



**RED-LEGGED  
SERIEMA**  
*(Cariama cristata)*  
**CARE MANUAL**

CREATED BY  
**AZA RED-LEGGED SERIEMA  
SPECIES SURVIVAL PLAN<sup>®</sup>**  
IN ASSOCIATION WITH THE  
**AZA GRUIFORMES  
TAXON ADVISORY GROUP**

## **Red-Legged Seriema (*Cariama cristata*) Care Manual**

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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.

## Table of Contents

<b>Introduction</b> .....	<b>5</b>
Taxonomic Classification .....	5
Genus, Species, and Status .....	5
General Information .....	5
<b>Chapter 1. Ambient Environment</b> .....	<b>7</b>
1.1 Temperature and Humidity .....	7
1.2 Light .....	7
1.3 Water and Air Quality .....	8
1.4 Sound and Vibration .....	8
<b>Chapter 2. Habitat Design and Containment</b> .....	<b>10</b>
2.1 Space and Complexity .....	10
2.2 Safety and Containment .....	12
<b>Chapter 3. Transport</b> .....	<b>16</b>
3.1 Preparations .....	16
3.2 Protocols .....	17
<b>Chapter 4. Social Environment</b> .....	<b>19</b>
4.1 Group Structure and Size .....	19
4.2 Influence of Others and Conspecifics .....	19
4.3 Introductions and Reintroductions .....	21
<b>Chapter 5. Nutrition</b> .....	<b>22</b>
5.1 Nutritional Requirements .....	22
5.2 Diets .....	24
5.3 Nutritional Evaluations .....	25
<b>Chapter 6. Veterinary Care</b> .....	<b>27</b>
6.1 Veterinary Services .....	27
6.3 Transfer Examination and Diagnostic Testing Recommendations .....	30
6.4 Quarantine .....	30
6.5 Preventive Medicine .....	32
6.6 Capture, Restraint, and Immobilization .....	34
6.7 Management of Diseases, Disorders, Injuries and/or Isolation .....	35
<b>Chapter 7. Reproduction</b> .....	<b>39</b>
7.1 Reproductive Physiology and Behavior .....	39
7.2 Assisted Reproductive Technology .....	41
7.3 Egg-laying .....	42
7.4 Hatching Facilities .....	43
7.5 Assisted Rearing .....	44
7.6 Contraception .....	45
<b>Chapter 8. Behavior Management</b> .....	<b>46</b>
8.1 Animal Training .....	46
8.2 Environmental Enrichment .....	47
8.3 Staff and Animal Interactions .....	48
8.4 Staff Skills and Training .....	49
<b>Chapter 9. Program Animals</b> .....	<b>50</b>
9.1 Program Animal Policy .....	50
9.2 Institutional Program Animal Plans .....	51

9.3 Program Evaluation ..... 54

**Chapter 10. Research..... 55**

    10.1 Known Methodologies ..... 55

    10.2 Future Research Needs..... 56

**Chapter 11. Other Considerations..... 58**

    11.1 Additional Information..... 58

**Acknowledgements ..... 59**

**References ..... 60**

**Appendix A: Accreditation Standards by Chapter..... 62**

**Appendix B: Acquisition/Disposition Policy..... 65**

**Appendix C: Recommended Quarantine Procedures ..... 69**

**Appendix D: Program Animal Policy and Position Statement..... 71**

**Appendix E: Developing an Institutional Program Animal Policy ..... 75**

**Appendix F: Red-legged Seriema Hematological Reference Values ..... 80**

**Appendix G: Handrearing Protocol..... 81**

**Appendix H: Red-legged Seriema Ethogram..... 83**

## 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 red-legged seriema

Classification	Taxonomy
Kingdom	Animalia
Phylum	Chordata
Class	Aves
Order	Gruiformes
Suborder	
Family	Cariamidae

### Genus, Species, and Status

Table 2. Genus, species, and status information for red-legged seriema

Genus	Species	Common Name	USA Status	IUCN Status	AZA Status
<i>Cariama</i>	<i>cristata</i>	Red-legged seriema	Not listed	Least Concern	SSP

### 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), Studbook Programs, biologists, veterinarians, nutritionists, reproduction physiologists, behaviorists and researchers. They are based on the most current science, practices, and technologies used in animal care and management and are valuable resources that enhance animal welfare by providing information about the basic requirements needed and best practices known for caring for *ex situ* red-legged seriema 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 red-legged seriema must comply with all relevant local, state, and federal wildlife laws and regulations; AZA accreditation standards that are more stringent than these laws and regulations must be met (AZA Accreditation Standard 1.1.1).

#### AZA Accreditation Standard

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

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

Seriemas are members of the order Gruiformes, and are the only living members of the Cariamidae family. Their placement within this order has been disputed over the years, but they are generally placed closest to bustards, with which they share similar cestode parasites. The two species of seriemas are found in South America: the red-legged *Cariama cristata* and the black-legged *Chunga burmeisteri*. Red-legged seriemas are managed by the AZA as a Species Survival Plan® (SSP) species.

**Red-legged seriema:** The red-legged seriema (*Cariama cristata*) ranges in South America from central and eastern Brazil through eastern Bolivia and Paraguay, to Uruguay and central Argentina. It can be found in lightly wooded areas, as well as open savanna-like areas. The main concentration of red-legged seriemas is in the grassy savanna region of central Brazil. Here, termite mounds litter the landscape and provide seriemas with places from which to vocalize and scout for food. Further south, seriemas are found in more wooded areas, as well as grasslands, and can be found at elevations of 2000 m (6561.68 ft). Seriemas have recently colonized man-made grassy areas, and other semi-open areas of Brazil, which were formerly covered by tropical forests. They are often found in areas where fire has recently passed through and where insects and small vertebrates may be easily found. Seriemas are territorial and usually sedentary in their movements, although movements in response to temperature changes have been reported.

Male and female red-legged seriemas look alike, with males being slightly larger than females. Birds weigh approximately 2.5–3 kg (5.5–6.6 lb), and stand about 90 cm (35.4 in.) tall. Their most striking feature is their crest, which is unique among South American birds. The crest is comprised of tufts of permanently raised, slightly stiff feathers at the base of the bill, which can reach 10 cm (3.9 in.) in length. Males have longer crest feathers. They are one of few bird species with modified feathers that resemble eye lashes. Seriemas have loose plumage, especially on the neck and under parts. Red-legged seriemas are mainly gray in coloration, with shades of brown, except the abdomen, which is white. The wing and tail feathers are banded black and white. The skin surrounding the eye is blue, and the iris of the eye is yellow. The bill and the legs are both red. The hooked beak is often compared to that of a raptor. Mostly ground-dwelling birds, seriemas have three short, very sharp front toes, and a raised smaller hind toe. This anatomical arrangement prevents them from catching prey with their feet. Instead, the sharp claws on the feet are used to hold prey in place while the strong bill tears the flesh. They are quick runners, generally preferring to run from danger than fly. They have been clocked running upwards of 70 km/hour (43 mph). When they do fly, it is generally only when they cannot outrun their pursuer, or to reach an elevated perch (del Hoyo, 1996).

Seriemas are most often seen alone or in pairs. Groups of three or more birds are most likely parents and offspring. They are a diurnal species and roost in trees at night. Dust bathing and sunbathing are practiced. During sunbathing, birds often lie on their side and appear as if they are dead.

**Black-legged seriema:** While red-legged seriemas are generally found in open habitats, the slightly smaller black-legged seriemas (*Chunga burmeisteri*) prefer more wooded areas. The range of black-legged seriemas is considerably smaller than that of the red-legged seriema (del Hoyo, 1996). Black-legged seriemas are not recommended for management by the AZA Gruiformes TAG due to a lack of birds in AZA collections.

**Conservation issues:** Neither species of seriema is listed as a CITES species and do not require any special permits into the United States. The AZA red-legged seriema population is managed as a Species Survival Plan® (SSP). Threats to both species' habitats are in the form of agricultural development and hunting, although red-legged seriemas seem to have adapted to this threat and in fact have colonized certain deforested areas in Brazil (del Hoyo, 1996). Populations of both species should continue to be monitored given their precarious status in certain parts of their range.

## Chapter 1. Ambient Environment

### 1.1 Temperature and Humidity

Animal collections within AZA-accredited institutions must be protected from weather detrimental to their health (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 animal collection must be protected from weather detrimental to their health.

**Cold weather:** Zoos in zones where temperatures fall below 0 °C (32 °F) should have winter holding facilities available for housing birds during inclement weather (see section 2.1 for additional information). Seriemas have succumbed to frostbite, and should be locked in heated shelters when temperatures are below 0 °C (32 °F). Feathers will be fluffed and body movement limited when birds are cold. Access to heated areas should be available at all times. They should also be housed indoors during periods of freezing rain or snow as their loose plumage does not provide them adequate protection from such weather conditions. Sheds should be heated to 10–15.5 °C (50–60 °F). Heat bulbs, if used, should be encased in protective wiring to prevent bulb breakage in case a bird makes contact with the bulb and should be mounted above the perch so that the heat shines down on the bird. One heat bulb per bird is sufficient. Radiant heaters should be used in addition to heat bulbs. Birds should be able to move to cooler parts of the holding area if they so desire.

**Hot weather:** Seriemas are birds of the pampas of South America, and are able to tolerate hot, dry conditions well. During warm parts of the year and in warmer climates, shaded areas should be made available both on the ground and from above in the form of perching. Seriemas exhibiting heat stress will pant, and the ability to retreat to cooler areas of the pen is critical. Seriemas are not heavy water drinkers, but fresh water should be available at all times. Areas of full sun should be provided within seriema exhibits, as seriemas are frequent sunbathers. Sunning occurs on the ground, generally in areas with sandy substrate. Sunning seriemas often appear as if they are dead, so good exhibit interpretation is recommended to avoid “dead bird” reports.

**Humidity:** Seriemas do not thrive in climates that are consistently wet, rainy, and damp. These conditions lead to poor feather condition because the birds are unable to properly dry off. Poor feather condition will appear in the form of tattered feathers. Warm, dry shelters and areas of full sun that allow animals to dry themselves are recommended (S. Hallager, personal communication). Humidity levels have not been noted within the zoological management of seriemas as being problematic at any specific levels.

AZA institutions with exhibits which rely on climate control must have critical life-support systems for the animal collection and emergency backup systems available, while all mechanical equipment should be included in a documented preventative maintenance program. Special equipment should be maintained under a maintenance agreement or records should indicate that staff members are trained to conduct specified maintenance (AZA Accreditation Standard 10.2.1).

The AZA Gruiformes TAG and Red-Legged Seriema SSP recommend that each institution identify the most appropriate climate control systems suitable for their seriema enclosures in order to meet the temperature and humidity recommendations provided above.

#### AZA Accreditation Standard

(10.2.1) Critical life-support systems for the animal collection, 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. All mechanical equipment should be under a preventative maintenance program as evidenced through a record-keeping system. Special equipment should be maintained under a maintenance agreement, or a training record should show that staff members are trained for specified maintenance of special equipment.

### 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.

Natural photoperiods within U.S. facilities, for outdoor enclosures, appear to be sufficient stimuli for periods of full gonadal maturation and subsequent regressions required for breeding and molt. For safety

reasons, a minimum light intensity of 500 lux within enclosures is suggested—this is similar to the light amount required for human activities and is sufficient to register changing day length. Lights should be installed within indoor exhibits, holding areas, and winter facilities that can be turned on during the day and off at night, mimicking the local daylight cycle. A period of gradual darkening and lightening is not necessary.

Skylights allowing for natural light in the stalls may be advantageous for birds that should be housed indoors for extended periods, but are not required. A small night-light turned on at night will provide some degree of light for the birds during the overnight hours allowing them to move easily if they so choose. As most seriemas are not maintained indoors for extended periods, artificial seasonal changes in indoor light intensity and duration are not necessary. However, facilities that move their birds indoors for the winter months may want to consider artificial manipulation of photoperiods to ensure full progression of all circannual rhythms.

**Sunbathing:** Sunbathing does not appear to be a thermoregulation mechanism, as it is in some birds. Seriemas do not sunbathe in the colder months (S. Hallager, personal observation). Sunbathing is most prevalent during the summer months.

### 1.3 Water and Air Quality

AZA-accredited institutions must have a regular program of monitoring water quality for collections of 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 collections.

#### AZA Accreditation Standard

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

There are no recommendations or regulations specific to air and water quality requirements for seriemas in zoos. Any clean water source that is considered potable for humans is acceptable for seriemas. Seriemas require only small areas of water from which to drink. They are not heavy drinkers, but do drink on a daily basis. In order to avoid contamination of the water source by fecal material, pools or water bowls should not be placed under areas where birds perch. Heated water dispensers for northernmost zones are recommended. Seriemas do not bathe in water, so pools are not required in exhibits—unless for aesthetic reasons. If pools are present in enclosures, they should be shallow enough that a bird can walk through the water, and the sides should gradually slope to the deepest portion. Pools should not be deeper than 0.6 m (24 in.). To prevent accidental drowning, pools should be drained once chicks leave the nest. Once chicks are 30 days old, the pools may be filled to their normal depth.

From an air quality perspective, holding areas and indoor or winter enclosures should not be sealed tightly enough to prevent fresh air from entering the area, as this can adversely affect air quality within the enclosure. A ventilation system, small windows with screens, and/or the ability to open windows, will allow fresh air to enter these areas, and will discourage the formation of fungal spores. The size of indoor enclosures and the number of housed specimens should be evaluated to determine the effectiveness of ventilation systems and air quality. Sufficient airflow should be provided to reduce humidity levels and remove the build-up of noxious gases, which may create a predisposition to respiratory diseases (S. Hallager, personal communication).

### 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.

Consideration should be given to controlling sounds and vibrations that can be heard by seriemas in their indoor and outdoor enclosures. Seriemas often become habituated to the routine sounds of normal zoo operation (e.g., trash trucks, nearby construction, leaf blowers), as well as to other environmental sound stimuli (e.g., overhead aircraft, traffic noise, etc.). However, unusual sounds can act as stressors, and may cause birds to react negatively by running or crouching. Breeding activities can also be interrupted by novel sounds. Timing of planned construction work near to seriema enclosures should coincide with the non-breeding season to minimize effects on the birds. Workers should be cautioned that

their activities might affect the birds. Work should be stopped at once and the situation re-evaluated if it causes changes in the birds' behaviors (e.g., birds not eating, running within their enclosure, or remaining in the crouch position). In some cases, birds may need to be temporarily housed or even relocated to another exhibit, although the pros and cons of moving animals should be carefully discussed (S. Hallager, personal communication).

Little is known about the hearing sensitivity of seriemas. There is no information available on whether certain frequencies of sounds or decibel levels will have the greatest negative effect on the welfare of seriemas, or what should be minimized. Animals should be carefully monitored in any situations where animal caretakers can hear loud, atypical sounds near seriema enclosures. Additional research on hearing in seriemas would provide some guidance for creating more objective recommendations for managing sound stimuli for this vocally charismatic species (see Chapter 10.2).

