extra step in the accession process, it allows the records from both institutions to link more seamlessly.

Removing Individuals from Historical Group Records - The decision of whether to use individual or group accession for historical records should be made thoughtfully and carefully. As detailed above, group accession should be used if there is insufficient information to create an *accurate* individual record. The use of group accession is preferable to the inclusion of "best guess" information, i.e., fiction, to fill the information necessary to complete an individual record.

If additional information is later found that allows the creation of an individual record for one of the members of a historical group record, the procedure for removal from the group is different from that for

current records. This situation is treated differently because the historical individual was not truly part of a group accession – the information necessary for a complete individual record was merely not known and the group accession was used “temporarily” until the required information was found or learned. For this reason, the individual should NOT be split from the group, but all reference to the individual should instead be *deleted entirely* from the group, as if it were never part of the group. This will allow the individual record to begin with the initial acquisition (instead of the date of removal from a group) and will include the animal’s entire history in one record. It also prevents inflation of inventory numbers by eliminating the possible duplication of the same information in both the group and the individual records.

Appendix C: Guidelines for Creating and Sharing Animal and Collection Records

Developed by the AZA Institutional Data Management Scientific Advisory Group
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The goal of maintaining a centralized, compiled record for each animal cared for in a zoo or aquarium is ideal, however, oftentimes, information belonging in an animal record is spread across many departments and may originate with any member of the animal care staff. Therefore, it is important for zoos and aquariums to have a formal method for collecting or linking various pieces of information into the official records and that the roles and responsibilities for each named record type are clearly defined in written protocols for the reporting, recording, distribution, storage, and retrieval processes; there should also be a stated process of review for the accuracy and completeness of these records. For example, a recording/reporting protocol would state who reports births or deaths, to whom they are reported, in what manner and in what time frame they are reported, who officially records the information, and who reviews the resulting record for accuracy and completeness. Then, the maintenance and archiving protocol would state where the record is to be filed, who may have access, and how long the record is to be maintained before being archived or disposed of.

Information contained in animal records is essential not only to the immediate care of the individual animal but also as pooled data to manage larger concerns (e.g., providing norms for species-related veterinary and population management decisions, evidence of compliance with laws and regulations, showing trends in populations on every level from institutional to global, etc.). No matter what its use, it is critical for the information contained in an animal record to be factual, clear, complete, and documented. Because zoos and aquariums vary greatly in size and organizational structure, it is impossible to set defined procedures that would be applicable to all; therefore, the following guidelines for creating and sharing animal records have been developed to assist with the establishment of written policies that best fit their own internal structure and protocols.

Animal and Collection Records – Definitions and Examples

The AZA Institutional Data Management Scientific Advisory Group (IDMAG) defines an animal record as: *"data, regardless of physical form or medium, providing information about individual animals, groups of animals, or samples or parts thereof".* An animal's record may include, but is not limited to, information about its provenance, history, daily care, activities, and condition; some may originate in non-animal care departments. Some examples of animal records are:

- transaction documents (including proof of legal ownership, purchase contracts, etc.)
- identification information
- reports of collection changes (including in-house moves)
- pedigrees/lineages
- veterinary information, including images, test results, etc.
- nutrition and body condition information
- information on sampling and parts/products distribution

In addition, the IDMAG defines collection records as: *"information, evidence, rationalizations about an animal collection as a whole that may supplement or explain information contained in an animal record"*. Collection records may include, but are not limited to, documentation of collection decisions and changes, evidence of structural change at the institution, evidence of building name changes, and documentation of institution level or unit level husbandry protocols and changes. Some examples of collection records are:

- collection plans
- permits
- annual inventories (which include reconciliation with the previous year)
- area journals/notebooks (including information to/from/between other animal care staff)
- keeper reports

- animal management protocols (e.g., species hand-rearing protocols, special care or treatments, etc.)
- enclosure maps/trees
- enclosure/exhibit information (monitoring, maintenance, modifications, etc.)
- research plans and published papers

Animal and Collection Records - Development

It is recommended that each zoo and aquarium develop written policies and procedures, applicable to all staff involved with animal care, that:

- define the types of records that are required.
  For example, daily keeper reports might be required from the keeper staff and weekly summaries of activities might be required from the animal curator and senior veterinarian.
- define the information that is to be included in each type of record.
  Following the example above, the institution would state the specific types of information to be recorded on the daily keeper report and the weekly summaries.
- define the primary location where each record can be found.
  For example, if a zoo does not employ a nutritionist, the policy or procedures might state that animal diet information will be found in keeper daily reports, curator-developed daily diets, and/or veterinarian-prescribed treatment diets.
- assign responsibility for the generation of each record type and set time limits for the their creation.
  For example, keepers might be held responsible for producing daily reports by the start of the next day and curators might be held responsible for producing weekly summaries by the Tuesday of the following week.
- define a process to review the accuracy of each record type and assign responsibility for that review process.
  For example, the identity of who will review each type of record, the date of reviews, and the review/correction processes might be included in the policy.
- define a process to identify official records and assign responsibility for the recording of, or linking of, information into these records.
  For example, the identity of who will be responsible for placing information into the official records and the processes of how to identify official records might be included in the policy.
- ensure entries in official records are never erased or deleted.
  For example, if an entry is determined to be erroneous, rather than deleting it, the entry should be amended and an audit trail should be created that identifies what data was changed, who made the change, the date it was changed, and the reason for the change.
- ensure records relating to specific animals in the collection, including the records of non-animal care departments, are permanently archived as part of the animal's record.
  For example, if your zoo or aquarium's records retention schedules differ from this recommendation every attempt should be made to exempt these records from schedules requiring their destruction.

Animal and Collection Records – Sharing of Information

Each zoo and aquarium should assess the ownership of their animal and collection records and determine the rights of employees and outside entities to the information contained in them. It is recommended that each zoo and aquarium develop written policies and procedures for the distribution and/or availability of the animal and collection records that:

- identify who has access to animal and collection records and under what conditions.
  For example, animal care staff whose duties require a direct need for information about specific animals or collection of animals should be identified as individuals who are allowed access to any or specified records, regardless of who created them or when they were created.
- assign responsibility for the distribution, archiving and retrieval of each record type.

For example, the record-keeper or registrar might be held responsible for maintaining all past and current transaction documents and the curator might be held responsible for maintaining the daily keeper reports from his/her section.

- define a notification system that specifies what information will be provided in the notification, who will be notified, the date they will be notified by, and the mechanism that will be used to ensure the notification is communicated appropriately.

  For example, the shipment of an animal might require that written notice be made to the senior keeper in the animal's area, the curator, and the veterinarian at least 30 days prior to the move, and identifies the animal by group or individual identification/accession number, sex, and tag/transponder number, etc.
- define where each record type (stored or archived) is available and what format (paper or digital) it is in.

  For example, all original animal transaction documents might be kept in the registrar's office in fire-proof file cabinets but copies of the Animal Data Transfer Forms are kept in the appropriate keeper area.
- define a system for obtaining necessary information such that the information is available regardless of department and regardless of staffing issues

  For example, keeper daily reports might be maintained in an electronic database run on the institution's network, to which all animal care staff members have at least read-only access.

Implementation of these Recommendations

Well-written, consistent data-recording protocols and clear lines of communication will increase the quality of animal records and should be implemented by all institutions, regardless of technical resources. While the best option for availability of information is an electronic database system run on a computer network (intranet) to which all animal care staff members have unrestricted access, the above recommendations may also be adopted by zoos and aquariums without full electronic connections.

Appendix D: AZA Policy on Responsible Population Management

PREAMBLE

The stringent requirements for AZA accreditation, and high ethical standards of professional conduct, are unmatched by similar organizations and far surpass the United States Department of Agriculture's Animal and Plant Health Inspection Service's requirements for licensed animal exhibitors. Every AZA member must abide by a Code of Professional Ethics (https://www.aza.org). In order to continue these high standards, AZA-accredited institutions and certified related facilities should make it a priority, when possible, to acquire animals from and transfer them to other AZA member institutions, or members of other regional zoo associations that have professionally recognized accreditation programs.

AZA-accredited institutions and certified related facilities cannot fulfill their important missions of conservation, education, and science without live animals. Responsible management and the long-term sustainability of living animal populations necessitates that some individuals be acquired and transferred, reintroduced or even humanely euthanized at certain times. The acquisition and transfer of animals should be prioritized by the long-term sustainability needs of the species and AZA-managed populations among AZA-accredited and certified related facilities, and between AZA member institutions and non-AZA entities with animal care and welfare standards aligned with AZA. AZA member institutions that acquire animals from the wild, directly or through commercial vendors, should perform due diligence to ensure that such activities do not have a negative impact on species in the wild. Animals should only be acquired from non-AZA entities that are known to operate legally and conduct their business in a manner that reflects and/or supports the spirit and intent of the AZA Code of Professional Ethics as well as this Policy.

I. INTRODUCTION

This AZA Policy on Responsible Population Management provides guidance to AZA members to:

1. Assure that animals from AZA member institutions and certified related facilities are not transferred to individuals or organizations that lack the appropriate expertise or facilities to care for them [*see taxa specific appendices (in development)*],

2. Assure that the health and conservation of wild populations and ecosystems are carefully considered as appropriate,

3. Maintain a proper standard of conduct for AZA members during acquisition and transfer/reintroduction activities, including adherence to all applicable laws and regulations,

4. Assure that the health and welfare of individual animals is a priority during acquisition and transfer/reintroduction activities, and

5. Support the goals of AZA's cooperatively managed populations and associated Animal Programs [Species Survival Plans® (SSPs), Studbooks, and Taxon Advisory Groups (TAGs)].

This AZA Policy on Responsible Population Management will serve as the default policy for AZA member institutions. Institutions should develop their own Policy on Responsible Population Management to address specific local concerns. Any institutional policy must incorporate and not conflict with the AZA acquisition and transfer/transition standards.

II. LAWS, AUTHORITY, RECORD-KEEPING, IDENTIFICATION AND DOCUMENTATION

The following must be considered about the acquisition or transfer/management of all living animals and specimens (their living and non-living parts, materials, and/or products):

1. Any acquisitions, transfers, euthanasia, and reintroductions must meet the requirements of all applicable local, state, federal, national, and international laws and regulations. Humane euthanasia must be performed in accordance with the established euthanasia policy of the institution and follow the recommendations of current AVMA Guidelines for the Euthanasia of Animals (2013 Edition https://www.avma.org/KB/Policies/Documents/euthanasia.pdf) or the AAZV's Guidelines on the Euthanasia of Non-Domestic Animals. Ownership and any applicable chain-of-custody must be documented. If such information does not exist, an explanation must be provided regarding such animals and specimens. Any acquisition of free-ranging animals must be done in accordance with all local, state, federal, national, and international laws and regulations and must not be detrimental to the long-term viability of the species in the wild.

2. The Director/Chief Executive Officer of the institution must have final authority for all acquisitions, transfers, and euthanasia.

3. Acquisitions or transfers/euthanasia/reintroductions must be documented through institutional record keeping systems. The ability to identify which animal is being transferred is very important and the method of identifying each individual animal should be documented. Any existing documentation must accompany all transfers. Institutional animal records data and records guidelines have been developed for certain species to standardize the process (https://www.aza.org/AnimalCare).

4. For some colonial, group-living, or prolific species, it may be impossible or highly impractical to identify individual animals when these individuals are maintained in a group. These species can be maintained, acquisitioned, transferred, and managed as a group or colony, or as part of a group or colony.

5. If the intended use of specimens from animals either living or non-living is to create live animal(s), their acquisition and transfer should follow the same guidelines. If germplasm is acquired or transferred with the intention of creating live animal(s), ownership of the offspring must be clearly defined in transaction documents (e.g., breeding loan agreements).

   Institutions acquiring, transferring, or otherwise managing specimens should consider current and possible future uses as new technologies become available. All specimens from which nuclear DNA could be recovered should be carefully considered for preservation as these basic DNA extraction technologies already exist.

6. AZA member institutions must maintain transaction documents (e.g., confirmation forms, breeding agreements) which provide the terms and conditions of animal acquisitions, transfers, and loans, including documentation for animal parts, products and materials. These documents should require the potential recipient or provider to adhere to the AZA Policy on Responsible Population Management, and the AZA Code of Professional Ethics, and must require compliance with the applicable laws and regulations of local, state, federal, national, and international authorities.

7. In the case of animals (living or non-living) and their parts, materials, or products (living or non-living) held on loan, the owner's written permission should be obtained prior to any transfer and documented in the institutional records.

8. AZA SSP and TAG necropsy and sampling protocols should be accommodated.

9. Some governments maintain ownership of the species naturally found within their borders. It is therefore incumbent on institutions to determine whether animals they are acquiring, or transferring are owned by a government entity, foreign or domestic, and act accordingly by reviewing the government ownership policies available on the AZA website. In the case of government owned animals, proposals for and/or notifications of transfers must be sent to the species manager for the government owned species.

III. ACQUISITION REQUIREMENTS

A. General Acquisitions

1. Acquisitions must be consistent with the mission of the institution, as reflected in its Institutional Collection Plan, by addressing its exhibition/education, conservation, and/or scientific goals regarding the individual or species.

2. Animals (wild, feral, and domestic) may be held temporarily for reasons such as assisting governmental agencies or other institutions, rescue and/or rehabilitation, research, propagation or head starting for reintroduction, or special exhibits.

3. Any receiving institution must have the necessary expertise and resources to support and provide for the professional care and management of the species, so that the physical, psychological, and social needs of individual animals and species are met.

4. If the acquisition involves a species managed by an AZA Animal Program, the institution should communicate with the Animal Program Leader and, in the case of Green SSP Programs, must adhere to the AZA Full Participation Policy http://www.aza.org/full-participation-in-ssp-program-policy/).
5. AZA member institutions should consult AZA Animal Population Management Committee (APMC). - approved TAG Regional Collection Plans (RCPs), Animal Program Leaders, and AZA Animal Care Manuals (ACMs) when making acquisition decisions.