## 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 should be displayed, whenever possible, in exhibits replicating their wild habitat and in numbers sufficient to meet their social and behavioral needs (AZA Accreditation Standard 1.5.2).

All enclosures should be large enough for seriemas to exercise their preferred flight distance from animal care staff. Indicators that the size and complexity of the enclosures are not meeting the needs of the birds may include poor physical health, pacing along fence lines, and increased behavioral displacements between males and females.

#### AZA Accreditation Standard

(1.5.2) Animals should be displayed, whenever possible, in exhibits replicating their wild habitat and in numbers sufficient to meet their social and behavioral needs. Display of single specimens should be avoided unless biologically correct for the species involved.

**Species-appropriate behaviors:** All seriema enclosures and husbandry management programs in zoos should be designed with knowledge of the species' natural behaviors in mind. Appendix H provides a comprehensive ethogram of seriema behavior that should be carefully considered from an enclosure design and enrichment perspective. It would be beneficial to conduct additional research on the behaviors of wild seriemas to make general comparisons, which would benefit animal management recommendations (see Chapter 10.2).

**Locomotion:** Seriemas are quick runners, generally preferring to run from danger rather than fly. They have been clocked running upwards of 70 km/hour (43 mph) in the wild (del Hoyo, 1996). Exhibits should be designed to allow birds to reach a high speed of running. Holding areas are unlikely to provide suitable running areas, so birds should not be housed in these areas longer than necessary.

Seriemas are mostly terrestrial birds, but they do fly (e.g., when they cannot outrun a pursuer in the wild). They will fly to reach elevated perches, to get from perch to perch, or to reach elevated nest sites. Unless the enclosure is completely covered, birds will need to be flight restrained (see flight restriction information in Chapter 6.5). Covered enclosures have the added benefit of keeping out unwanted pests or potential predatory species, and can help to minimize the spread of parasites and diseases from wild animals to seriemas.

**Foraging:** Seriemas are predatory by nature, and like to hunt for insects and small vertebrates. Some naturally occurring leaf litter should be left to encourage insects, and filling artificial termite mounds with crickets in the exhibit will encourage foraging behavior.

**Dust bathing:** Areas that provide the opportunity for dust bathing should be provided in both indoor and outdoor enclosures, as seriemas in zoos commonly display this behavior. These areas can contain sand, mulch, peat moss, or coarse oyster shell.

**Nesting materials:** During the breeding season, seriemas should be provided with nesting material in addition to the material they would naturally collect themselves. All nesting material must be identified and assessed for safety by at least one qualified individual (AZA Accreditation Standard 2.6.4). Small sticks (pencil size in diameter) and reeds are preferred. To avoid injury to chicks and adults, sticks with pointed barbs or sharp ends should not be provided. Seriemas in non-breeding situations may appreciate nesting material to satisfy any natural breeding urges.

**Socialization:** Seriema pairs are sociable by nature, and compatible pairs will usually rest near each other and feed from the same pan. Males will offer females food during the breeding season. During introduction periods, separate food pans are recommended until the birds are compatible. Despite the compatibility of pairs, multiple perches should be available to allow birds to roost apart if they choose. Birds that are incompatible (e.g., two adult males) should always be housed separately.

**Stress:** Attention to the design of facilities and the behavior of staff members working with seriemas is important to minimize stressors and other trauma-related problems. Various stimuli within the zoo environment can be potential stressors for seriema, including capture and restraint of birds, animal introductions, aggressive behavior between birds, feeding time, the presence of several keepers in visual range of the birds, or staff working in or near the enclosure (especially with loud machinery).

Indicators of stress may be non-vocal such as running/chasing and stereotypical pacing and hiding (induced by high crowd levels and may cause subordinate birds to seek areas away from visitors). New seriema enclosures should limit visitor access to no more than two sides of the enclosure, in order to prevent excessive visitor presence around the enclosure perimeter. Reducing the number of non-essential people who enter seriema enclosures, or the off-exhibit areas directly around these enclosures, can also potentially reduce stress.

**Exhibit barriers:** Visual barriers such as thick shrubs placed around the perimeter of the enclosure and within the enclosure, will provide birds with an increased sense of security from conspecifics, other exhibit mates, and zoo visitors—especially if housed in pens of minimum size. If enclosures are accessible from all sides by people (e.g., staff members and visitor viewing), providing areas for hiding is even more important to minimize potential stress.

Using shade-cloth or tension netting on the roof and sides of aviaries can minimize visual stressors, and can cushion any impact resulting from birds flying within an enclosure as a result of stressors in that environment.

Seriemas do not have a well-developed sense of smell, so olfactory stimuli are not of concern. Similarly, they do not seem negatively affected by auditory stimuli, although further research is required to determine the effect of other seriemas within auditory range.

**Exhibit substrates:** The substrate of all enclosures should be natural and non-abrasive for feet and hock joints of the birds. Outdoor enclosure substrate usually consists of grass, sand, dirt, or a combination of all three. Areas under nests should be soft and padded in the event chicks fall from the nest. Seriemas should also be provided with substrates that promote a wide range of species-appropriate behaviors (e.g., dust-bathing, preening, foraging, nest building, etc.). Dust bathing areas can contain sand, mulch, peat moss, or coarse oyster shell.

Indoor substrates: The floor of indoor enclosures can be dirt or sand that is covered with bedding hay (straw). Enclosures with concrete floors should be covered with non-slip materials (e.g., indoor/outdoor carpeting or rubber matting).

Outdoor substrates: A natural soil or grass substrate is the most appropriate substrate for outdoor exhibits. There should be ample bare ground that is not covered with grasses or turf. Impaction does not appear to be a problem with adult seriemas in naturalistic aviaries. Damp, marshy areas within enclosures should be avoided.

**Exhibit size:** The size of seriema pens varies widely. With large pens, dimensions are not critical. Outdoor enclosures that are small in scale should be longer than they are wide. A good recommended size is 7.5 m x 5 m x 2.5 m (24.5 ft x 16 ft x 8 ft) for a pair of birds (Collins, 1998). However seriemas have lived and bred in both smaller and larger exhibits. Smaller exhibits should provide ample areas for seriemas to hide. The recommended oblong dimensions provide some exercise space, and allow the birds to distance themselves from keepers during enclosure cleaning. These size recommendations are highly dependent on the compatibility of conspecifics. Larger dimensions or separate shelters may be required for birds that have a lower degree of social compatibility. All pens, regardless of size, should have areas that permit seriemas to run, and should be high enough that birds can perch at least 1.2–1.5 m (4–5 ft) off the ground. Fowler (2001) recommends a space of 10 m<sup>2</sup> (107.64 ft<sup>2</sup>) per bird, and a minimum aviary height of 2 m (6.5 ft). In the wild, seriemas nest 1–5 m (3–16 ft) off the ground (del Hoyo, 1996), so elevated perches and nests as high as the exhibit allows should be provided for them to meet their desire to roost and nest at this level. Opportunities for locomotion and exercise (i.e., walking, running and short flights) should be provided to the birds within their exhibits. This includes an area to promote running, by providing long runs within the exhibit. Although seriemas are very agile and can navigate around obstacles with ease, running areas should be free of items such as perches and stumps. Runs should be long enough that a bird can reach full stride. Long runs are also important for chicks, which need plenty of exercise to avoid developmental problems such as a slipped tendon.

Enclosures designed for seriemas should minimize negative stressors, allow for efficient handling and restraint when necessary, provide access for emergency and routine procedures, maximize the potential for social interaction (and separation when needed), allow for a full range of species-appropriate behaviors, and should effectively integrate enrichment and animal training (see Chapter 8) into the daily husbandry routine.

For seriemas, some change within their environment is important to satisfy their natural curiosity and intelligence. Variation in the enrichment food items offered is one way to accomplish this, along with occasional movement of perching and alterations in feeding times. Seriema enrichment is currently limited, and requires further development.

Seriemas do not have preferred areas of defecation, and so keepers should inspect the entire pen daily and remove all fecal matter to minimize the spread of disease and parasites (S. Hallager personal communication).

The same careful consideration regarding exhibit size and complexity and its relationship to the red-legged seriemas' 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).

#### 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; and exhibit enclosures must include provisions for the behavioral enrichment of the animals.

**Holding enclosures:** It is recommended that all facilities housing seriemas have a holding area available, even if periods of cold/freezing weather are not common. The shelter can be used for times when pen repairs are needed, for medical confinement, to minimize food loss from wild birds, or when birds need to be caught. Sliding doors, operated from outside of the holding area, are always useful for controlling the location of birds within the shelter.

If birds are compatible, sheds that are 2.4 m x 3 m x 2.5 m (8 ft x 8 ft x 8 ft) are sufficient. In colder climates, where sheds are used when temperatures are below freezing, overhead heat panels should be installed. Heat bulbs are optional, but they should be encased with wire mesh to prevent breakage in the event of contact if they are used. Smaller sheds should have one stump per bird for perching; larger sheds can accommodate horizontal perching. Extreme northern climates that require housing of birds for the entire winter should provide seriemas with holding facilities which are larger than the facilities that house their birds for only a short period of time (e.g., overnight or a few days). These quarters should have several perching areas (both high and low). Areas for dust bathing can be given provided they remain dry.

Winter holding areas should have the capability to be divided in the event that birds are not compatible in small areas, as can occasionally occur when males and females are housed together. Sheds should be heated to a maximum of 10–15.5 °C (50–60 °F), and less if heating lamps and/or pads provide warmer areas. Skylights within the winter holding area can be advantageous for birds that have to be housed for extended periods during the winter, but artificial lights should also be installed to provide adequate light during the day. A small night-light turned on at night will provide some degree of light for the birds. The floor of the shed can be dirt or sand that can be covered with bedding hay or straw. Concrete floors should be covered with absorbent material especially when birds are housed long term (i.e., greater than 3 days). Sliding doors, operated from outside of the holding area, are always useful for controlling the location of birds within the shelter.

**Substrate:** Outdoor holding enclosures are usually grass, sand [children's play sand is ideal], dirt, or a combination of all three. Seriemas should not be housed in pens consisting solely of rocks or gravel, as this can lead to foot injuries (e.g., broken nails and toes). The floor of indoor enclosures can be covered with dirt or sand with a 5 cm (2 in.) layer of bedding hay (straw) or wood chips. All substrate should be routinely changed to keep it fresh and free of contaminants. Some facilities have indoor quarters with cement floors that are hosed daily. As long as sufficient perching is provided, concrete is acceptable for short-term holding and/or winter holding situations. Keepers may opt to provide dust-bathing areas for birds that are housed indoors for extended periods of time, but should ensure that these areas are kept dry, as seriemas will not dust-bathe in wet substrate. Small dust bathing areas (1.2 m x 1.2 m [4 ft x 4 ft]) of sand should also be provided in the exhibit.

#### AZA Accreditation Standard

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

## 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).

**Exhibit safety:** Any small holes that develop in the soil within any seriema enclosure (either from erosion or rodent activity) should be filled as soon as possible; seriema feet are small, and broken toes or legs can result from tripping or falling due to holes. Keepers should inspect the areas of the enclosure where birds have the closest access to the public and immediately remove any foreign materials on a daily basis. Seriemas can ingest objects such as nails, batteries, broken glass, and coins. There can be serious health consequences associated with ingestion of these items. The animals should be regularly monitored for signs of impaction and zinc toxicity. Hand-reared seriemas may tolerate a metal detector device held against the abdomen to check for the presence of ingested metal, especially if this is part of a husbandry-training program. Plants in and around enclosures should also be carefully selected to ensure that they do not have any poisonous properties, or do not pose any risk of physical injury to the birds (e.g., from thorns).

**Pest and predator control:** Keepers should check enclosures each day for signs of rodent activity. Spilled food should be removed on a daily basis to aid in rodent control. Poison should not be used inside seriema exhibits. If snap traps need to be set, they should be covered so that the birds are unable to see or reach the trap. Seriemas are curious and will investigate a trap if they can see it.

Wild birds and rodents can pose a problem for seriemas, especially at feeding time, as most will not aggressively defend their food; however, seriemas will also actively hunt, kill, and consume wild prey especially during the breeding season. Keepers may need to compensate for this by using special feeders to discourage wild birds and squirrels. Where possible, it is advisable to work out a pest control program with a qualified pest control officer.

**Predators:** Native/feral predators are dangerous for both adult and young seriemas. Foxes and/or raccoons have attacked adult birds, sometimes fatally, and small chicks left out in unsecured exhibits are at great risk. All enclosures should be built to minimize predator access. Digging predators (e.g., dogs, foxes) can be excluded by burying the base of the boundary 0.3 m (1 ft) in the ground. Surrounding the enclosure with electrical wire can deter climbing predators (e.g., raccoons). For the safety of the chicks being raised naturally by their parents, covered pens are strongly recommended. More research is needed to determine if covered pens may also play a role in minimizing the risk of avian transmitted diseases (see Chapter 10.2). In areas where large predators (e.g., coyote, bobcat, cougar, etc.) are common, birds may need to be housed indoors at night if outdoor pens are not covered. Shifting and housing birds indoors each day may negatively impact breeding success (S. Hallager, personal communication).

Walk-through exhibits are fine for housing breeding pairs or single birds, but will depend upon the personality and tolerance level of the bird or birds. Animal exhibits and holding areas in all AZA-accredited institutions must be secured to prevent unintentional animal egress (AZA Accreditation Standard 11.3.1).

**AZA Accreditation Standard**

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

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.

An enclosure boundary of wire mesh with a diameter measuring 2.5 cm (1 in.) reduces the chances of chicks getting out. It is common practice for seriemas to have 24-hour access to their public exhibits. Since most seriemas are full-winged, covered enclosures are preferable, but not always possible. Maintaining seriemas in a full-flighted status will not lead to injury, as seriemas are incapable of flying great distances, flying only to get from perch to perch. Housing full-flighted birds in a covered pen removes the need to feather clip, allows birds to perch high, and eliminates any chance of predation. If pens are not covered, birds should be feather clipped as needed—usually once several flight feathers have grown in. While not recommended, if birds are maintained in open topped pens, perches should be placed as far away as possible from enclosure barriers to prevent escape from the pen. Seriemas are excellent jumpers, and even feather-clipped birds have escaped from enclosures that are up to 2.4 m (8 ft) high. If hot wire is used on the outside of the enclosure, ensure that birds cannot make contact with it via perching. Pens should be inspected daily for debris that may be ingested.

Exhibits in which the visiting public may have contact with animals must have a guardrail/barrier that separates the two (AZA Accreditation Standard 11.3.6).

**Public barriers/guardrails:** To prevent any physical interaction between seriemas within their enclosures and members of the public outside the enclosure, there should be a guardrail/barrier of at least one foot [0.3m] that separates the two in addition to the primary containment (e.g., wire mesh).

All emergency safety procedures must be clearly written, provided to appropriate staff and volunteers, and readily available for reference in the event of an actual emergency (AZA Accreditation Standard 11.2.3).