6. AZA member institutions that work with commercial vendors that acquire animals from the wild, must perform due diligence to assure the vendors' collection of animals is legal and using ethical practices. Commercial vendors should have conservation and animal welfare goals like those of AZA institutions.

7. AZA member institutions may acquire animals through public donations and other non-AZA entities when it is in the best interest of the animal and/or species.

B. Acquisitions from the Wild

Maintaining wild animal populations for exhibition, education and wildlife conservation purposes is a core function of AZA-member institutions. AZA zoos and aquariums have saving species and conservation of wildlife and wildlands as a basic part of their public mission. As such, the AZA recognizes that there are circumstances where acquisitions from the wild are needed to maintain healthy, diverse animal populations. Healthy, sustainable populations support the objectives of managed species programs and the core mission of AZA members. In some cases, acquiring individuals from the wild may be a viable option in addition to, or instead of, relying on breeding programs with animals already in human care.

Acquiring animals from the wild can result in socioeconomic benefit and environmental protection and therefore the AZA supports environmentally sustainable/beneficial acquisition from the wild when conservation is a positive outcome.

1. Before acquiring animals from the wild, institutions are encouraged to examine alternative sources including other AZA institutions and other regional zoological associations or other non-AZA entities.

2. When acquiring animals from the wild, both the long-term health and welfare impacts on the wild population as well as on individual animals must be considered. In crisis situations, when the survival of a population is at risk, rescue decisions will be made on a case-by-case basis by the appropriate agency and institution.

3. AZA zoos and aquariums may assist wildlife agencies by providing homes for animals born in nature if they are incapable of surviving on their own (e.g., in case of orphaned or injured animals) or by euthanizing the animals because they pose a risk to humans or for humane reasons.

4. Institutions should only accept animals from the wild after a risk assessment determines the zoo/aquarium can mitigate any potential adverse impacts on the health, care and maintenance of the existing animals already being housed at the zoo or aquarium, and the new animals being acquired.

IV. TRANSFER, EUTHANASIA AND REINTRODUCTION REQUIREMENTS

A. Living Animals

Successful conservation and animal management relies on the cooperation of many entities, both AZA and non-AZA. While preference is given to placing animals with AZA-accredited institutions or certified related facilities, it is important to foster a cooperative culture among those who share AZA's mission of saving species and excellence in animal care.

1. AZA members should assure that all animals in their care are transferred, humanely euthanized and/or reintroduced in a manner that meets the standards of AZA, and that animals are not transferred to those not qualified to care for them properly. Refer to IV.12, below, for further requirements regarding euthanasia.

2. If the transfer of animals or their specimens (parts, materials, and products) involves a species managed by an AZA Animal Program, the institution should communicate with that Animal Program Leader and must adhere to the AZA Full Participation Policy (http://www.aza.org/full-participation-in-ssp-program-policy/).

3. AZA member institutions should consult WCMC-approved TAG Regional Collection Plans, Animal Program Leaders, and Animal Care Manuals when making transfer decisions.

4. Animals acquired solely as a food source for animals in the institution's care are not typically accessioned. There may be occasions, however, when it is appropriate to use accessioned animals that exceed population carrying capacity as feeder animals to support other animals. In some cases, accessioned animals may have their status changed to "feeder animal" status by the institution as part of their program for long-term sustained population management of the species.

5. In transfers to non-AZA entities, AZA members must perform due diligence and should have documented validation, including one or more letters of reference, for example from an appropriate AZA Professional Fellow or other trusted source with expertise in animal care and welfare, who is familiar with the proposed recipient and their current practices, and that the recipient has the expertise and resources required to properly care for and maintain the animals. Any recipient must have the necessary expertise and resources to support and provide for the professional care and management of the species, so that the physical, psychological, and social needs of individual animals and species are met within the parameters of modern zoological philosophy and practice. Supporting documentation must be kept at the AZA member institution (see #IV.9 below).

6. Domestic animals should be transferred in accordance with locally acceptable humane farming practices, including auctions, and must be subject to all relevant laws and regulations.

7. AZA members must not send any non-domestic animal to auction or to any organization or individual that may display or sell the animal at an animal auction. *See certain taxa-specific appendices to this Policy (in development) for information regarding exceptions*.

8. Animals must not be sent to organizations or individuals that allow the hunting of these individual animals; that is, no individual animal transferred from an AZA institution may be hunted. For purposes of maintaining genetically healthy, sustainable zoo and aquarium populations, AZA-accredited institutions and certified related facilities may send animals to non-AZA organizations or individuals (refer to #IV.5 above). These non-AZA entities (for instance, ranching operations) should follow

appropriate ranch management practices and other conservation minded practices to support population sustainability.

9. Every loaning institution must annually monitor and document the conditions of any loaned specimen(s) and the ability of the recipient(s) to provide proper care (refer to #IV.5 above). If the conditions and care of animals are in violation of the loan agreement, the loaning institution must recall the animal or assure prompt correction of the situation. Furthermore, an institution's loaning policy must not conflict with this AZA Policy on Responsible Population Management.

10. If living animals are sent to a non-AZA entity located in the U.S. for research purposes, it must be a registered research facility by the U.S. Department of Agriculture and accredited by the Association for the Assessment & Accreditation of Laboratory Animal Care, International (AAALAC), if eligible. For international transactions, the receiving facility must be registered by that country's equivalent body having enforcement over animal welfare. In cases where research is conducted, but governmental oversight is not required, institutions should do due diligence to assure the welfare of the animals during the research.

11. Reintroductions and release of animals into the wild must meet all applicable local, state, and international laws and regulations. Any reintroduction requires adherence to best health and veterinary practices to ensure that non-native pathogens are not released into the environment exposing naive wild animals to danger. Reintroductions may be a part of a recovery program and must be compatible with the IUCN Reintroduction Specialist Group's Reintroduction Guidelines (http://www.iucnsscrsg.org).

12. Humane euthanasia may be employed for medical reasons to address quality of life issues for animals or to prevent the transmission of disease. AZA also recognizes that humane euthanasia may be employed for managing the demographics, genetics, and diversity of animal populations. Humane euthanasia must be performed in accordance with the established euthanasia policy of the institution and follow the recommendations of current AVMA Guidelines for the Euthanasia of Animals (2013 Edition https://www.avma.org/KB/Policies/Documents/euthanasia.pdf) or the AAZV's Guidelines on the Euthanasia of Non-Domestic Animals.

B. Non-Living Animals and Specimens

AZA members should optimize the use and recovery of animal remains. All transfers must meet the requirements of all applicable laws and regulations.

1. Optimal recovery of animal remains may include performing a complete necropsy including, if possible, histologic evaluation of tissues which should take priority over specimens' use in education/exhibits. AZA SSP and TAG necropsy and sampling protocols should be accommodated. This information should be available to SSP Programs for population management.

2. The educational use of non-living animals, parts, materials, and products should be maximized, and their use in Animal Program sponsored projects and other scientific projects that provide data for species management and/or conservation must be considered.

3. Non-living animals, if handled properly to protect the health of the recipient animals, may be utilized as feeder animals to support other animals as deemed appropriate by the institution.

4. AZA members should consult with AZA Animal Program Leaders prior to transferring or disposing of remains/samples to determine if existing projects or protocols are in place to optimize use.

5. AZA member institutions should develop agreements for the transfer or donation of non-living animals, parts, materials, products, and specimens and associated documentation, to non-AZA entities such as universities and museums. These agreements should be made with entities that have

appropriate long-term curation/collections capacity and research protocols, or needs for educational programs and/or exhibits.

DEFINITIONS

Acquisition: Acquisition of animals can occur through breeding (births, hatchings, cloning, and division of marine invertebrates = "fragging"), trade, donation, lease, loan, transfer (inter- and intra-institution), purchase, collection, confiscation, appearing on zoo property, or rescue and/or rehabilitation for release.

Annual monitoring and Due diligence: Due diligence for the health of animals on loan is important. Examples of annual monitoring and documentation include and are not limited to inventory records, health records, photos of the recipient's facilities, and direct inspections by AZA professionals with knowledge of animal care. The level of due diligence will depend on professional relationships.

AZA member institution: In this Policy "AZA member institutions" refers to AZA-accredited institutions and certified related facilities (zoological parks and aquariums). "AZA members" may refer to either institutions or individuals.

Data sharing: When specimens are transferred, the transferring and receiving institutions should agree on data that must be transferred with the specimen(s). Examples of associated documentation include provenance of the animal, original permits, tags and other metadata, life history data for the animal, how and when specimens were collected and conserved, etc.

Dispose: "Dispose/Disposing of" in this document is limited to complete and permanent removal of an individual via incineration, burying or other means of permanent destruction

Documentation: Examples of documentation include ZIMS records, "Breeding Loan" agreements, chain-of-custody logs, letters of reference, transfer agreements, and transaction documents. This is documentation that maximizes data sharing.

Domestic animal: Examples of domestic animals may include certain camelids, cattle, cats, dogs, ferrets, goats, pigs, reindeer, rodents, sheep, budgerigars, chickens, doves, ducks, geese, pheasants, turkeys, and goldfish or koi.

Ethics of Acquisition/Transfer/Euthanasia: Attempts by members to circumvent AZA Animal Programs in the acquisition of animals can be detrimental to the Association and its Animal Programs. Such action may also be detrimental to the species involved and may be a violation of the Association's Code of Professional Ethics. Attempts by members to circumvent AZA Animal Programs in the transfer, euthanasia or reintroduction of animals may be detrimental to the Association and its Animal Programs (unless the animal or animals are deemed extra in the Animal Program population by the Animal Program Coordinator). Such action may be detrimental to the species involved and may be a violation of the Association's Code of Professional Ethics.

"Extra" or Surplus: AZA's scientifically managed Animal Programs, including SSPs, have successfully bred and reintroduced critically endangered species for the benefit of humankind. To accomplish these critical conservation goals, populations must be managed within "carrying capacity" limits. At times, the number of individual animals in a population exceeds carrying capacity, and while meaning no disrespect for these individual animals, we refer to these individual animals as "extra" within the managed population.

Euthanasia: Humane death. This act removes an animal from the managed population. Specimens can be maintained in museums or cryopreserved collections. Humane euthanasia must be performed in accordance with the established euthanasia policy of the institution and follow the recommendations of current AVMA Guidelines for the Euthanasia of Animals (2013 Edition https://www.avma.org/KB/Policies/Documents/euthanasia.pdf) or the AAZV's Guidelines on the Euthanasia of Non-Domestic Animals.

Feral: Feral animals are animals that have escaped from domestication or have been abandoned to the wild and have become wild, and the offspring of such animals. Feral animals may be acquired for temporary or permanent reasons.

Group: Examples of colonial, group-living, or prolific species include and are not limited to certain terrestrial and aquatic invertebrates, fish, sharks/rays, amphibians, reptiles, birds, rodents, bats, big herds, and other mammals,

Lacey act: The Lacey Act prohibits the importation, exportation, transportation, sale, receipt, acquisition or purchase of wildlife taken or possessed in violation of any law, treaty or regulation of the United States or any Indian tribal law of wildlife law. In cases when there is no documentation accompanying an acquisition, the animal(s) may not be transferred across state lines. If the animal was illegally acquired at any time, then any movement across state or international borders would be a violation of the Lacey Act.

Museum: It is best practice for modern zoos and aquariums to establish relationships with nearby museums or other biorepositories, so that they can maximize the value of animals when they die (e.g., knowing who to call when they have an animal in necropsy, or specimens for cryopreservation). Natural history museums that are members of the Natural Science Collections Alliance (NSCA) and frozen biorepositories that are members of the International Society of Biological and Environmental Repositories (ISBER) are potential collaborators that could help zoos find appropriate repositories for biological specimens.

Non-AZA entity: Non – AZA entities include facilities not accredited or certified by the AZA, facilities in other zoological regions, academic institutions, museums, research facilities, private individuals, etc.

Reintroduction: Examples of transfers outside of a living zoological population include movements of animals from zoo/aquarium populations to the wild through reintroductions or other legal means.

Specimen: Examples of specimens include animal parts, materials and products including bodily fluids, cell lines, clones, digestive content, DNA, feces, marine invertebrate (coral) fragments (“frags”), germplasm, and tissues.

Transaction documents: Transaction documents must be signed by the authorized representatives of both parties, and copies must be retained by both parties*. In the case of loans, the owner’s permission for appropriate activities should be documented in the institutional records. This document(s) should be completed prior to any transfer. In the case of rescue, confiscation, and evacuation due to natural disasters, it is understood that documents may not be available until after acceptance or shipping. In this case documentation (e.g., a log) must be kept reconciling the inventory and chain of custody after the event occurs. (*In the case of government owned animals, notification of transfers must be sent to species manager for the government owned species).

Transfer: Transfer occurs when an animal leaves the institution for any reason. Reasons for transfer or euthanasia may include cooperative population management (genetic, demographic, or behavioral management), animal welfare or behavior management reasons (including sexual maturation and individual management needs). Types of transfer include withdrawal through donation, trade, lease, loan, inter- and intra-institution transfers, sale, escape, theft. Reintroduction to the wild, humane euthanasia or natural death are other possible individual animal changes in a population.

RECIPIENT PROFILE EXAMPLE

Example questions for transfers to non-AZA entities (from AZA-member Recipient Profile documents):

Has your organization, or any of its officers, been indicted, convicted, or fined by a State or Federal agency or any national agency for any statute or regulation involving the care or welfare of animals housed at your facility? (If yes, please explain on a separate sheet).

Recipients agree that the specimen(s) or their offspring will not be utilized, sold or traded for any purpose contrary to the Association of Zoos and Aquariums (AZA) Code of Ethics (enclosed)

References, other than (LOCAL ZOO/AQUARIUM) employees, 2 minimum (please provide additional references on separate sheet):

Reference Name		Phone	
Facility		Fax	
Address		E-mail	
City	State		Zip
Country		AZA Member?	
Reference Name		Phone	
Facility		Fax	
Address		E-mail	
City	State		Zip
Country		AZA Member?	