Transport crates should be readily available to move seriemas in the event of a fire or other natural disaster that requires their immediate relocation. There should be one crate per bird to ensure that translocation can be performed quickly, if needed. For zoos in hurricane prone zones, birds should be housed in sheds or cement structures (e.g., basements, bathrooms) that can withstand hurricane force winds during the storm. Institutions should develop protocols that provide step-by-step instructions for where birds should be moved, how, when, and by whom. Non-perishable food and sufficient water should be left with the seriemas in their shelters in the event staff cannot immediately service the birds after the storm.

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

In regions of North America that experience severe weather events, such as, hurricanes, floods, fire, etc. an emergency response plan (ERP) should be developed and re-examined on a regular basis (yearly is recommended). The ERP should explain animal handling recommendations and hierarchy of decision-making and contact information for all applicable personnel (phone tree). An alternative holding location should be identified for short-term emergency movement of seriemas. The placement of portable extra-large airline kennels (as stated above), handling gloves and large capture nets near exhibits can aid in the prompt transfer of birds in emergency (and non-emergency) situations.

Emergency drills should 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 should 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 should be maintained and improvements in the procedures duly noted whenever such are identified. AZA-accredited institutions must have a communication system that can be quickly accessed in case of an emergency (AZA Accreditation Standard 11.2.4).

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 11.2.5)

AZA-accredited institutions which care for potentially dangerous animals must have appropriate safety procedures in place to prevent attacks and injuries by these animals. 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. If an animal attack occurs and injuries result from the incident, a written account

#### AZA Accreditation Standard

(11.3.6) Guardrails/barriers must be constructed in all areas where the visiting public could have contact with other than handleable animals.

#### AZA Accreditation Standard

(11.2.3) All emergency procedures must be written and provided to staff and, where appropriate, to volunteers. Appropriate emergency procedures must be readily available for reference in the event of an actual emergency. These procedures should deal with four basic types of emergencies: fire, weather/environment; injury to staff or a visitor; animal escape.

#### AZA Accreditation Standard

(11.6.2) Security personnel, whether staff of 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

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

#### AZA Accreditation Standard

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

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).

**AZA Accreditation Standard**

**(11.5.3)** Institutions maintaining potentially dangerous animals (sharks, whales, tigers, bears, etc.) 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. 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 prepared and maintained for five years from the date of the incident.

## Chapter 3. Transport

### 3.1 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 general public (AZA Accreditation Standard 1.5.11). Safe animal transport requires the use of appropriate conveyance and equipment that is in good working order. All crates for shipping seriemas by air should meet IATA recommendations (container requirement #17, IATA 2010). Shipping recommendations can also be found at [www.iata.org](http://www.iata.org).

#### 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 local, state, and federal laws must be adhered to.

Transport protocols should be developed to ensure the safe transport of seriemas between shipping and receiving institutions, and both institutions should have appropriate equipment and supplies to care for birds immediately before and after the birds are loaded onto aircraft for transport. The equipment should provide for the adequate containment, life support, comfort, temperature control, food/water, and safety of the animal(s). Sufficient diet should be shipped with the animal to allow for a gradual transition to a new diet at the receiving institution.

“Live Animal” labels with up arrows should be attached to the crate on at least three sides. As a substitute for red arrow and live animal stickers provided by the airline, red paint or pen can be used to draw arrows and to write “Live Animal” on three sides of the crate. Contact information and telephone numbers for the sending and receiving institutions should be securely attached to the crate during shipment.

Seriemas are best transported in medium-sized, commercial pet carriers (e.g., sky kennels) or wooden crates. The roof of the transport container should be padded to minimize head trauma. The floor should be covered with a non-slip material such as carpeting and straw, or wood shavings placed on top of the carpeting to absorb waste material. The sides and front of the sky kennel should be covered with a breathable fabric like burlap, which will provide the bird with some degree of cover while still allowing sufficient ventilation. Medium-sized sky kennels (69 cm x 51 cm x 48 cm [27 in. x 20 in. x 19 in.]) are appropriate for seriemas as well as a wooden container of similar size. Close confinement will help them to retain their balance and reduce struggling. It is not necessary for a seriema to be able to turn around easily within its crate. A crate that is padded on top, tall enough for the bird to stand upright, and just narrow enough to restrict a large amount of movement is recommended. Perching in the crate is not recommended.

Food and water are not needed in the crate unless the bird will be held in the crate for more than 24 hours. Birds should be well fed prior to transport, as they may not immediately eat upon their arrival at their new destination. For transport longer than 24 hours, seriemas can be offered water in a small bowl placed in the crate. The water should be removed after an hour to prevent the bird from tripping. Dead mice are appropriate food items during transport.

Shipments are preferably carried out early in the day, especially during times of extreme heat. Temperatures within the crate should remain within the range of 7–29.5 °C (45–85 °F). Seriemas should not be shipped when temperatures are below 0 °C (32 °F). Consultation with airlines is recommended prior to shipping. Upon pickup of the bird from the airport cargo area, the bird should be placed in a climate-controlled vehicle as soon as possible to minimize heat stress if temperatures are warm, or to warm the bird if temperatures are cold.

The bird should not be able to see out of the crate easily. Darkness reduces stress. However, good ventilation is also important. Seriemas should always be shipped singly in crates to eliminate aggression and injury.

Transport crates should not be opened during transport unless there is a medical emergency, or unless total journey time goes beyond 24 hours and food and water needs to be provided. Small access doors where food/water can be placed can be installed in crates so that the main door of the crate does not have to be opened. If the crate should be opened during transport, it should be opened in a secured room where the bird can be easily captured should it escape. If the crate should be opened, it is recommended that bird staff from a nearby zoo be present to assist with the procedure in the event a recapture is necessary.

When recovering from transport (or anesthesia) in a crate, it is best to make sure the bird is safe from injury and has recovered completely before release. Release should occur as soon as possible after prolonged transport. Release is similar to the manual release described below, with the direction of the door to the crate positioned to a clearing that the bird can see. Handlers may also want to consider facing the crate door towards a bush to slow the bird down. The best method will be dictated by the personality of the bird. The bird should be allowed to step out on its own accord. Once the bird has moved away from the crate, this can be removed while watching the bird for any negative reaction. Water should be immediately available (S. Hallager, personal communication).

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 in the course of transport. For seriemas, one person (usually a keeper or curator) is sufficient for transport unless individual zoo policy dictates otherwise. 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. The transport of seriemas is a fairly low risk endeavor provided all appropriate safety measures are followed.

### 3.2 Protocols

Transport protocols should be well defined and clear to all animal care staff.

**Crating animals for transport:** Protocols for successfully capturing and crating birds in preparation for transport (either on ground or between facilities) are described in Chapter 6, section 6.6. The use of operant conditioning to train birds to enter crates without the need for capture is discussed in Chapter 8, section 8.1.

**Food and water:** Food and water are not needed in the crate unless the bird will be held in the crate for more than 24 hours. Birds should be well fed prior to transport, as they may not eat immediately upon their arrival at their new destination. Wild-caught and/or parent reared birds, even those previously held in zoos, may not eat for several days after shipping. Hand-reared birds will likely eat within a day of arrival (if not sooner). Water should be immediately available once the bird has arrived at the receiving institution. For transport longer than 24 hours, seriemas can be offered water in a small bowl placed in the crate. The water should be removed after an hour to prevent the bird from tripping. Mice are appropriate food items during transport. If it is known that transport will take longer than 24 hours, transport crates should be designed to allow food and water to be provided to the bird through appropriate access ports.

**Substrate and bedding:** The floor of the transport crate should be covered with a non-slip material such as indoor/outdoor carpeting. Hay or straw should be placed on top of non-slip materials, as they do not provide enough traction when placed directly on a plywood or plastic floor. Hay and straw can be used effectively to absorb urates and feces during transport.

**Temperature, light, and sound:** Seriemas are medium sized birds, and their body heat can increase the interior temperature of crates. This is especially significant for shipping that takes place during summer months. It is recommended that shipments should be carried out early in the day during the warmer summer months, so that the birds are not subjected to extreme temperatures while in their crates waiting to be loaded onto planes or trucks. Temperatures within the crate should remain within the range of 7.2–29.4 °C (45–85 °F) to ensure the safety and comfort of the birds. Air holes in crates are necessary to provide sufficient ventilation (IATA, 2010), and these can be covered with breathable fabrics (e.g., burlap) if more darkness is required for the bird within the crate; low light conditions may help to minimize the stress associated with transport. The bird within the crate should not be able to see out of the crate easily. The shade-cloth material should not restrict ventilation within the crate.

**Animal monitoring:** Seriemas should always be shipped singly in crates. There is no requirement for animal caretakers to accompany seriemas during shipping, although some zoos have their own requirements for keepers to accompany birds on international flights. Where possible, seriemas should not be held in a crate longer than 24 hours. Transport crates should not be opened during transport unless there is a medical emergency, and only under the supervision of a veterinarian or animal caretaker at the shipping or receiving institution. Doors that slide up and down are recommended for seriema

shipping crates, as these will reduce the risk of the bird breaking free from the crate if access by a veterinarian or caretaker is needed.

**Post-transport release:** When recovering from transport (or anesthesia within a crate), it is important to make sure the bird is safe from injury and has recovered completely before it is released, although release should occur as soon as possible after prolonged transport. The release protocol should be similar to the manual release described in Chapter 6.6, with the crate door directed towards an open space within the bird's new enclosure (e.g., quarantine enclosure) that the bird can see. The bird should be allowed to step out of the transport crate on its own accord. Once the bird has moved away from the crate, this can be removed while the bird continues to be watched for any negative reactions associated with the shipping experience.

**Within-institution transportation:** For the transportation of seriemas within an institution, it is generally recommended that the bird be transported in a crate. Seriemas used in conservation and education should also be crated when moved (S. Hallager, personal communication).

## Chapter 4. Social Environment

### 4.1 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.

Wild seriemas are most often seen alone or in pairs. Groups of three or more birds are most likely parents and offspring. In zoos, a male and female can be housed together year round. More than one pair of seriemas cannot be exhibited in the same enclosure, as they are extremely territorial. Juveniles can stay with the parents until the start of the next breeding season, but should be removed if the parents show signs of re-nesting as the parents are not tolerant of the juveniles' presence. Juvenile seriemas are self-sufficient at 3–4 months, and males can breed as early as 8 months (Collins, 1998).

At 3 months, parents will start to wean the chicks by encouraging them to pick up food for themselves. By 3.5 months, chicks are nearly full-grown, although their plumage is still in juvenile form. At 4–5 months of age, chicks can be moved to their own enclosure or sent to another zoo. They may remain with their parents as long as the parents show no aggression. Offspring should be removed from the enclosure several months prior to the start of the breeding season.

Male/Male or female/female pairs have not been reported for seriemas. Males older than 6 months should not be housed together due to aggression. The effect of housing several females together is unknown, but it is presumed that aggression levels would not be expected to be as high as they would for males. Housing all-male groups of seriemas is not recommended due to the risk of aggression.

Birds used in conservation and education programs are often maintained as single individuals. Whenever possible, a bird of the opposite sex should also be kept even if just for companionship as seriemas are generally social birds (S. Hallager, personal communication).

Winter housing: Winter housing is usually smaller or more restrictive than regular housing. Thus, housing options are dependent on individual bird personalities. Aggressively dominant females and males can harm subordinate or juvenile birds especially when confined in small areas. Adult males should never be housed in the same stall together. However, juvenile males and juvenile females (less than 6 months) may be housed together depending on individual bird personalities. Keepers should rely on their knowledge of each bird's behavior when making housing arrangements.

### 4.2 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.

Seriemas can be exhibited with a wide variety of bird and mammal species, but can only be exhibited as pairs or single birds. Although it has not been intentionally attempted, two females can (in theory) live together, but should be monitored more than paired birds for signs of aggression. Seriemas are hunters, and small fledglings of any species will be consumed if the opportunity presents itself. The following tables list species of birds and mammals that have been successfully exhibited with seriemas.

Table 3. Birds that have been successfully exhibited with seriemas (S. Hallager, personal communication)

Common name	Species
Andean goose	<i>Chloephaga melanoptera</i>
Black-necked swan	<i>Cygnus melanocoryphus</i>
Boat-billed heron	<i>Cochlearius cochlearius</i>
Cinnamon teal	<i>Anas cyanoptera</i>
Common peafowl	<i>Pavo cristatus</i>
Common shelduck	<i>Tadorna tadorna</i>
Conures	<i>Aratinga sp.</i>
Crows	<i>Corvus sp.</i>
Doves	<i>Columba sp.</i>
Egyptian goose	<i>Alopochen aegyptiacus</i>
Grey-winged trumpeter	<i>Psophia crepitans</i>
Guans	<i>Penelope sp.</i>
Hyacinth macaw	<i>Anodorhynchus hyacinthinus</i>
Keel-billed toucan	<i>Ramphastos sulfuratus</i>
King vulture	<i>Sarcorhamphus papa</i>
Kookaburra	<i>Dacelo novaeguineae</i>
Paradise shelduck	<i>Tadorna variegata</i>
Red-billed hornbill	<i>Tockus erythrorhynchus</i>
Red-billed toucan	<i>Ramphastos tucanus</i>
Ringed teal	<i>Callonetta leucophrys</i>
Scarlet ibis	<i>Eudocimus ruber</i>
Storks	<i>Ciconia sp.</i>
Tawny frogmouth	<i>Podargus strigoides</i>
Thrushes	<i>Garrulax sp.</i>
Toco toucan	<i>Ramphastos toco</i>
Turacos	<i>Tauraco sp.</i>
White ibis	<i>Eudocimus albus</i>

Table 4. Mammal species that have been successfully exhibited with seriemas (S. Hallager, personal communication)

Common name	Species
Brazilian tapir	<i>Tapirus terrestris</i>
Capybara	<i>Hydrochaeris hydrochaeris</i>
Collared peccary	Pecari tajacu
Giant anteater	<i>Myrmecophaga tridactyla</i>
Guanaco	<i>Lama guanicoe</i>
Squirrel monkey	<i>Saimiri ustus</i>

Seriemas need an area where they feel secure, and where predators cannot enter. Space, complexity, and design of exhibits are just as important for mixed-species enclosures as they are for single-species enclosures. For exhibits where only seriemas are housed, areas of hiding (e.g., bushes) are recommended to allow less dominant birds to hide from dominant birds, and to allow the birds to get out of sight from visitors. For mixed species exhibits, seriemas should have access to areas that only they can reach (usually high perching). For all enclosures, areas that provide hiding from visitors are necessary.

In mixed species exhibits, seriemas should have areas in the exhibit where they feel secure, and where the other species within the exhibit cannot enter. It is critical that seriemas have areas of elevated perching where they can escape to, as well as areas of high perching for nesting.

For zoos with small enclosures, or where breeding is encouraged, it is recommended that seriemas be housed by themselves.

Groups of adult males (two or more birds 6 months or older) cannot be maintained due to the incompatibility of male seriemas with each other (S. Hallager, personal communication).