Veterinary Information:

Veterinarian		Phone	
Clinic/Practice		Fax	
Address		E-mail	
City	State		Zip
Country			

How are animals identified at your facility? If animals are not identified at your facility, please provide an explanation about why they are not here:

Where do you acquire and send animals? (Select all that apply)

AZA Institutions	Non-AZA Institutions	Exotic Animal Auctions	Pet Stores
Hunting Ranches	Dealers	Private Breeders	Non-hunting Game Ranches
Entertainment Industry	Hobbyists	Research Labs	Wild
Other			

What specific criteria are used to evaluate if a facility is appropriate to receive animals from you?

Please provide all of the documents listed below:
Required:
1. Please provide a brief statement of intent for the specimens requested.
2. Resumes of primary caretakers and those who will be responsible for the husbandry and management of animals.
3. Description (including photographs) of facilities and exhibits where animals will be housed.
4. Copy of your current animal inventory.

Only if Applicable:
5. Copies of your last two USDA inspection reports (if applicable).
6. Copies of current federal and state permits.
7. Copy of your institutional acquisition/disposition policy.

(in-house use only) In-Person Inspection of this facility (Staff member/Date, attach notes):

(Local institution: provide Legal language certifying that the information contained herein is true and correct)

(Validity of this: This document and all materials associated will be valid for a period of 2 years from date of signature.)

Example agreement for Receiving institution (agrees to following condition upon signing):
RECIPIENT AGREES THAT THE ANIMAL(S) AND ITS (THEIR) OFFSPRING WILL NOT BE UTILIZED, SOLD OR TRADED FOR THE PURPOSE OF COMMERCE OR SPORT HUNTING, OR FOR USE IN ANY STRESSFUL OR TERMINAL RESEARCH OR SENT TO ANY ANIMAL AUCTION. RECIPIENT FURTHER AGREES THAT IN THE EVENT THE RECIPIENT INTENDS TO DISPOSE OF AN ANIMAL DONATED BY (INSITUTION), RECIPIENT WILL FIRST NOTIFY (INSTITUTION) OF THE IDENTITY OF THE PROPOSED TRANSFEREE AND THE TERMS AND CONDITIONS OF SUCH DISPOSITION AND WILL PROVIDE (INSTITUTION) THE OPPORTUNITY TO ACQUIRE THE ANIMAL(S) WITHOUT CHARGE. IF (INSTITUTION) ELECTS NOT TO RECLAIM THE ANIMAL WITHIN TEN (10) BUSINESS DAYS FOLLOWING SUCH NOTIFICATION, THEN, IN SUCH EVENT, (INSTITUTION) WAIVES ANY RIGHT IT MAY HAVE TO THE ANIMAL AND RECIPIENT MAY DISPOSE OF THE ANIMAL AS PROPOSED.

Institutional note: The text above is similar to the language most dog breeders use in their contracts when they sell a puppy. If people can provide that protection to the puppies they place, zoos/aquariums can provide it for animals that we place too! Some entities have been reluctant to sign it, and in that case, we revert to a loan and our institution retains ownership of the animal. Either way, we are advised of the animal's eventual placement and location.

Appendix E: Recommended Quarantine Procedures

Quarantine facility: A separate quarantine facility, with the ability to accommodate mammals, birds, reptiles, amphibians, and fish should exist. If a specific quarantine facility is not present, then newly acquired animals should be isolated from the established collection in such a manner as to prohibit physical contact, to prevent disease transmission, and to avoid aerosol and drainage contamination.

Such separation should be obligatory for primates, small mammals, birds, and reptiles, and attempted wherever possible with larger mammals such as large ungulates and carnivores, marine mammals, and cetaceans. If the receiving institution lacks appropriate facilities for isolation of large primates, pre-shipment quarantine at an AZA or American Association for Laboratory Animal Science (AALAS) accredited institution may be applied to the receiving institutions protocol. In such a case, shipment must take place in isolation from other primates. More stringent local, state, or federal regulations take precedence over these recommendations.

Quarantine length: Quarantine for all species should be under the supervision of a veterinarian and consist of a minimum of 30 days (unless otherwise directed by the staff veterinarian). Mammals: If during the 30-day quarantine period, additional mammals of the same order are introduced into a designated quarantine area, the 30-day period must begin over again. However, the addition of mammals of a different order to those already in quarantine will not have an adverse impact on the originally quarantined mammals. Birds, Reptiles, Amphibians, or Fish: The 30-day quarantine period must be closed for each of the above Classes. Therefore, the addition of any new birds into a bird quarantine area requires that the 30-day quarantine period begin again on the date of the addition of the new birds. The same applies for reptiles, amphibians, or fish.

Quarantine personnel: A keeper should be designated to care only for quarantined animals, or a keeper should attend quarantined animals only after fulfilling responsibilities for resident species. Equipment used to feed and clean animals in quarantine should be used only with these animals. If this is not possible, then equipment must be cleaned with an appropriate disinfectant (as designated by the veterinarian supervising quarantine) before use with post-quarantine animals.

Institutions must take precautions to minimize the risk of exposure of animal care personnel to zoonotic diseases that may be present in newly acquired animals. These precautions should include the use of disinfectant foot baths, wearing of appropriate protective clothing and masks in some cases, and minimizing physical exposure in some species, e.g., primates, by the use of chemical rather than physical restraint. A tuberculin testing/surveillance program must be established for zoo/aquarium employees in order to ensure the health of both the employees and the animal collection.

Quarantine protocol: During this period, certain prophylactic measures should be instituted. Individual fecal samples or representative samples from large numbers of individuals housed in a limited area (e.g., birds of the same species in an aviary or frogs in a terrarium) should be collected at least twice and examined for gastrointestinal parasites. Treatment should be prescribed by the attending veterinarian. Ideally, release from quarantine should be dependent on obtaining two negative fecal results spaced a minimum of two weeks apart either initially or after parasiticide treatment. In addition, all animals should be evaluated for ectoparasites and treated accordingly.

Vaccinations should be updated as appropriate for each species. If the animal arrives without a vaccination history, it should be treated as an immunologically naive animal and given an appropriate series of vaccinations. Whenever possible, blood should be collected, and sera banked. Either a -70 °C (-94 °F) frost-free freezer or a -20 °C (-4 °F) freezer that is not frost-free should be available to save sera. Such sera could provide an important resource for retrospective disease evaluation.

The quarantine period also represents an opportunity to, where possible, permanently identify all unmarked animals when anesthetized or restrained (e.g., tattoo, ear notch, ear tag, etc.). Also, whenever animals are restrained or immobilized, a complete physical, including a dental examination, should be performed. Complete medical records should be maintained and available for all animals during the quarantine period. Animals that die during quarantine should have a necropsy performed under the supervision of a veterinarian and representative tissues submitted for histopathologic examination.

Quarantine procedures: The following are recommendations and suggestions for appropriate quarantine procedures for owls/Strigiformes:

Owls/Strigiformes:

Required:

1. Direct and floatation fecals
2. Vaccinate as appropriate

Strongly recommended:

1. CBC/sera profile
2. Urinalysis
3. Appropriate serology
4. Heartworm testing in appropriate species

Appendix F: Ambassador Animal Policy and Position Statement

Ambassador (Program) Animal Policy

Originally approved by the AZA Board of Directors—2003
Updated and approved by the Board—July 2008 & June 2011
Modified from "Program Animal" to "Ambassador Animal" to avoid confusion with "Animal Programs," approved by the CEC; no change to meaning of these terms - January 2015

The Association of Zoos & Aquariums (AZA) recognizes many benefits for public education and, ultimately, for conservation in ambassador animal presentations. AZA's Conservation Education Committee's *Ambassador Animal Position Statement* summarizes the value of ambassador animal presentations (see pages 42–44).

For the purpose of this policy, an ambassador animal is defined as "an animal whose role includes handling and/or training by staff or volunteers for interaction with the public and in support of institutional education and conservation goals." Some animals are designated as Ambassador Animals on a full-time basis, while others are designated as such only occasionally. Ambassador Animal-related Accreditation Standards are applicable to all animals during the times that they are designated as Ambassador Animals.

There are three main categories of Ambassador Animal interactions:

1. On Grounds with the Ambassador Animal Inside the Exhibit/Enclosure:
    a. Public access outside the exhibit/enclosure. Public may interact with animals from outside the exhibit/enclosure (e.g., giraffe feeding, touch tanks).
    b. Public access inside the exhibit/enclosure. Public may interact with animals from inside the exhibit/enclosure (e.g., lorikeet feedings, 'swim with' programs, camel/pony rides).
2. On Grounds with the Ambassador Animal Outside the Exhibit/Enclosure:
    a. Minimal handling and training techniques are used to present Ambassador Animals to the public. Public has minimal or no opportunity to directly interact with Ambassador Animals when they are outside the exhibit/enclosure (e.g., raptors on the glove, reptiles held "presentation style").
    b. Moderate handling and training techniques are used to present Ambassador Animals to the public. Public may be near, or have direct contact with, Ambassador Animals when they're outside the exhibit/enclosure (e.g., media, fund raising, photo, and/or touch opportunities).
    c. Significant handling and training techniques are used to present Ambassador Animals to the public. Public may have direct contact with Ambassador Animals or simply observe the in-depth presentations when they're outside the exhibit/enclosure (e.g., wildlife education shows).
3. Off Grounds:
    a. Handling and training techniques are used to present Ambassador Animals to the public outside of the zoo/aquarium grounds. Public may have minimal contact or be near and have direct contact with Ambassador Animals (e.g., animals transported to schools, media, fund raising events).

These categories assist staff and accreditation inspectors in determining when animals are designated as Ambassador Animals and the periods during which the Ambassador Animal-related Accreditation Standards are applicable. In addition, these Ambassador Animal categories establish a framework for understanding increasing degrees of an animal's involvement in Ambassador Animal activities.

Ambassador Animal presentations bring a host of responsibilities, including the safety and welfare of the animals involved, the safety of the animal handler and public, and accountability for the take-home, educational messages received by the audience. Therefore, AZA requires all accredited institutions that make Ambassador Animal presentations to develop an institutional Ambassador Animal policy that clearly identifies and justifies those species and individuals approved as Ambassador Animals and details their long-term management plan and educational program objectives.

AZA's accreditation standards require that education and conservation messages must be an integral component of all Ambassador Animal presentations. In addition, the accreditation standards require that the conditions and treatment of animals in education programs must meet standards set for the remainder of the animal collection, including species-appropriate shelter, exercise, appropriate environmental enrichment, access to veterinary care, nutrition, and other related standards. In addition, providing Ambassador Animals with options to choose among a variety of conditions within their environment is essential to ensuring effective care, welfare, and management. Some of these requirements can be met outside of the primary exhibit enclosure while the animal is involved in a program or is being transported. For example, free-flight birds may receive appropriate exercise during regular programs, reducing the need for additional exercise. However, the institution must ensure that in such cases, the animals participate in programs on a basis sufficient to meet these needs or provide for their needs in their home enclosures; upon return to the facility the animal should be returned to its species-appropriate housing as described above.

Ambassador Animal Position Statement

Last revision 1/28/03
Re-authorized by the Board June 2011

The Conservation Education Committee (CEC) of the Association of Zoos and Aquariums supports the appropriate use of Ambassador Animals as an important and powerful educational tool that provides a variety of benefits to zoo and aquarium educators seeking to convey cognitive and affective (emotional) messages about conservation, wildlife, and animal welfare.
Utilizing these animals allows educators to strongly engage audiences. As discussed below, the use of Ambassador Animals has been demonstrated to result in lengthened learning periods, increased knowledge acquisition and retention, enhanced environmental attitudes, and the creation of positive perceptions concerning zoo and aquarium animals.

Audience Engagement

Zoos and aquariums are ideal venues for developing emotional ties to wildlife and fostering an appreciation for the natural world. However, developing and delivering effective educational messages in the free-choice learning environments of zoos and aquariums is a difficult task.

Zoo and aquarium educators are constantly challenged to develop methods for engaging and teaching visitors who often view a trip to the zoo as a social or recreational experience (Morgan & Hodgkinson, 1999). The use of Ambassador Animals can provide the compelling experience necessary to attract and maintain personal connections with visitors of all motivations, thus preparing them for learning and reflection on their own relationships with nature.

Ambassador Animals are powerful catalysts for learning for a variety of reasons. They are generally active, easily viewed, and usually presented near the public. These factors have proven to contribute to increasing the length of time that people spend watching animals in zoo exhibits (Bitgood, Patterson & Benefield, 1986, 1988; Wolf & Tymitz, 1981).

In addition, the provocative nature of a handled animal likely plays an important role in captivating a visitor. In two studies (Povey, 2002; Povey & Rios, 2001), visitors viewed animals three and four times longer while they were being presented in demonstrations outside of their enclosure with an educator than while they were on exhibit. Clearly, the use of Ambassador Animals in shows or informal presentations can be effective in lengthening the potential time period for learning and overall impact.

Ambassador Animals also provide the opportunity to personalize the learning experience, tailoring the teaching session to what interests the visitors. Traditional graphics offer little opportunity for this level of personalization of information delivery and are frequently not read by visitors (Churchman, 1985; Johnston, 1998). For example, Povey (2001) found that only 25% of visitors to an animal exhibit read the accompanying graphic; whereas 45% of visitors watching the same animal handled in an educational presentation asked at least one question and some asked as many as seven questions. Having an animal accompany the educator allowed the visitors to make specific inquiries about topics in which they were interested.

Knowledge Acquisition
Improving our visitors' knowledge and understanding regarding wildlife and wildlife conservation is a fundamental goal for many zoo educators using Ambassador Animals. A growing body of evidence supports the validity of using Ambassador Animals to enhance delivery of these cognitive messages as well.