To promote breeding and encourage normal socialization, keepers should limit their interaction with seriemas to routine husbandry tasks. However, good management of seriemas should include scale training and crate training (see Chapter 8). Seriemas are popular in bird shows, so many birds are trained to exhibit behaviors such as “slamming” where prey items (often rubber snakes) are slammed against the ground. The use of seriemas in educational programs and shows can be beneficial for promoting

conservation messages about seriemas and birds in general. Curators are encouraged to consult the AZA SSP Coordinator when considering the use of a seriema in a show, as some seriemas are more genetically valuable than others, and are therefore better suited for placement in a breeding situation.

Seriemas are not aggressive to humans by nature, although they will assume a threatening pose if attempts are made to access their nest site during incubation or chick rearing. The main cause of injury to a keeper at that point will most likely come from the seriema kicking at the keeper with its sharp talons. Goggles may be worn as an added safety measure to protect the eyes. Seriemas do not bite or peck at the eyes of handlers, but their talons are extremely sharp, and great care should be exercised when handling birds to avoid punctures. Thick gloves should be worn when reaching into the nest.

Walk-through aviaries containing single birds, or pairs are acceptable, although hand-reared birds may approach visitors, and some birds may opt to sun in visitor pathways. Zoos may wish to display appropriate signage describing the behavior to alert visitors. Some breeding pairs have been exhibited in walk through aviaries successfully (S. Branch, personal communication, 2011) although these birds should be carefully observed during the breeding season for aggression towards visitors. Birds that show aggression towards visitors should be removed from walk-through enclosures to prevent injury to visitors. Birds that opt to sun on walkways should be given alternative areas in which to sun, and/or the preferred sunning area blocked so that the bird cannot sunbathe in the location.

### 4.3 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.

**Male-female introductions:** Seriemas should not be introduced to new mates during the breeding season. Males can be overly amorous in their efforts to breed, causing undue stress upon a newly introduced female. During the initial introduction period, part of the yard should be fenced off to separate the birds. Prolonged introductions are generally not necessary, as males and females are usually quite compatible. Aggression is rare and may indicate the presence of two males instead of a male and a female. Aggression between seriemas consists of fighting, kicking, and chasing. The dominant bird may try and copulate with the subordinate bird. Seriemas are not reliably sexed using visual means so DNA sexing is usually the preferred method. However, seriemas have been mis-sexed using DNA sexing, and laparoscopy may be needed to positively confirm the sex if two birds are not proving compatible.

**Female-female introductions:** Social groupings of females have not been attempted. More research is needed to determine if this is a viable alternative to housing seriemas.

## Chapter 5. Nutrition

### 5.1 Nutritional Requirements

A formal nutrition program is recommended to meet the nutritional and behavioral needs of all red-legged seriemas (AZA Accreditation Standard 2.6.2). Diets should be developed using the recommendations of nutritionists, the Nutrition Scientific Advisory Group (NAG) feeding guidelines: ([http://www.nagonline.net/Feeding%20Guidelines/feeding\\_guidelines.htm](http://www.nagonline.net/Feeding%20Guidelines/feeding_guidelines.htm)), 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.

From the limited data available, it appears that although seriemas are omnivorous, their dietary habits may be primarily insectivorous/carnivorous, as hypothesized by Redford and Peters (1986). The gastrointestinal tract of the seriema was noted to have a large gizzard, but no visible crop (Boyle, 1917). This type of gastrointestinal tract is seen with insectivores, herbivores, and omnivores. Carnivores tend to have a more developed proventriculus and thin-walled, weak gizzard (Klasing, 1998). With this in mind, seriemas may be best adapted for an omnivorous/insectivorous feeding strategy. Suggested target nutrient levels are presented in Table 5. These concentrations are based on those for poultry, dogs, and cats, which are similar to the seriema's omnivorous/insectivorous eating habits. Recommended diet proportions are listed in Table 6.

#### AZA Accreditation Standard

(2.6.2) A formal nutrition program is recommended to meet the behavioral and nutritional needs of all species and specimens within the collection.

Table 5. Proposed nutrient guidelines for seriemas on a dry matter basis. \*

Nutrient	Proposed Nutrient Guidelines 2008
Protein, %	16.5–30.0**
Fat, %	10-30***
Crude Fiber, %	-
Calcium, %	0.66–2.0**
Phosphorus, %	0.33–1.0**
Calcium:Phosphorus Ratio	1:1–2:1
Potassium, %	0.44–0.72
Sodium, %	0.13–0.18
Magnesium, %	0.04–0.06
Copper, mg/kg	5.5–12.4
Iron, mg/kg	55–80
Zinc, mg/kg	55–96
Manganese, mg/kg	66–72
Selenium, mg/kg	0.2–0.4
Iodine, mg/kg	0.33–0.44
Vitamin A, IU/kg	170–7500
Vitamin D3, IU/kg	22–550
Vitamin E, IU/kg	11.0–38
Thiamin, mg/kg	2.2–5.6
Riboflavin, mg/kg	2.75–10.5
Pyridoxine, mg/kg	3.3–5.0
Vitamin B12, mg/kg	0.003–0.035
Biotin, mg/kg	0.11–0.25
Choline, mg/kg	990–2250
Folacin, mg/kg	0.8–1.1
Niacin, mg/kg	15–42.5
Pantothenic Acid, mg/kg	10.5–17.6

\* Target values based on NRC for poultry, 1994 and NRC dogs and cats, 2006

\*\* Values at high end of range for breeding only.

\*\*\* This is not a requirement for fat, but represents the range of fat in prey items and zoo diet items commonly fed. This range is thought to be appropriate, will supply essential fatty acids and will promote fat-soluble vitamin absorption.

Table 6. Seriema recommended diet proportion guidelines (as fed basis)

Item	Minimum, % of Diet	Maximum, % of Diet
Vertebrate Prey	0	25
Invertebrate Prey*	10	30
Nutritionally Complete Feeds**	40	75
Produce (greens, vegetables)	5	20

\*Insects should be gut loaded or supplemented with a high calcium diet prior to feeding to compensate for the inverse Ca:P ratio in insects. To help explain further gut-loading please refer to Coslik et. al., 2009 and Latney et.al., 2009.

\*\* Nutritionally complete feeds are those designed to meet specific recommended nutrient levels. These may be dry feeds, meat-based diets or a combination thereof.

Most adult red-legged seriemas average between 2.5–3 kg (5.5–6.6 lb), with females weighing less than males. Weights of juvenile birds have not been reported. Quantifiable data is not available on energy requirements/feeding based on body size.

No life stage research is available for this species (see Chapter 10.2); however, offering diets that meet the target nutrient range should meet nutritional needs through all life stages. Feeding diets with a nutrient composition at the upper end of the range should meet the needs of growing and reproductive birds. It is important to consider the nutrients provided by the overall diet as consumed. The analysis of many “maintenance” diets may already meet or exceed the target nutrients for growth and reproduction. Consequently, as long as appropriate foods and sufficient quantity to support growth and reproduction are available, diets may not need to be altered in composition for life stages. More research can be done on the target serum and nutrient values seriemas by collecting blood samples from clinically “normal” seriemas (see Chapter 10.2).

In the wild, parents were observed selecting small reptiles to feed to their chicks (Redford & Peters, 1986). If chicks consume a diet that meets the target ranges expressed in Table 5, no changes are needed. However, adjustments may be needed to the size of items offered to allow the parents to select appropriate size items for the chicks. Some institutions crush bones and remove pelts of vertebrate prey to reduce the possibility of impaction. All insects should be gut-loaded and/or supplemented with a high calcium diet to provide appropriate calcium levels in these food items.

Seriemas swallow small prey items whole and head first. Larger animals are held between their sharp claws, and torn apart. In the wild, killing their prey may involve beating the animal on the ground, or throwing it against a hard surface such as a rock. Seriemas in zoos will often kill a live rodent by beating it against the ground, but will not do this with dead prey items. Provided that the current diet is meeting target nutrient levels, dietary changes for breeding birds is not necessary (see Table 5). Excess calcium can be toxic with the effect of reducing the absorption of phosphorus, magnesium, manganese, and zinc. Some institutions begin supplementation to bring the calcium levels up to 2% after the third clutch of eggs has been laid to prevent depletion of the hen’s calcium stores. The calcium:phosphorus ratio should be 1:1 to 2:1 for the best tolerance of high calcium levels (Klasing, 1998).

Seasonal weight changes have not been reported for red-legged seriemas, as they have in some other Gruiformes. Diet composition and amounts can be fairly consistent throughout the year, although food consumption may increase during the colder months due to increased caloric needs. While nutritional requirements for seriemas do not change seasonally, in northern latitudes, where temperatures regularly fall below 0 °C (32 °F), birds should be offered more food during colder months. Such increases may be based on observed increased food consumption. Seriema activity level remains fairly stable year round, and food amounts are likely to remain stable throughout the year as well. Seasonal changes will influence food changes more than other factors. As long as a diet meeting target nutrient levels is consumed, no alterations should be necessary.

Decreased food consumption and listlessness is a main sign of stress in seriemas. Decreased food consumption should be monitored very closely, as it may not only be caused by stressors, but also by impaction or illness. If a bird does not eat after 2 days, a veterinarian should be notified. Encouraging birds to eat with favorite food items, or food items not normally part of the diet, may be needed after consultation with veterinarians. Birds that are not provided with appropriate levels of nutrients may show poor feather conditions, low weights, and lack of reproductive activity.

#### AZA Accreditation Standard

**(2.6.3)** Animal diets must be of a quality and quantity suitable for each animal's nutritional and psychological needs. Diet formulations and records of analysis of appropriate feed items should be maintained and may be examined by the Visiting Committee. Animal food, especially seafood products, should be purchased from reliable sources that are sustainable and/or well managed.

## 5.2 Diets

The formulation, preparation, and delivery of all diets must be of a quality and quantity suitable to meet the animal's psychological and behavioral needs (AZA Accreditation Standard 2.6.3). Food should be purchased from reliable, sustainable, and well-managed sources. The nutritional analysis of the food should be regularly tested and recorded.

Tables 7 and 8 list sample maintenance diets and selected nutrient composition of these diets. The sample diets meet or exceed the proposed target nutrient levels for the nutrient selected. More investigation is needed to acquire complete nutrient data for all ingredients as well as diets for different life stages.

Table 7. Sample daily diet compositions and amounts provided to a single, adult seriema by AZA institutions

Institution	Diet item	Amount
A	AM: Nebraska Feline diet	75 g
	AM: Hopper mice	2
	AM: Adult crickets	10
	PM: Nebraska Feline diet	75 g
	PM: Hopper mouse	1
	PM: Adult crickets	10
B	Natural Balance Carnivore	150 g
	Zeigler Bird of Paradise pellet	160 g
	Mazuri Exotic Gamebird Maintenance	160 g
	Fuzzy mice	10
	Mealworms	3 g
C	Nebraska Bird of Prey diet	0.62 g
	Diamond Adult dog kibble, soaked	0.16 g
	Fruits and vegetables	108.86 g
	Mazuri Exotic Gamebird Maintenance	90.72 g
	Weds/Fri: Mice or small rats	2
D	Shur-gain Plus weight dog kibble, soaked	30 g
	Millken meat feline diet	75 g
	Mazuri softbill diet M512	15 g
	Sun/Tues/Thurs: Hard boiled egg	½
	Mon: Crickets	4
	Weds/Sat: Mealworms	4

Table 8. Nutrient composition of sample diets compared to proposed target nutrient levels

Nutrient	Target nutrient levels	Zoo A	Zoo B	Zoo C	Zoo D
Protein, %	16.5–30.0	51.04	21.92	30.5	40.7
Fat, %	10-30	31.3	8.10	13	13.5
Vitamin A, IU/kg	170–7500	6900	16530	12600	11000
Vitamin D3, IU/kg	22–550	910	~5580	2200	500
Vitamin E, IU/kg	11.0–38	77	106	87	173
Calcium, %	0.66–2.0	1.16	2.34	1.01	1.11
Phosphorus, %	0.33–1.0	1	1.09	0.44	0.85

The potential for spoilage is based on the type/number of micro-organisms present on the meat, in the storage and preparation areas, or transferred by the handler or by “pest” species with access to the seriema enclosures (Frazier & Westhoff, 1988). Meat and whole prey items should be held at appropriate temperatures during periods of thawing, preparation, and storage, and meat items should not remain at temperatures capable of promoting excessive microbial growth for excessive periods of time once fed to the animals (Crissey et al., 2001). Uneaten meat should be disposed of according to local or state requirements.

**Feeding schedules:** In zoos, seriemas should be fed twice per day, but additional feedings should be considered to allow for necessary husbandry management and to promote behavioral opportunities for foraging and feeding throughout the day. As long as birds have adequate time to consume the diet, the period of access to diet can range from several hours to all day. Minimizing the presence of pest species, and their consumption of the diet, may shorten the periods of time when the diet is offered to the birds,

unless pest-proof feeders are provided. The presence of pests should always be considered when determining the period of time the seriemas have access to the diet.

**Species-appropriate feeding and foraging:** Seriemas are curious, intelligent animals. Table 9 lists a range of food items that can promote foraging behavior. Most of the items can be scattered around enclosures to encourage foraging/searching and object manipulation behaviors. It is important to note that different seriemas will respond differently to different items, and observations on preferred items that promote species-appropriate behaviors should be recorded for each individual. Approval from area veterinarians, managers, and nutritionists should be obtained if the following feeding approaches are considered.

Table 9. List of enrichment initiatives to promote foraging behaviors (S. Hallager, personal communication)

Food Item	Description
Live Insects	Seriemas respond well to live insects, such as super worms, crickets, regular mealworms, and waxworms. Birds that are off their food for various medical reasons will often start eating again if live insects are offered.
Live prey	If available, live mice are often relished by seriemas and promote natural feeding behaviors. The birds are also good at capturing and consuming small snakes, lizards, toads, and small birds that make their way into their pens.

Food preparation must be performed in accordance with all relevant federal, state, or local regulations (AZA Accreditation Standard 2.6.1). Meat processed on site must be 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 the taxa or species specified. 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.

#### AZA Accreditation Standard

(2.6.1) Animal food preparations must meet all local, state/provincial, and federal regulations.

If browse plants are used within the animal's diet or for enrichment, all plants must be identified and assessed for safety. The responsibility for approval of plants and oversight of the program should be assigned to at least one qualified individual (AZA Accreditation Standard 2.6.4). 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 red-legged seriema. If animals have access to plants in and around their exhibits, there should be a staff member responsible for ensuring that toxic plants are not available.

#### AZA Accreditation Standard

(2.6.4) The institution should assign at least one person to oversee appropriate browse material for the collection.

Seriemas are typically not browsers nor do they exhibit herbivorous behaviors. However, plant material should be offered during the nesting season to aid in nest construction. This should consist of small pencil diameter sized sticks and grass stems of species approved by the curator, nutritionist or veterinarian.