- MacMillen (1994) found that the use of live animals in a Zoomobile outreach program significantly enhanced cognitive learning in a vertebrate classification unit for sixth grade students.
- Sherwood and his colleagues (1989) compared the use of live horseshoe crabs and sea stars to the use of dried specimens in an aquarium education program and demonstrated that students made the greatest cognitive gains when exposed to programs utilizing the live animals.
- Povey and Rios (2002) noted that in response to an open-ended survey question ("Before I saw this animal, I never realized that . . ."), visitors watching a presentation utilizing an Ambassador Animal provided 69% cognitive responses (i.e., something they learned) versus 9% made by visitors viewing the same animal in its exhibit (who primarily responded with observations).
- Povey (2002) recorded a marked difference in learning between visitors observing animals on exhibit versus being handled during informal presentations. Visitors to demonstrations utilizing a raven and radiated tortoises were able to answer questions correctly at a rate as much as eleven times higher than visitors to the exhibits.

Enhanced Environmental Attitudes
Ambassador Animals have been clearly demonstrated to increase affective learning and attitudinal change.

- Studies by Yerke and Burns (1991), and Davison and her colleagues (1993) evaluated the effect live animal shows had on visitor attitudes. Both found their shows successfully influenced attitudes about conservation and stewardship.
- Yerke and Burns (1993) also evaluated a live bird outreach program presented to Oregon fifth graders and recorded a significant increase in students' environmental attitudes after the presentations.
- Sherwood and his colleagues (1989) found that students who handled live invertebrates in an education program demonstrated both short and long-term attitudinal changes as compared to those who only had exposure to dried specimens.
- Povey and Rios (2002) examined the role Ambassador Animals play in helping visitors develop positive feelings about the care and well-being of zoo animals.
- As observed by Wolf and Tymitz (1981), zoo visitors are deeply concerned with the welfare of zoo animals and desire evidence that they receive personalized care.

Conclusion
Creating positive impressions of aquarium and zoo animals, and wildlife in general, is crucial to the fundamental mission of zoological institutions. Although additional research will help us delve further into this area, the existing research supports the conclusion that Ambassador Animals are an important tool for conveying both cognitive and affective messages regarding animals and the need to conserve wildlife and wild places.

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Appendix G: Developing an Institutional Ambassador Animal Policy

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Rationale

Membership in AZA requires that an institution meet the AZA Accreditation Standards collectively developed by our professional colleagues. Standards guide all aspects of an institution's operations; however, the accreditation commission has asserted that ensuring that member institutions demonstrate the highest standards of animal care is a top priority. Another fundamental AZA criterion for membership is that education be affirmed as core to an institution's mission. All accredited public institutions are expected to develop a written education plan and to regularly evaluate program effectiveness.

The inclusion of animals (native, exotic, and domestic) in educational presentations, when done correctly, is a powerful tool. CEC's **Ambassador Animal Position Statement** describes the research underpinning the appropriate use of Ambassador Animals as an important and powerful educational tool that provides a variety of benefits to zoo and aquarium educators seeking to convey cognitive and affective messages about conservation and wildlife.

Ongoing research, such as AZA's Multi-Institutional Research Project (MIRP) and research conducted by individual AZA institutions will help zoo educators to determine whether the use of Ambassador Animals conveys intended and/or conflicting messages and to modify and improve programs accordingly and to ensure that all Ambassador Animals have the best possible welfare.

When utilizing Ambassador Animals our responsibility is to meet both our high standards of animal care and our educational goals. Additionally, as animal management professionals, we must critically address both the species' conservation needs and the welfare of the individual animal. Because "wild creatures differ endlessly," in their forms, needs, behavior, limitations, and abilities (Conway, 1995), AZA, through its Animal Welfare Committee, has recently given the responsibility to develop taxon- and species-specific animal welfare standards and guidelines to the Taxon Advisory Groups (TAG) and Species Survival Plan® Program (SSP). Experts within each TAG or SSP, along with their education advisors, are charged with assessing all aspects of the taxon's' and/or species' biological and social needs and developing Animal Care Manuals (ACMs) that include specifications concerning their use as Ambassador Animals.

However, even the most exacting standards cannot address the individual choices faced by each AZA institution. Therefore, each institution is required to develop an Ambassador Animal policy that articulates and evaluates program benefits. The following recommendations are offered to assist each institution in formulating its own Institutional Ambassador Animal Policy, which incorporates the AZA Ambassador Animal Policy and addresses the following matters.

The Policy Development Process

Within each institution, key stakeholders should be included in the development of that institution's policy, including, but not limited to representatives from:

- The Education Department
- The Animal Husbandry Department
- The Veterinary and Animal Health Department
- The Conservation & Science Department
- The Behavioral Husbandry Department
- Any animal show staffs (if in a separate department)
- Departments that frequently request special Ambassador Animal situations (e.g., special events, development, marketing, zoo or aquarium society, administration)

Additionally, staff from all levels of the organization should be involved in this development (e.g., curators, keepers, education managers, interpreters, volunteer coordinators).

To develop a comprehensive Ambassador Animal Policy, we recommend that the following components be included:

I. Philosophy

In general, the position of the AZA is that the use of animals in up close and personal settings, including animal contact, can be extremely positive and powerful, if:

1. The use and setting are appropriate.
2. Animal and human welfare is always considered.
3. The animal is used in a respectful, safe manner and in a manner that does not misrepresent or degrade the animal.
4. A meaningful conservation message is an integral component. Read the AZA Board-approved Conservation Messages.
5. Suitable species and individual specimens are used.

Institutional Ambassador Animal policies should include a philosophical statement addressing the above, and should relate the use of Ambassador Animals to the institution's overall mission statement.

II. Appropriate Settings

The Ambassador Animal Policy should include a listing of all settings both on and off site, where Ambassador Animal use is permitted. This will clearly vary among institutions. Each institution's policy should include a comprehensive list of settings specific to that institution. Some institutions may have separate policies for each setting; others may address the various settings within the same policy. Examples of settings include:

1. On-site programming
    a. Informal and non-registrants:
        i. On-grounds programming with animals being brought out (demonstrations, lectures, parties, special events, and media)
        ii. Children's zoos and contact yards
        iii. Behind-the-scenes open houses
        iv. Shows
        v. Touch pools
    b. Formal (registration involved) and controlled settings
        i. School group programs
        i. Summer camps
        ii. Overnights
        iii. Birthday parties
        iv. Animal rides
        v. Public animal feeding programs
    c. Offsite and outreach
        i. PR events (TV, radio)
        ii. Fundraising events
        iii. Field programs involving the public
        iv. School visits
        v. Library visits
        vi. Nursing home visits (therapy)
        vii. Hospital visits
        viii. Senior centers
        ix. Civic group events

In some cases, policies will differ from setting to setting (e.g., on-site, and off-site use with media). These settings should be addressed separately, and should reflect specific animal health issues, assessment of distress in these situations, limitations, and restrictions.

III. Compliance with Regulations

All AZA institutions housing mammals are regulated by the USDA's Animal Welfare Act. Other federal regulations, such as the Marine Mammal Protection Act, may apply. Additionally, many states, and some cities, have regulations that apply to animal contact situations. Similarly, all accredited institutions are bound by the AZA Code of Professional Ethics. It is expected that the Institution Ambassador Animal Policy address compliance with appropriate regulations and AZA Accreditation Standards.