### 5.3 Nutritional Evaluations

**Health issues:** One of the most common signs of stress in seriemas is decreased food consumption. Decreased food consumption should be monitored very closely, as it may not only be caused by environmental stressors, but also by impaction or illness. If a bird does not eat for more than 48 hours ~~days~~ a veterinarian should be notified immediately. Encouraging birds to eat by providing favorite food items—or food items not normally part of the diet—may be needed after consultation with area veterinarians.

For hand-reared chicks, it is strongly recommended that individual food items be weighed when diets are prepared, so that a more accurate determination of nutrient content can be made when assessing the diet during the early growth period of the chicks (S. Hallager, personal communication).

Huchzermeyer (1998) provides a scale (1–10) for scoring body condition in ostrich and Bailey (2008) provides descriptive text for assessing weight, hydration, cere, nares, beak, oropharynx, eyes, ears,

pectoral muscle condition, neck, saccus oralis, body, coelomic space, vent, thoracic and pelvic limbs, feathers, and skin in bustards. A grading system for overall body condition that takes into account the entire body of the bird should be developed for seriemas to assist in proper husbandry (see Chapter 10.2).

## Chapter 6. Veterinary Care

### 6.1 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 practical, a consulting/part-time veterinarian must be under contract to make at least twice monthly inspections of the animal collection and to any emergencies (AZA Accreditation Standard 2.1.1). Veterinary coverage must also be available at all times so that any indications of disease, injury, or stress may be responded to in a timely manner (AZA Accreditation Standard 2.1.2). The AZA Accreditation Standards recommend that AZA-accredited institutions adopt the guidelines for medical programs developed by the American Association of Zoo Veterinarians (AAZV) that were updated in 2009 ([http://aazv.affiniscape.com/associations/6442/files/veterinary\\_standards\\_2009\\_final.docx](http://aazv.affiniscape.com/associations/6442/files/veterinary_standards_2009_final.docx)).

Animal keeper staff should make daily assessments of activity, attitude, appetite, fecal output, and new concerns for each seriema in their care. Routine veterinary health assessments should be performed for each individual as recommended by the veterinarian where the seriema is housed, or when otherwise indicated by signs of illness. These assessments may include: physical examination, blood collection for a complete blood cell count, chemistry panel and plasma/serum banking, radiographs, fecal parasite screen, and fecal culture. No unique equipment or technologies are necessary for performing routine health assessments in seriemas. Additionally, regular body weights should be obtained to enable more sensitive monitoring of possible disease.

Protocols for the use and security of drugs used for veterinary purposes must be formally written and available to 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.

Since there is no Veterinary Advisor to the AZA Seriema SSP, the AZA Gruiformes TAG recommends that veterinarians at each institution be involved in formulating their own institutional protocols for the storage and use of drugs that could be used in the care and management of seriemas. Given the wide variation in veterinary practices, veterinary staff, and equipment available to veterinarians at different institutions, no red-legged seriema-specific recommendations can be made. Institutional veterinarians will also be needed to determine which drugs and medications are important for the treatment of seriemas and individual animals. Recommendations for drugs used in parasite control, vaccinations, and anesthesia are provided in the sections within this chapter. Other commonly used drugs include: Anthelmintics (Fenbendazole, ivermectin, pyrantel); analgesics (NSAIDs and steroids); and antibiotics (cephalosporins, Beta-lactams, fluroquinolones, aminoglycosides) (S. Johnson, personal communication). Common pharmaceuticals used for seriemas include those for preventive care (vaccines) and therapeutic use (antibiotics). These drugs should be securely stored in a locked pharmacy to which only the veterinary staff and selected animal keeper staff have access. It should be a dry, cool, dark place (e.g., locked cabinets in the hospital). Additionally all controlled drugs need to be kept in compliance with DEA guidelines.

Any of the drugs kept in a veterinary pharmacy may pose a toxicology hazard when used inappropriately. Some antibiotics have been shown to have immunosuppressive effects on some humans, humans are also more sensitive than certain animal taxa to some of the opioids used and depending on the potency of the opioids, they can severely suppress the respiratory system; other drugs may trigger anaphylactic reactions in sensitive individuals. It is not possible to know ahead of time which animals may develop an allergic reaction.

#### AZA Accreditation Standard

(2.1.1) A full-time staff veterinarian is recommended. However, the Commission realizes that in some cases such is not practical. In those cases, a consulting/part-time veterinarian must be under contract to make at least twice monthly inspections of the animal collection and respond as soon as possible to any emergencies. The Commission also recognizes that certain collections, because of their size and/or nature, may require different considerations in veterinary care.

#### 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 animal collection 24 hours a day, 7 days a week.

Animal recordkeeping is an important element of animal care and ensures that information about individual animals and their treatment is always available. A designated staff member should be responsible for maintaining an animal record keeping system and for conveying relevant laws and regulations to the animal care staff (AZA Accreditation Standard 1.4.6). Recordkeeping must be accurate and documented on a daily basis (AZA Accreditation Standard 1.4.7). Complete and up-to-date animal records must be retained in a fireproof container within the institution (AZA Accreditation Standard 1.4.5) as well as be duplicated and stored at a separate location (AZA Accreditation Standard 1.4.4).

All pertinent health information for seriemas should be recorded in ARKS and MedARKS as required by institutional animal recordkeeping protocols. When the new Zoological Information Management System (ZIMS) becomes widely available, it is recommended that institutions make full use of this resource. ZIMS provides the opportunity to record key animal behavior information along with health records, including data collected on aggressive or abnormal behavior, and responses to enrichment initiatives, conspecifics, or heterospecifics.

Records for the entire life of each bird should be kept within institutional records, and should include information on:

- Diet: Dietary components, amount of food fed, and method of feeding
- Housing: Dates when birds are moved indoors, outdoors, or to new enclosures
- Egg production and reproduction: Yearly onset of egg laying, male display, copulation observations, egg fertility, egg measurements
- Weight of adult birds: Weights can be taken from adult birds using the scale training method described in Chapter 8.1.
- Behavior: Observations of aggressive behavior and animals involved
- Medical problems: As required by institutional veterinary programs
- Cause of death

Additionally, any other information that animal caretakers at an institution consider pertinent, and which may improve husbandry standards for the species, should be included within each individual's medical record. No specific permits, titles, or other formal documentation is commonly associated with this taxon.

Seriemas are generally hardy, long-lived birds with few medical complications arising during their life. Adult mortality is often the outcome of complications from puncture wounds, compound fractures of legs or wings, or from aggression caused when individuals are housed with incompatible exhibit mates.

**Hospitalization:** Hospitalized seriemas benefit from surroundings that are free from noise and disturbance. Hand-reared birds are not as stress prone, but even they should not be housed in areas where sudden noise or frequent disturbances are a possibility. Sudden and unexpected noises can cause birds to hit the ceiling of their enclosure or run into walls, especially in unfamiliar surroundings. Hospital stays should be as short as possible and birds returned to their pens as soon as possible. Favored food items should be offered to encourage eating. The presence of a familiar keeper may help some birds adjust to their temporary quarters.

**Parasite control:** Minimally, seriemas should be tested for the normal range of avian parasites at least once a year, and dewormed if necessary. The frequency of these examinations depends on the incidence of parasitism in the geographic region and the animals' likelihood of exposure. Animals also should be screened for parasites before shipment and during quarantine. Fecal testing should include a direct smear examination and a fecal flotation, as well as sedimentation techniques if possible. Deworming medicine can be placed into a favored food item (small mouse).

#### AZA Accreditation Standard

(1.4.6) A staff member must be designated as being responsible for the institution's animal record-keeping system. That person must be charged with establishing and maintaining the institution's animal records, as well as with keeping all animal care staff members apprised of relevant laws and regulations regarding the institution's animal collection.

#### AZA Accreditation Standard

(1.4.7) Animal records must be kept current, and data must be logged daily.

#### AZA Accreditation Standard

(1.4.5) At least one set of the institution's historical animal records must be stored and protected. Those records should include permits, titles, declaration forms, and other pertinent information.

#### AZA Accreditation Standard

(1.4.4) Animal records, whether in electronic or paper form, including health records, must be duplicated and stored in a separate location.

**Routine examinations:** Seriemas should be inspected daily by keepers to check for overall health and vigor. Birds that appear fluffed, depressed, or non-responsive to favored food items should be immediately checked by a veterinarian. The AZA Gruiformes TAG does not currently provide a recommendation for routine physicals for seriemas. The frequency of physicals should be determined by each holding facility.

**Vaccinations:** The AZA Gruiformes TAG does not currently recommend vaccinations for seriemas, and the decision to vaccinate (e.g. against West Nile Virus) should be determined by each holding facility.

**Parents and Neonates:** Young seriemas are not cold tolerant. If a pair has nested too early in the season, resulting in chicks that would be born when temperatures are below 15.6 °C (60 °F), keepers should remove the eggs, which will encourage the pair to re-cycle later in the season when temperatures will be warmer.

Nesting pairs should be given privacy. All unnecessary yard work should cease once eggs are laid until chicks are at least 2 weeks old. Parents that are overly disturbed by yard work in the pen and in adjacent yards during the incubation period, and when chicks are small, have either ejected the eggs from the nest or killed the chicks. Seriemas often raise only one chick, although rearing two chicks is possible. Often, one chick is simply found missing. Some pairs have been observed consuming the dead chick. Inexperienced parents may not adequately feed chicks, and supplemental feedings by keepers may then be necessary.

Daily inspection of the nest should reveal dry, alert chicks that hold their heads up and appear vigorous. Weak and non-responsive chicks are candidates for supplemental feedings or hand-rearing, if the facility chooses this option. If supplemental feedings are required, they may be performed right in the nest by providing the chick a small pinkie or fuzzy 4–6 times per day. Leaving the chick with the parents is the best way to reduce imprinting, and parents generally tolerate the supplemental feedings well. If disturbance proves too great to the nesting pair, the compromised chick should be removed for hand-rearing to allow the parents to concentrate on the healthy chick.

**Geriatrics:** Seriemas are generally long-lived birds, with life spans of 25 years not uncommon in zoos; some birds have lived to be 30 years (Hallager, 2010). Some older birds may benefit from a daily supplement of nutraceuticals such as cosequin (a patented combination of glucosamine, purified chondroitin sulfate, and manganese ascorbate). Cosequin® is considered an adjunctive therapy for osteoarthritis in many species. Older birds may not be able to jump as high as younger birds, and may require perching that is placed lower to the ground. Older birds may also be less tolerant of cold temperatures, requiring indoor housing at lower temperatures than younger birds (S. Hallager, personal communication).

## 6.2 Identification Methods

Ensuring that red-legged seriemas are identifiable through various means increases the ability to care for individuals more effectively. Animals must be identifiable and have corresponding ID numbers whenever practical, or a means for accurately maintaining animal records must be identified if individual identifications are not practical (AZA Accreditation Standard 1.4.3).

A basic requirement for successful management of seriemas is individual identification. Techniques used in seriemas include leg bands and transponders. Leg bands should be placed above the hock. Leg bands may be placed at any age, but in young chicks, they should be changed as the bird grows. Leg bands aid in quick identification of the bird; transponders are a permanent marking system. Colored, metal, or plastic leg bands [placed above the hock] are recommended for those zoos with multiple birds to aid in fast, easy identification. Zoos should follow the standard practice of banding males on the right leg and females on the left leg. Transponders can be injected by syringe under the skin near the shoulder area, where they can be detected and read by an electronic scanner. Transponders can be placed after 3 weeks of age.

AZA member institutions must inventory their red-legged seriema population at least annually and document all red-legged seriema acquisitions and dispositions (AZA Accreditation Standard 1.4.1).

### AZA Accreditation Standard

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

Transaction forms help document that potential recipients or providers of the animals should adhere to the AZA Code of Professional Ethics, the AZA Acquisition/Disposition Policy (see Appendix B), and all relevant AZA and member policies, procedures and guidelines. In addition, transaction forms must insist on compliance with the applicable laws and regulations of local, state, federal and international authorities. All AZA-accredited institutions must abide by the AZA Acquisition and Disposition policy (Appendix B) and the long-term welfare of animals should be considered in all acquisition and disposition decisions. All species 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).

The AZA Red-Legged Seriema SSP member institutions are obligated to follow the AZA Animal Acquisition and Disposition Policy that was approved by the Board of Directors in 2000. Institutional identification (ISIS number) should be assigned on the day of hatch and reported to the AZA Red-Legged Seriema SSP Coordinator and Studbook Keeper.

#### AZA Accreditation Standard

(1.4.1) An animal inventory must be compiled at least once a year and include data regarding acquisitions and dispositions in the animal collection.

#### AZA Accreditation Standard

(1.4.2) All species owned by the institution must be listed on the inventory, including those animals on loan to and from the institution. In both cases, notations should be made on the inventory.

### 6.3 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. Diagnostic tests should be planned in communication between the veterinarian at the sending and at the receiving institution; additionally the state requirements should be taken into account. There are no pre-shipment testing requirements specific to seriemas, so any tests performed are at the discretion of the sending and receiving institution. Minimally, seriemas should be examined for ecto- and endoparasites and treated appropriately. Serum can be frozen (banked) for future reference. All procedures and results should be recorded in the animal's medical record. For a listing of hematological reference values for seriemas see Appendix F.

**Pre-shipment recordkeeping:** A hard copy and/or disc of the complete medical records for seriemas should be sent to the receiving institution and reviewed (prior to shipment), including results from all prior diagnostic testing. Specific areas of interest that should be specifically documented include:

- Vaccination status; housing history
- Reproductive history
- Individual history (e.g., conspecific relationships, aggression, etc.)
- Chronic medical problems
- Current diet
- Location and number of permanent identification (e.g., leg band, and/or microchip)

### 6.4 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 (AZA Accreditation Standard 2.7.1). All quarantine, hospital, and isolation areas should be in compliance with AZA standards/guidelines (AZA Accreditation Standard 2.7.3; Appendix C). All quarantine procedures should be supervised by a veterinarian, formally written and available to 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

#### 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.

#### AZA Accreditation Standard

(2.7.3) Quarantine, hospital, and isolation areas should be in compliance with standards or guidelines adopted by the AZA.

(AALAS) accredited institution may be applicable. Local, state, or federal regulations that are more stringent than AZA Standards and recommendation have precedence.

Quarantine facilities should consist of at least a 3.6 m x 3.6 m x 2.5 m (12 ft by 12 ft x 8 ft) fully enclosed stall (with covered outside access if possible), with a soft substrate in one corner (e.g., hay) and perching. The stall should be cleaned daily by a dedicated staff member who will ideally not be interacting with other birds throughout the day. Staff should change clothes (i.e., scrubs and booties) before and after they enter the quarantine area. Additionally, there should be a disinfectant footbath to minimize carrying potential disease into or out of the quarantine area.

Upon arrival at the new destination, the bird should be let out of the crate as soon as possible. Water should be immediately available. When newly arrived birds are placed in quarantine after shipping, they may initially refuse to eat; privacy and a continuous abundance of live insects and baby mice are recommended. Wild caught birds, even those previously held in zoos, may not eat for several days. Hand-reared birds will likely eat within a day of arrival (if not sooner). Quarantine stalls should be set up with a few stumps and perches so that birds can get off the ground and perch slightly elevated. The floor of the stall can be left bare to facilitate cleaning. Birds arriving together may be quarantined together, but this is dependent upon the quarantine protocol of the receiving institution.