IV. Collection Planning

AZA accredited institutions should have a collection planning process in place. Ambassador Animals are part of an institution's overall collection and must be included in the overall collection planning process. The AZA Guide to Accreditation contains specific requirements for the institution collection plan. For more information about collection planning in general, please see the Collection Management Pages in the Members Only section.

The following recommendations apply to Ambassador Animals:

1. Listing of approved Ambassador Animals (to be periodically amended as collection changes). Justification of each species should be based upon criteria such as:
    a. Temperament and suitability for program use
    b. Husbandry requirements
    c. Husbandry expertise
    d. Veterinary issues and concerns
    e. Ease and means of acquisition / disposition according to the AZA code of ethics
    f. Educational value and intended conservation message
    g. Conservation Status
    h. Compliance with TAG and SSP guidelines and policies
2. General guidelines as to how each species (and, where necessary, for each individual) will be presented to the public, and in what settings
3. The collection planning section should reference the institution's acquisition and disposition policies.

V. Conservation Education Message

As noted in the AZA Accreditation Standards, if animal demonstrations are part of an institution's programs, an educational and conservation message must be an integral component. The Ambassador Animal Policy should address the specific messages related to the use of Ambassador Animals, as well as the need to be cautious about hidden or conflicting messages (e.g., "petting" an animal while stating verbally that it makes a poor pet). This section may include or reference the AZA Conservation Messages.

Although education value and messages should be part of the general collection planning process, this aspect is so critical to the use of Ambassador Animals that it deserves additional attention. In addition, it is highly recommended to encourage the use of biofacts in addition to or in place of the live animals. Whenever possible, evaluation of the effectiveness of presenting Ambassador Animals should be built into education programs.

VI. Human Health and Safety

The safety of our staff and the public is one of the greatest concerns in working with Ambassador Animals. Although extremely valuable as educational and affective experiences, contact with animals poses certain risks to the handler and the public. Therefore, the human health and safety section of the policy should address:

1. Minimization of the possibility of disease transfer from non-human animals to humans, and vice-versa (e.g., hand washing stations, no touch policies, use of hand sanitizer).
2. Safety issues related to handlers' personal attire and behavior (e.g., discourage or prohibit use of long earrings, perfume, and cologne, not eating or drinking around animals, smoking, etc.).

AZA's Animal Contact Policy provides guidelines in this area; these guidelines were incorporated into accreditation standards in 1998.

VII. Animal Health and Welfare

Animal health and welfare are the highest priority of AZA accredited institutions. As a result, the Institutional Ambassador Animal Policy should make a strong statement on the importance of animal welfare. The policy should address:

1. General housing, husbandry, and animal health concerns (e.g., that the housing and husbandry for Ambassador Animals meets or exceeds general AZA standards and that the physical, social and psychological needs of the individual animal, such as adequate rest periods, provision of enrichment, visual cover, contact with conspecifics as appropriate, etc., are accommodated).

2. Wherever possible provide a choice for animal program participation, e.g., retreat areas for touch tanks or contact yards, evaluation of willingness/readiness to participate by handler, etc.)
3. The empowerment of handlers to make decisions related to animal health and welfare, such as withdrawing animals from a situation if safety or health is in danger of being compromised.
4. Requirements for supervision of contact areas and touch tanks by trained staff and volunteers.
5. Frequent evaluation of human / animal interactions to assess safety, health, welfare, etc.
6. Ensure that the level of health care for the Ambassador Animals is consistent with that of other animals in the collection.
7. Whenever possible have a "cradle to grave" plan for each Ambassador Animal to ensure that the animal can be taken care of properly when not used as an Ambassador Animal anymore.
8. If lengthy "down" times in Ambassador Animal use occur, staff should ensure that animals accustomed to regular human interactions can still maintain such contact and receive the same level of care when not used in programs.

VIII. Taxon Specific Protocols

We encourage institutions to provide taxonomically specific protocols, either at the genus or species level, or the specimen, or individual, level. Some taxon-specific guidelines may affect the use of Ambassador Animals. To develop these, institutions refer to the Conservation Programs Database.

Taxon and species -specific protocols should address:

1. How to remove the individual animal from and return it to its permanent enclosure, including suggestions for operant conditioning training.
2. How to crate and transport animals.
3. Signs of stress, stress factors, distress, and discomfort behaviors.

Situation specific handling protocols (e.g., whether animal is allowed to be touched by the public, and how to handle in such situations):

1. Guidelines for disinfecting surfaces, transport carriers, enclosures, etc. using environmentally safe chemicals and cleaners where possible.
2. Animal facts and conservation information.
3. Limitations and restrictions regarding ambient temperatures and or weather conditions.
4. Time limitations (including animal rotation and rest periods, as appropriate, duration of time each animal can participate, and restrictions on travel distances).
5. The number of trained personnel required to ensure the health and welfare of the animals, handlers and public.
6. The level of training and experience required for handling this species
7. Taxon/species-specific guidelines on animal health.
8. The use of hand lotions by program participants that might touch the animals

IX. Logistics: Managing the Program

The Institutional Policy should address several logistical issues related to Ambassador Animals, including:

1. Where and how the Ambassador Animal collection will be housed, including any quarantine and separation for animals used off-site.
2. Procedures for requesting animals, including the approval process and decision-making process.
3. Accurate documentation and availability of records, including procedures for documenting animal usage, animal behavior, and any other concerns that arise.

X. Staff Training

Thorough training for all handling staff (keepers, educators, and volunteers, and docents) is clearly critical. Staff training is such a large issue that many institutions may have separate training protocols and procedures. Specific training protocols can be included in the Institutional Ambassador Animal Policy or reference can be made that a separate training protocol exists.

It is recommended that the training section of the policy address:

1. Personnel authorized to handle and present animals.
2. Handling protocol during quarantine.

3. The process for training, qualifying and assessing handlers including who is authorized to train handlers.
4. The frequency of required re-training sessions for handlers.
5. Personnel authorized to train animals and training protocols.
6. The process for addressing substandard performance and noncompliance with established procedures.
7. Medical testing and vaccinations required for handlers (e.g., TB testing, tetanus shots, rabies vaccinations, routine fecal cultures, physical exams, etc.).
8. Training content (e.g., taxonomically specific protocols, natural history, relevant conservation education messages, presentation techniques, interpretive techniques, etc.).
9. Protocols to reduce disease transmission (e.g., zoonotic disease transmission, proper hygiene and hand washing requirements, as noted in AZA's Animal Contact Policy).
10. Procedures for reporting injuries to the animals, handling personnel or public.
11. Visitor management (e.g., ensuring visitors interact appropriately with animals, do not eat or drink around the animal, etc.).

XI. Review of Institutional Policies

All policies should be reviewed regularly. Accountability and ramifications of policy violations should be addressed as well (e.g., retraining, revocation of handling privileges, etc.). Institutional policies should address how frequently the Ambassador Animal Policy will be reviewed and revised, and how accountability will be maintained.

XII. TAG and SSP Recommendations

Following development of taxon-specific recommendations from each TAG and SSP, the institution policy should include a statement regarding compliance with these recommendations. If the institution chooses not to follow these specific recommendations, a brief statement providing rationale is recommended.