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. 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.

Seriemas entering a collection should undergo quarantine in an isolated facility designed to allow handling of the animals and proper cleaning and sanitizing of the enclosures. The shipping crate should be cleaned and disinfected before it leaves the quarantine area, and the crate's contents disposed of appropriately.

During quarantine, birds should have their permanent ID checked, receive diagnostic testing, be examined for ecto- and endoparasites, and be treated for any parasites appropriately. Before release from quarantine, the animal should receive physical and laboratory examinations, including radiographs (if deemed necessary by the attending veterinarian), hematology, and clinical chemistry. Blood should be collected, analyzed, and the sera banked in either a -70 °C (-94 °F) freezer or a frost-free -20 °C (-4 °F) freezer for retrospective evaluation. 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.

The AZA Gruiformes TAG recommends that all institutions follow AZA quarantine guidelines (Appendix C), and that veterinarians should develop appropriate quarantine testing protocols for their seriema. The recommended quarantine period for seriema is 30 days (unless otherwise directed by the staff veterinarian). If additional mammals, birds, reptiles, amphibians, or fish of the same order are introduced into their corresponding quarantine areas, the minimum quarantine period must begin over again.

The AZA Gruiformes TAG does not currently have a recommendation for standard quarantine exams for seriemas. Minimally, seriemas should be tested for the normal range of avian parasites and blood should be taken for WBC and CBC. Birds can also be anesthetized for x-rays, in order to check for the presence of foreign bodies if the attending veterinarian feels this is important.

A tuberculin testing and surveillance program must be established for animal care staff as appropriate to protect both the health staff and animals (AZA Accreditation Standard 11.1.3). Depending on the disease and history of the animals, testing

#### AZA Accreditation Standard

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

#### AZA Accreditation Standard

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

#### AZA Accreditation Standard

(11.1.3) A tuberculin testing and surveillance program must be established for appropriate staff in order to ensure the health of both the employees and the animal collection.

protocols for animals may vary from an initial quarantine test to yearly repetitions of diagnostic tests as determined by the veterinarian. Animals should be permanently identified by their natural markings or, if necessary, marked when anesthetized or restrained (e.g., tattoo). Release from quarantine should be contingent upon normal results from diagnostic testing and two negative fecal tests that are spaced a minimum of two weeks apart. Medical records for each animal should be accurately maintained and easily available during the quarantine period.

The birds should be evaluated for endoparasites and ectoparasites and treated accordingly. Endoparasites can be treated with pyrantel, ivermectin, or fenbendazole. Ectoparasites can be treated with dilute pyrethrin spray topically or systemic ivermectin. Blood should be taken for a complete blood count (CBC) and chemistry panel. Blood should also be collected, analyzed, and then both heparinized plasma and serum banking should be performed, when feasible, and stored in a -80 °C (-112 °F) freezer or a frost-free -20 °C (-4 °F) freezer for possible future analysis and retrospective evaluation. Preliminary work to assess nutritional status and disease exposure is underway, and banked blood samples could help supplement these projects. Hematological reference values for mature seriema are summarized in Appendix F, which should be consulted and compared with values taken during quarantine assessments.

When there is an indication, viral testing may also be appropriate (see Chapter 6.7). Vaccinations should be updated as appropriate during quarantine, and if the vaccination history is not known, the animal should be treated as immunologically naive and given the appropriate series of vaccinations. There are currently no recommended seriema-specific vaccination protocols or regulations to follow. Birds can also be anesthetized for radiographs in order to establish a “normal” radiograph baseline, but also to check for any abnormalities, including the presence of a foreign body that the birds may have ingested in their previous environment. While birds are anesthetized for their physical assessment, they should also be permanently identified (see Chapter 6.2), if this has not been done before.

Hand-reared or zoo-born seriemas used in shows are generally more tolerant of quarantine conditions than wild-caught birds, and are less prone to developing social or behavioral problems during the quarantine period. The most commonly observed behavioral problems (e.g., pacing, low appetite) arise when birds are responding to perceived stressors in the environment. Common stressors include loud noises, sudden noises, excessive vibrations, and separation from exhibit mates. Hand-reared birds may benefit from increased visits by keepers, installation of a mirror within the quarantine enclosure, an increase in favored food items, and quiet surroundings. Wild-caught birds may benefit from a reduction in keeper presence and environments as free from noise and disruption as possible (S. Hallager, personal communication).

If a seriema should die in quarantine, a necropsy should be performed and the subsequent disposal of the body must be done in accordance with any local or federal laws (AZA Accreditation Standard 2.5.1). 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 6.7).

#### AZA Accreditation Standard

(2.5.1) Deceased animals should be necropsied to determine the cause of death. Disposal after necropsy must be done in accordance with local/federal laws.

## 6.5 Preventive Medicine

AZA-accredited institutions should have an extensive veterinary program that must emphasize disease prevention (AZA Accreditation Standard 2.4.1). 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/6442/files/zoo\\_aquarium\\_vet\\_med\\_guidelines.pdf](http://www.aazv.org/associations/6442/files/zoo_aquarium_vet_med_guidelines.pdf)).

#### AZA Accreditation Standard

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

**Parasite screening:** Seriemas should be screened biannually for parasites and de-wormed if necessary.

**Vaccinations:** Vaccination policies for seriema depend upon individual institution policies that are generally based on a risk/benefit analysis. This analysis usually involves the prevalence of the specific disease, subsequent threat of exposure, efficacy and safety of a vaccine, and the risk to the bird.

**Blood sampling:** Blood can be taken from seriema when they are appropriately restrained. Blood sampling plays an important role in assessing the overall health of individual animals. If blood samples

are taken from the leg of birds when the temperature is below 4 °C (40 °F), it is recommended that birds first be housed in a warm area for a minimum of 30 minutes to allow their legs to warm up. The increased temperature will allow veins to dilate and will facilitate blood collection. Blood samples may also be collected from the jugular or ulnar veins, but this requires a greater degree of skill and expertise in safely restraining the bird and locating the vessels. Appendix F lists normal seriema blood values. Additional hematological reference values for mature seriema can be found in Appendix F and should be consulted to compare them with the current health status of birds as part of each institution's preventative veterinary health program.

**Medical management of neonates:** Male and female seriemas have a similar death rate during the first year of life with a Qx of 0.30 for males (N=120) and 0.31 for females (N=114).

Information on some of the main issues encountered in the veterinary management of parent- and hand-reared chicks in zoos is provided below.

- **Dehydration:** Newly hatched chicks (especially hand-reared birds) may be prone to dehydration for the first 2–3 days of life. Hand-reared chicks can be properly hydrated by dipping food items in water immediately prior to feeding. Subcutaneous fluids may need to be administered if oral hydration is not sufficient.
- **Weighing and handling:** Hand-reared chicks should be weighed daily. In the first 2 days, chicks may lose 10% of their body weight, but should gain 2–18% per day from then onwards. If chicks show continued weight loss, then supplemental feedings or medical treatment may be needed. If necessary for social housing considerations, earlier determination of sex can be determined by taking a small amount of blood for DNA sexing.
- **Hypothermia:** For the first couple of months after hatching, seriema chicks are sensitive to the cold. Gout associated with hypothermia in juvenile seriemas has been reported.
- **Care should be taken to provide sufficient heating,** especially to debilitated chicks that are hospitalized. Managers should follow the advice of the referring aviculturist or veterinarian for temperature guidelines. Under sub-optimal temperature conditions, seriema chicks and even juvenile birds can suffer from hypothermia. Hypothermic chicks may not feed until their body temperature has returned to normal again.

**Medical management of geriatrics:** The greatest recorded longevity of a seriema in zoos to date is a wild caught female who has been managed in a zoo for 32 years (Hallager, 2010). Older birds may need to be housed inside more often than younger birds during inclement weather, and may need to be supplied with supplemental heat earlier and later in the season. Assessments of the behavioral response of older birds to changing temperatures should be used to evaluate the needs of the animals. When catching or herding older birds, they should be moved slowly, as some may experience arthritic symptoms in their legs. Older birds may benefit from a daily supplement of nutraceuticals such as Cosequin® (a patented combination of glucosamine, purified chondroitin sulfate, and manganese ascorbate). Cosequin® is considered an adjunctive therapy for osteoarthritis in many species, but its use should be based on recommendations made by veterinarians.

Some older birds may also be partially or totally deaf. If this is the case, animal caretakers should ensure that these birds are not startled during daily management by maintaining visual contact with the birds when working within or near to the enclosure. Geriatric females may need to be isolated from breeding males during the breeding season, as overly aggressive males may harass them in an attempt to copulate.

**Medical management of molt:** The molt cycle of red-legged seriemas has not been studied and research is required to determine the effect it has, if any, on the management of birds. However, feathers do tend to be shed mainly in the spring (before breeding season) and fall (after breeding season). Information on molt patterns should be recorded with the animal's medical records, and a summary provided to the AZA Red-Legged Seriema SSP Coordinator on an annual basis.

**Zoonosis:** As stated in the Chapter 6.4, 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. Keepers

**AZA Accreditation Standard**

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

should be designated to care for only healthy resident animals, however if they need to care for both quarantined and resident animals of the same class, they should care for the resident animals before caring for the quarantined 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 the healthy resident animals should only be used with those animals.

The AZA Gruiformes TAG recommends that veterinarians at each institution develop their own specific zoonotic disease and disinfection protocols for animal caretakers, animal management equipment, and enrichment initiatives provided in quarantine and hospital facilities. Effective measures that help prevent the transmission of diseases between animals include (as designated by veterinarians at each institution):

- Washing hands between and after handling animals, feces and urates, other bodily fluids or secretions, or animal diets
- Wearing gloves, goggles, and a mask when cleaning animal enclosures
- 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 initiative is used again with the birds

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).

Also stated in Chapter 6.4, a tuberculin testing and surveillance program must be established for 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. To prevent specific disease transmission, vaccinations should be updated as appropriate for the species. Animal care staff working with seriemas do not need to be tested for TB.

#### 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 collection from exposure to infectious agents.

#### AZA Accreditation Standard

**(11.1.3)** A tuberculin testing and surveillance program must be established for appropriate staff in order to ensure the health of both the employees and the animal collection.

## 6.6 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 in good working order and available to authorized and trained animal care staff at all times (AZA Accreditation Standard 2.3.1).

Seriemas are easily caught using a large net with a tight mesh weave that does not allow the legs to push through the mesh, or herded into a small shed and captured there. Care should be taken when extracting the bird from the net so that the sharp talon of the bird’s inner toe does not pierce the handler. Once in hand, the greatest threat to the handler is the razor-sharp nails, and handlers are strongly advised to immediately secure the feet by grasping the legs and restricting movement of the legs. The bird can then be held much like a crane [hold the wings and body with one arm and the legs with the other arm]. Another restraint method is to hold the wings and body of the seriema with one arm, and the legs with the other. The legs should be grasped just above the hocks, and one finger should be placed between the hocks to prevent the legs from abrading one another. Care should be taken to ensure that the tarsi cannot contact the seriema’s neck, or the person holding the bird, in order to prevent the bird from ripping its neck open.

If the seriema’s legs need to be folded (not recommended), the tarsi can be gently forced around, but if the bird locks its hocks rigidly, the legs should not be forced to fold. Instead, steady pressure can be maintained on the tarsi until the bird allows its legs to be folded. Once the feet are secure, the handler should immediately pull the seriema’s body against his/her own being careful not to put too much pressure on the sternum. Wrapping the body of the bird in a blanket or towel will aid in restraint. A second person should hold the head. The bill of the seriema is not particularly dangerous—seriemas do not use

#### AZA Accreditation Standard

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

their bill as a weapon—although they will hold it open in an attempt to appear more ferocious. The head should be restrained by encircling the bird’s upper neck with one hand, without restricting the airway; the nares cannot be covered. A hood can be placed on the bird if necessary to induce calmness.

When holding a seriema with folded legs, the bird’s weight should be supported with the arm holding its body. The legs of a seriema should not be kept folded for more than 5 minutes. These precautions will help prevent slipped tendons, capture myopathy, and leg fractures. It is also important to reduce those conditions that increase the likelihood of capture myopathy occurring, such as extended pursuit times, transport, excessive handling, and over-exertion during times of high heat. When releasing a seriema, its legs should be allowed to touch the ground before the body or wings are released.

Show birds may crate themselves using a recall and some are also tame enough to be approached and picked up calmly, using the restraining method described above.

**Flight restraint:** The main methods of flight restraint for seriemas are routine feather clipping and the use of covered enclosures. Pinioning is not recommended for this species. Each method poses some risk to the birds. Feather clipping requires that birds be captured and restrained on a regular basis, and can lead to physical injuries and trauma. Allowing fully winged birds to be housed in completely covered aviaries may also result in injuries if birds attempt to fly within the restricted space, and impact the containment barriers of the enclosure.

Regular feather clipping is the recommended procedure for rendering non-pinioned birds flightless. Educating handlers on the proper techniques of catching adult birds is necessary to minimize trauma to the birds during feather clipping. Additional research on the welfare of flight restricted seriema is still needed in order to develop the most effective animal care recommendations for housing these animals in zoos (see Chapter 10.2) (S. Hallager, personal communication).

**Immobilization:** It is recommended that institution-specific anesthesia protocols be developed for seriemas by veterinarians at each institution, and that effective protocols should be shared with the AZA Gruiformes TAG for wider dissemination.

**Release/recovery:** When recovering a bird from anesthesia, it will be necessary to restrain the bird for a longer period of time than after periods of manual restraint. Birds recovering from anesthesia should be manually restrained using firm, constant pressure, and the body and legs of the animals should be carefully controlled to restrict any sudden outbursts of energy. Covering the eyes of the bird with a hood or towel will help in reducing this reaction (ensuring that the nares are not covered). Once the animal has fully recovered from anesthesia, it can be released, ensuring that the bird has regained sufficient control of its legs to be stable. Seriemas need a sufficient glide distance when jumping off perches otherwise they can get microfractures in the long bones of the legs (S. Johnson, personal communication).

## 6.7 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 has the ability to isolate these animals in a hospital setting for treatment if necessary. Red-legged seriema keepers should be trained for meeting the animal’s dietary, husbandry, and enrichment needs, as well as in restraint techniques, and recognizing behavioral indicators animals may display if their health becomes compromised (AZA Accreditation Standard 2.4.2). Protocols should be established for reporting these observations to the veterinary department. Red-legged seriema hospital facilities should have x-ray equipment or access to x-ray 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.

### AZA Accreditation Standard

(2.4.2) Keepers should be trained to recognize abnormal behavior and clinical symptoms 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, keepers should not evaluate illnesses nor prescribe treatment.

### AZA Accreditation Standard

(2.3.2) Hospital facilities should have x-ray equipment or have access to x-ray services.

**Trauma:** Seriemas are generally hardy birds, but individuals can sustain life-threatening trauma such as puncture wounds, or compound fractures of legs or wings. The complications resulting from these injuries can be made worse if individuals are housed with incompatible exhibit-mates.

In response to stressors in the environment, seriema will run into or pace against the perimeter fencing or walls of their enclosures in attempts to flee from the stressor (or potential stressor). Excessive pacing may also lead to compaction of the soil, which can be a contributing factor to lameness and pododermatitis in these birds.

Ingestion of certain non-food items by seriema can lead to perforation or impaction of the gastrointestinal tract, and can be a significant source of morbidity and mortality for seriemas. Clinical signs of possible gastrointestinal trauma associated with the ingestion of foreign objects can include decreased appetite, poor pectoral muscle condition, weight loss, palpable abscesses in the abdominal wall, and hematological indicators associated with an inflammatory response. Foreign bodies that penetrate the ventriculus of birds once ingested can lead to decreased muscular contractions and poor digestion of food (Lumeij, 1994). The use of rigid endoscopy to remove foreign bodies from the ventriculus is generally not possible with seriema, given the length of the esophagus, and so ventriculostomy or proventriculostomy are the best techniques to use.

**Viral diseases:** No viral diseases have been reported for seriemas.

**Bacterial diseases:** Bacterial pododermatitis (gram negative) has resulted from birds jumping down on a foreign body, stick or thorn.

**Fungal diseases:** They are prone to aspergillosis

**Protozoal diseases:** Seriemas are likely susceptible to the same protozoal diseases as cranes or other gruiformes (e.g., giardia, avian nematodes, etc.).

**Parasites:** Seriemas are likely susceptible to common avian ecto- and endoparasites.

**Metabolic disorders:** No metabolic disorders have been reported for seriemas.

**Musculoskeletal disorders:** Musculoskeletal disorders can affect the health and development of any long legged bird and seriemas are no exception. Assessment of chick growth rate, body weight changes, and food intake, as well as performing routine physical examinations, is important to detect musculoskeletal disorders early on; early detection increases the likelihood of successful treatment (Naldo et al., 2000).

**Hereditary issues:** No known hereditary diseases or disorders have been reported in seriemas.

**Hospitalization:** Seriemas that have to be hospitalized benefit from surroundings that are free from noise and disturbance. While hand-reared or zoo born birds are not as stress prone, they should not be housed in areas where sudden noise or frequent disturbances are a possibility. Sudden and unexpected noises have the potential to lead to injury and death to birds in unfamiliar surroundings.

During hospitalization, hand-reared birds may benefit from increased visits by keepers, the installation of a mirror within their hospital enclosure, an increase in favored food items, and quiet surroundings. The response of the animal to a mirror should be monitored to ensure that it is not seen as an additional stressor. Wild-caught birds may benefit from a reduction in keeper presence, and environments as free from noise and disruption as possible.

Hospitalization facilities for seriema do not need to be elaborate or expensive. Small holding pens (2 m x 2 m x 2.5 m [6 ft x 6 ft x 8 ft]) are suitable for housing seriema. Perching at differing heights should be provided. Hospital stays should be as short as possible, and the birds returned to their normal enclosures as soon as possible. While housed in hospital facilities, favored food items should be offered to encourage eating. The presence of a familiar keeper may also help some birds adjust to their temporary quarters.

AZA-accredited institutions must have a clear process for identifying and addressing red-legged seriema animal welfare concerns within the institution (AZA Accreditation Standard 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

#### AZA Accreditation Standard

(1.5.8) The institution must develop a clear process for identifying and addressing animal welfare concerns within the institution.

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.

Given the wide variety of zoos that house seriema, the AZA Gruiformes TAG cannot provide specific recommendations for the best approaches to take to communicate animal welfare issues effectively within every institution. All animal caretakers that work with seriemas should be aware of institutional protocols in place for them to identify, communicate, and hopefully address potential animal welfare issues that are associated with the care and management of these animals.

Seriemas can be very good at hiding an illness. For this reason, animal caretakers should be especially vigilant, and immediately communicate their concerns to a curator and/or veterinarian, as required by institutional protocols. Animal caretakers should report any signs of illness, especially a reduced appetite, as soon as possible. Seriemas usually have a very good appetite, and any deviation from this behavior is unusual and should be reported within 48 hours. Any lameness issues observed should also be reported and monitored, as seriema can develop serious foot and leg problems; if these musculoskeletal health issues are detected early, more serious physical health complications can possibly be avoided. Familiarity with individual birds is essential when caring for this species effectively.

AZA-accredited zoos and aquariums provide superior daily care and husbandry routines, high quality diets, and regular veterinary care, to support red-legged seriema 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 red-legged seriema both in their care and in the wild. As stated in Chapter 6.4, necropsies should be conducted on deceased red-legged seriema 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). 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. Many institutions utilize private labs, 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 Red-legged Seriema SSP Program approved active research requests that could be filled from a necropsy.

#### AZA Accreditation Standard

(2.5.1) Deceased animals should be necropsied to determine the cause of death. Disposal after necropsy must be done in accordance with local/federal laws.

**Euthanasia and necropsy:** As care givers for the animals residing in our zoos, it is vital that we provide the best care possible for them until the time their health deteriorates to a point where euthanasia is the most humane treatment, or the animal dies on its own.

Common causes of seriema death (2010 AZA Red-legged Seriema Studbook):

- Generalized / Toxicity: 2
- Generalized / Trauma: 15
- Generalized / Unknown (after necropsy): 11
- Integumentary / Trauma: 1
- Integumentary / Circulatory, secondary: 1
- Musculoskeletal / Bacterial: 2
- Musculoskeletal / Toxicity: 1
- Musculoskeletal / Trauma: 5
- Musculoskeletal / Mechanical Abnormality: 2
- Cardiovascular / Mechanical Abnormality: 1
- Digestive / Trauma: 3
- Digestive / Metabolism: 2
- Digestive / Nutrition: 1
- Urinary / Toxicity: 2
- Urinary / Trauma: 1
- Nervous / Trauma: 1
- Reproductive / Trauma: 1
- Reproductive / Mechanical Abnormality: 1
- No Necropsy Planned / Unknown (after necropsy): 66

The AZA Gruiformes TAG does not currently have any specific recommended protocols for seriema euthanasia within zoos. Each institution housing seriema should have a euthanasia protocol in place, developed by the veterinary team, in case euthanasia becomes necessary in a particular situation. The AZA Animal Welfare Committee also encourages each institution to develop a process to determine when elective euthanasia might be appropriate from a quality of life perspective, taking into account behavioral, health, social, nutritional, and animal caretaker perspectives. Examples of approaches used by institutions are available from the AZA Animal Welfare Committee. Seriema display normal avian anatomy, which should be reflected in histopathological results.

## Chapter 7. Reproduction

### 7.1 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.

Seriemas are monogamous. In the wild, the breeding season corresponds to the rainy months of February to July in northeastern Brazil, September to January in central Brazil, and November to December in Argentina. In zoos, breeding can occur at any time of the year, especially in southern latitudes. In the United States, breeding typically commences in early April (Figure 1). The mean age of breeding in US zoos is 5 years for both sexes. Females have bred at 21 years, males at 24 years (Hallager, 2010). Males as young as 8 months have bred (Collins, 1998), and females have bred at 1 year (Hallager, 2010).

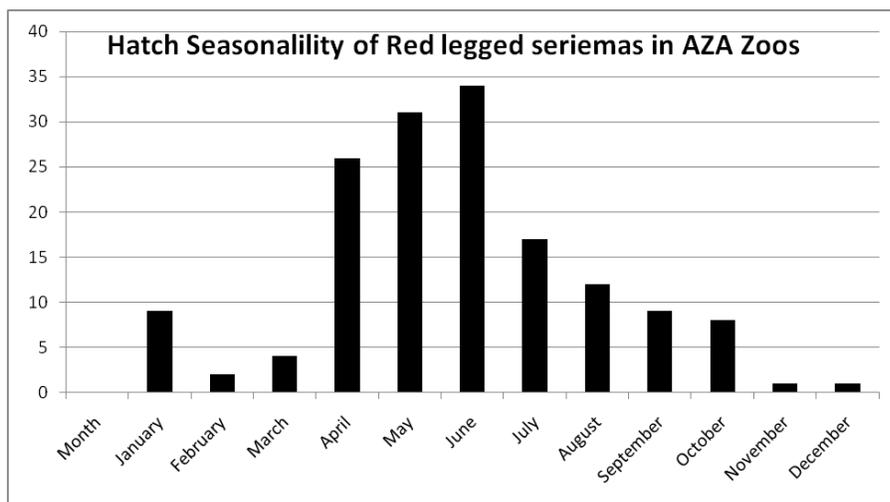


Figure 1. Graph showing seasonal differences in the number of clutches produced by red-legged seriemas in US zoos (Hallager, 2010)

The male initiates the breeding season by showing off his flight feathers to the female, stretching them to one side. The display is also accompanied by strutting in front of the female, with head pointed down and crest raised. The male often presents food (from the normal diet) to the female. Both of the birds call, thereby strengthening the bond between them as well as defining the territory of the pair (Redford & Peters, 1986). Copulation occurs on the ground (de Almeida, 1994).

Caretakers should provide a nest platform for seriemas that measures approximately 4 ft x 4 ft [1.2 m x 1.2 m] in diameter. The nest platform should be situated near existing bushes or small trees which will provide shade, privacy, and opportunities for chicks to leave the nest at the appropriate time. In the wild, seriemas nest 1–5 m (3–16 ft) off the ground (del Hoyo, 1996), so elevated nest platforms as high as the exhibit allows (while simultaneously allowing sufficient head room for a bird standing in a nest) should be provided for them to meet their desire to roost and nest at this level. A small mesh wire base (1 in x 1 in; 0.02 m x 0.02m) is adequate for the base and will provide a good foundation for the parents to build their nest as well as allow water to drain through.

Commonly, 2–3 white, slightly spotted eggs are laid (del Hoyo, 1996). The average clutch size of birds in US zoos is 1.5 (Hallager, 2010). Incubation is carried out by both sexes. Pairs sometimes eject the first clutch of the season, and some pairs are notorious for repeatedly ejecting eggs. It may often take several years for the pair to stop this behavior or even re-pairing of the birds to correct this problem.

Following a 27–28 day incubation period, the eggs hatch. The chicks are covered in long light brown feathers and are fed by both parents; they initially weigh about 40–60 g (1.4–2 oz). Their development is very fast. At birth, the eyes are open, but the chicks cannot stand. At 1 week, pinfeathers begin to emerge and chicks attempt to stand. As chicks approach 10 days, they are able to stand, and by 14 days may even leave the nest, although most chicks remain in the nest for 3–4 weeks. Even at this age, they can

produce a call similar to the adult vocalization, although it is very faint and not as complex as the adult vocalization. Chicks are brooded by both their parents for the first 3 weeks of life. After 3 weeks of age, the juvenile birds roost in trees at night.

Because they are unable to fly at this age, they should have perching positioned so that they can reach high roost sites at night. This is best accomplished by placing perches at various heights throughout the exhibit so that the young birds can jump from perch to perch to reach the desired height. At 3 months, the parents will start to wean their chicks by encouraging them to pick up food for themselves. By 3.5 months, chicks are nearly full-grown, although their plumage is still in juvenile form. At 4–5 months of age, chicks can be moved to their own enclosure or sent to other zoos. If chicks are left with their parents, keepers should watch to be sure the parents do not show aggression towards the chicks. Chicks should be removed from their parents several months before the start of the next breeding season (S. Hallager, personal communication).

Hormonal monitoring of the reproductive status of seriemas has not been researched. This would prove a useful tool for managers to increase their understanding of seriema breeding and general reproductive physiology of the species (see Chapter 10.2).

Pairs of breeding birds should be kept together throughout the year. Protocols for introduction can be found in section 4.3.

Nesting pairs should be given privacy as soon as eggs are laid. All unnecessary yard work should cease until chicks are at least 2 weeks old. Parents that are disturbed by normal yard maintenance during the incubation period, and when chicks are small, have either ejected the eggs from the nest or killed the chicks.

The AZA Red-Legged Seriema SSP recommends hand-rearing primarily for birds that are destined for show purposes. For future breeding success, chicks should be parent-reared whenever possible. However, sometimes hand-rearing is required when one chick is weak or not receiving proper care from its parents. Future breeding is not necessarily compromised when chicks are hand-reared and should be attempted particularly from pairs that have been recommended to breed by the SSP Coordinator. The following protocol is recommended:

**Hand-rearing protocol:** Once the chick is hatched, the umbilicus should be cleaned with Betadine (100%) solution. If the chick has had a prolonged hatch, and/or required assistance to hatch, 2cc of half-strength Lactated Ringer's and 2.5% dextrose solution should be provided subcutaneously. After being allowed to rest for several hours in the hatcher, the chick should be moved to an Animal Intensive Care Unit with recommended dimensions of deep 69.85 cm x 33 cm x 35.5 cm (27.5 in. x 13 in. x 14 in.) at 36.1 °C (97 °F). The floor of the brooder should be carpeted, and a feather duster hung in one corner to simulate the mother. A small mirror affixed in the brooder can also act as a visual stimulus for the chick. The floor should be lined with towels or carpet that allow for cleaning. See Appendix G for additional information on recommended hand-rearing protocols.

**Assisted rearing:** Seriema parents are normally very attentive, but sometimes chicks need some extra help if they are not growing at the proper rate, or if they appear weak. Younger siblings can get pushed out or dominated by older chicks, and may require supplemental feedings from keepers. The parents usually accept these extra feedings, but keepers should be mindful of the sharp talons of adult seriemas when providing supplemental feedings to chicks. Occasionally, if two or more chicks are hatched, one chick may die or be killed by the parent (likely the weakest chick), and then be fed to the remaining chick. Seriemas in the wild are reported to sometimes only raise one chick (del Hoyo, 1996). More documentation on the physiology of chicks is needed to better understand the developmental necessities of these early life stages (see Chapter 10.2).

In the wild, both sexes assist in building a nest, which is usually located in a tree 1–5 m (3–16 ft) off the ground. Construction generally takes one month. The nest is assembled of twigs and branches, and is lined with mud and leaves. It is usually placed so that the birds can jump up to it in 1–2 leaps. In zoos, once a pair shows signs of nesting (carrying sticks), keepers should provide extra nesting material such as twigs, dried grasses, and small branches. Although nest building is performed by both sexes, the male typically does more of the construction. Opportunities for the birds to construct nests 1–5 m (3–16 ft) off the ground are recommended. Pairs will often use the same nest site from year to year (S. Hallager, personal communication).

**Hormonal tracking:** Hormonal monitoring of a male or female's reproductive status is possible using fecal hormonal metabolite testing. If this is deemed necessary, the AZA Red-Legged Seriema SSP Coordinator should be contacted for further information. To date, this has not been done with seriemas but is an area that warrants future investigation (see Section 10.2).

## 7.2 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 has been achieved with a variety, but not all, taxa and should be investigated further.

Artificial insemination has not been performed with seriemas in AZA-accredited institutions, although it remains a feasible approach to take in future reproductive efforts if deemed necessary. Due to the complexity and inherent risk of transporting a medium sized bird like a seriema between institutions for breeding attempts, AI stands as a beneficial means to improve the mean kinship of seriemas in zoos. It is likely that AI techniques will be most applicable to hand-reared birds, as the nervous nature and inapproachability of wild-caught birds and/or parent-reared birds will make sperm collection and insemination procedures very challenging.

The process of extracting sperm and inseminating females does require handling, which can increase the risk of injuries to both animals and their human caretakers. For optimal results, ensure that the time of insemination coincides with the female's most fertile period, and this is best determined by running hormonal assays. The expense and the need for facilities and equipment to perform this type of hormonal analysis is a limiting factor for the use of AI techniques in zoos with seriema.

Houbara bustard semen collection techniques have been successful in the United Arab Emirates (Jalme & van Heezik, 1996), and might provide a useful foundation for future research if the technique is applied to seriema. Jalme et al. (1994) also provide some specific information on the results of Houbara bustard (*Chlamydotis undulata macqueenii* and *Chlamydotis undulata undulata*) artificial insemination approaches at the National Wildlife Research Center (Taif), including:

- Mean volume of ejaculate was recorded as 0.08 ml
- Mean sperm concentration was  $350 \times 10^6$  spermatozoa  $\text{ml}^{-1}$
- Mean number of spermatozoa per ejaculate was approximately  $20 \times 10^6$
- Mean quantity of spermatozoa produced per week by fully sexually mature Houbara bustards was  $165 \times 10^6$
- The intra-individual variation in the number of spermatozoa per ejaculate was attributed to seasonal variation.
- There was a statistically significant positive correlation between egg fertility and the quantity of sperm inseminated.
- The median sperm storage duration for females was 10 days, with a maximum storage duration of 22 days.
- The duration of sperm storage was related to the number of spermatozoa inseminated
- The greatest proportion of fertile eggs was obtained when  $>10^6$  spermatozoa were inseminated between 3–6 days before laying.
- Embryo mortality was found to increase when inseminations were performed more than 10 days before laying.

Further research is needed to determine if these research findings are applicable to seriema, and to develop appropriate protocols for the use of artificial insemination with this species (see Chapter 10.2).

General information on semen collection, artificial insemination, and cryopreservation of semen in non-domestic birds species is provided by Gee et al. (2004).

### 7.3 Egg-laying

It is extremely important to understand the physiological and behavioral changes that occur throughout a seriema's breeding cycle and incubation period.

**Egg laying:** The female may exhibit specific behavioral changes indicating that egg laying will occur within 2–4 days. She may be slightly off feed and will probably spend an increased amount of time in the nest as will the male. The pair may become more protective of the nest site. Eggs are most often laid overnight or in the early morning hours. Female red-legged seriemas typically begin laying in May in northern zones of the United States, and as early as February in southern zones. Seriema eggs generally hatch on the 27th or 28th day of incubation. The average clutch size for red-legged seriemas is 1.5 eggs (Hallager, 2010). Most females lay 1–2 eggs per clutch although three eggs are possible. The shortest inter-clutch interval for red-legged seriemas in North American zoos has been documented as 18 days (Hallager, 2010). Seriema eggs average approximately, 61.9 mm (2.4 in.) wide, and 45.6 mm (1.8 in.) long (n=18). Fresh egg weights from one zoo average 74.6 g (2.6 oz). Not all pairs incubate their eggs after laying. Unattended eggs should be placed in an incubator as soon as they are found to minimize breakage. Keepers should always be aware that egg binding can happen in any species and seriemas are no exception. Although no report of egg binding in seriemas has been documented, keepers should watch for signs of depression, inappetence, labored breathing, fluffed feathers and self-isolation.

**Incubation and hatching:** Disturbance near the nest should be avoided. Particularly with first-time parents, it is important to monitor the chick's vigor and determine whether parents are feeding successfully. Remote closed-circuit television monitoring is useful for this. If possible and without undue disturbance to the parents, chicks may be examined and weighed daily for the first few days. Once chicks have hatched, they should be left with their parents for 24 hours to allow normal imprinting and bonding; a quick medical assessment may be performed after 24 hours have passed, so that chicks can be examined, weighed and a determination made as to whether appropriate yolk-sac reabsorption is occurring. The chick should be returned to parents as quickly as possible (S. Hallager, personal communication).

If eggs have been artificially incubated while the female sits on dummy eggs (see Chapter 7.5 for additional information on artificial incubation), the eggs should be returned to the brooding pair at internal pip if the chick is to be parent-reared. The expected pip-to-hatch time is estimated at no more than 24 hours. No assistance should be provided to hatching chicks until at least 24 hours following external pipping, or if the chick appears to be weak. If the chick has not hatched after 24 hours, radiography, endoscopy, and oviductomy can be performed to determine the status of the embryo. Following assisted hatches, chicks may require supportive care in the form of subcutaneous fluids, vitamin injections, and antibiotics.

**Artificial Incubation:** The following protocols should be followed if seriema eggs are artificially incubated.

**Incubator preparation:** Incubators should be sterilized after they have been checked over for proper operation, and when egg laying is near. All of the working parts of the incubator should be checked before the season begins. It is recommended that the machines be run for several weeks prior to egg season. This will insure that the turners and thermostat controls are all functioning properly, and that fan belts and motors are in good working order, before eggs are put in them. Once it is determined that the machines are in good running order, they can be left running. Temperature and turning cycles should be continually monitored during this time. Temperatures should be checked 4–5 times daily and recorded on data sheets.

**Collection of eggs:** Prior to collecting eggs for the incubator, a container heated to approximately 35 °C (95 °F) for transporting the eggs from the nest box to the incubator should be prepared. The container should be filled with a sterile mix of finch seed or foam to prevent the eggs from moving. A pre-heated portable brooder can also be used. Two individuals should be present to pull eggs. Some pairs can be aggressive at nest sites, and one person will need to hold the birds off while the other removes the egg. This process can be facilitated by bringing food items into the enclosure, and enticing the birds to leave

the nest box voluntarily. The second person can also assist with gates and doors as the egg is transported to the incubation facility. The eggs should only be handled with exam gloves.

Examining and preparing eggs for incubation: Once the eggs are in the incubation facility, they should be closely examined. Any excess dirt/debris or fecal material should be lightly brushed off with a paper towel. After the debris is brushed off the surface of the egg, the egg should be checked for cracks, thin spots, and any possible abnormalities inside the egg. This is accomplished by looking closely at the surface of the egg with the naked eye, and by candling. Any cracks or serious thin spots should be repaired using white glue such as Elmer's. Paraffin can also be used. Once the egg has been examined and repaired, it should also be measured with calipers and weighed. If the egg is non-incubated and is considered fresh, the first day of incubation should be considered day zero. If the egg has had incubation within the first 24 hours, it should be considered day one, etc. A weight-loss table should be set up, showing daily weights based on the initial weight taken with the goal of achieving a 12–13% weight loss over the entire incubation period.

Artificial incubation: Eggs should be placed in the incubator horizontally. The automatic turners should be set to turn every 2 hours with an incubation temperature of 37.2 °C (99.0 °F) and a relative humidity of 55–65%. Staff should check incubators routinely three times a day to record temperature and to ensure that the turner is working properly, as well as other incubation functions. Record sheets to record parameters, egg-tray positions, and any problems that might be noted, should be available near the machines.

Weighing and candling: Eggs should be weighed and candled on a regular basis—at least weekly. Within the first 5 days of being laid, fertility can be determined. By late term, the frequency of candling should increase to cover the critical time of the air cell drop and the chick's progression toward entering the air cell. If these activities seem to be falling behind relative to incubation, and it is noted that there seems to be a lack of activity during candling, it is suggested that the eggs be radiographed to determine if the chick is malpositioned. Based on the results of the radiographs, plans can be made to intervene in the hatching of the chick, if necessary. Weighing the eggs can be performed on a more regular basis to keep eggs on track for attaining the desired weight loss by pip. Humidity can be adjusted accordingly to speed up or slow down weight loss to attain the 12–13% weight loss. Weighing and candling should be done with care.

Pipping and hatching: Once it has been determined that the chick is pushing on the air cell, the egg should be checked frequently. Once the chick has pipped the shell, its pip weight should be taken, and it should be removed from the incubator and taken to a hatcher. The type of hatcher may vary. The temperature should remain at 37.2 °C (99.0 °F) but relative humidity increased to 70–75%. If the egg is to be returned to the parents, it may be returned at internal or external pip. Eggs hatch after 27–28 days of incubation.

## 7.4 Hatching Facilities

As parturition approaches, animal care staff should ensure that the dam is comfortable in the area where the birth will take place, and that this area is “chick-proofed.”

Cross-fostering and shared rearing techniques are usually not suitable for seriemas. If the egg has been artificially incubated, and the parents are provided with a dummy egg, the dummy can be replaced by the real egg at internal or external pip (S. Hallager, personal communication).

Red-legged seriema chicks typically fledge at 3–4 weeks. After 3 weeks of age, the juvenile birds roost in trees at night. Because they are unable to fly at this age, they should have perching positioned so that they can reach high roost sites at night. This is best accomplished by placing perches at various heights throughout the exhibit so that the young birds can jump from perch to perch to reach the desired height. In the wild, they would follow their parents, gradually learning foraging strategies. In zoos, it is best to allow fledglings to remain with parents for at least 3 months post-fledging to allow the juvenile to develop skills needed for adult life. At three months, the parents will start to wean their chicks by encouraging them to pick up food for themselves. By 3.5 months, chicks are nearly full-grown, although their plumage is still in juvenile form. At 4–5 months of age, chicks can be moved to their own enclosure or sent to other zoos. If chicks are left with their parents, keepers should watch to be sure the parents do not show aggression towards the chicks. Chicks should be removed from their parents several months before the start of the next breeding season (S. Hallager, personal communication).

## 7.5 Assisted Rearing

Although eggs may successfully hatch, there are times when parents 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 are able to assist with the rearing of these offspring if necessary.

- On the first day after being laid, eggs should be taken from the incubating parents for weighing and measuring. During this procedure, the egg taken should be replaced with a dummy egg warmed to 37.5 °C (99.5 °F). Once the egg assessment has been completed, the egg should be returned to the pair and the dummy egg removed. Note that some pairs of seriemas may not tolerate this interference and pairs often immediately reject dummy eggs. The keepers' knowledge of the pairs incubation behavior including any past egg tossing behaviors should determine if the eggs are checked on day 1, or delayed until day 7 or not even checked at all.
- On day 7, the egg(s) (or first egg laid if there are two) should be removed for the remainder of the incubation period, and replaced with a warmed dummy egg. The removed egg should be reweighed and candled, and placed in an artificial incubator (e.g., Grumbach) at 37.2 °C (99.0 °F) and 55–65% relative humidity.
- The target weight loss for seriema eggs is 12–13%, and the humidity in the incubator should be adjusted to result in this weight loss. Eggs should be turned every two hours. Humidity should be increased to 70–80% once candling shows that the air cell within the egg begins to drop down or at internal pip.
- At internal pip, the egg should be placed back under the pair for hatching. Assistance with hatching is not recommended for at least 24 hours after external pipping. Once hatched, the chick should be left to imprint on the parents for the first 24 hours, where this is possible. After this time, the chick can be removed briefly so that it can be examined, weighed, and yolk-sac absorption confirmed, before being returned. A betadine solution should be applied to the umbilici of chicks when they are first handled.

**Artificial incubation:** The following table (Table 10) provides a summary of the artificial incubation protocols for seriema eggs used at an AZA-accredited institution. While the incubator used at this facility has been successful, other models may be appropriate as well.

Table 10. Artificial incubation protocol for red-legged seriema eggs. (J. Barkowski, personal communication)

Incubator	Grumbach incubator
Temperature	37.2 °C (99.0 °F)
Relative humidity	64.5%
Egg turning	Every 2 hours
Egg cleaning	No
Egg weight loss	12.8–13.6%
Moved to hatchery	External pip

When seriema eggs are artificially incubated, an average weight loss of 12–13% should be expected. If artificial incubation is performed, delayed incubation of seriema eggs is generally not recommended. Delayed incubation of Houbara bustard (*Chlamydotis undulata*) eggs (a species related to seriemas), where the eggs were stored for a period of time before being transferred to incubators, resulted in a 19% lower hatchability rate, with higher mortality recorded between 3–5 days of development (Jalme & Van Heezik, 1996). Seriema eggs should be placed in an incubator as soon as they are discovered.

If artificially incubated seriema chicks do not hatch within established pipping intervals, or seem to be weak, then it is possible to perform radiography, endoscopy, and oviductomy to determine the status of the embryo. Assisted hatching techniques can be successful, but survival of chicks is lower if they are used (see Bailey & Anderson, 2000 for details on this process in bustard eggs).

**Hand-rearing:** Hand-rearing should be considered, and is strongly recommended, for any situation where seriema enclosures are not predator-proof. Seriema chicks are vulnerable to predation by bird and mammal species that commonly occur in and around zoos in the United States. Hand-rearing should also be considered when parents do not show normal chick rearing behaviors (e.g., feeding and brooding the chicks). Hand-reared seriemas have become viable breeding birds.

**Hand-rearing protocol:** Hatching occurs on the 27th or 28th day of incubation. After hatching, the chick's umbilicus should be cleaned with Betadine (100%) solution, and the chick should be weighed. If the chick is clinically dehydrated or has had difficulty hatching, 2cc of half-strength Lactated Ringer's and 2.5% dextrose solution should be provided subcutaneously. After the initial assessment, the chick should be allowed to rest for several hours in the hatcher, before being moved to a brooder. Brooders that are 69.9 cm x 33 cm x 35.5 cm (27.5 in. x 13 in. x 14 in.) deep and that are kept at 36.1 °C (97 °F) have been successfully used to hand-rear chicks. The floor of the brooder should be carpeted, and a feather duster hung in one corner to simulate the parent. A small mirror affixed in the brooder can also act as a visual stimulus for the chick. Raising hand-reared chicks with a sibling reduces the likelihood of imprinting.

Chicks housed alone may benefit from a mirror, which acts as a calming agent, and serves to reduce the degree of imprinting that occurs. Typically, chicks reared alone have the highest degree of imprinting on their caretakers (e.g., approaching animal caretakers, readily accepting food from them) and for birds destined for show, this will be a desirable trait. Placing the chicks in visual contact with adult seriemas may also reduce human imprinting to some degree. However, this may negatively influence the behavior of the breeding pair, and should only be attempted at the end of the breeding season.

Cross-fostering and shared-rearing techniques have not been used with seriemas in zoos in the United States, but further investigation into these approaches might be useful to determine if they are applicable to this species. For cross-fostering to be successful, the timing needs to be appropriate for the animals involved.

As hand-reared seriema chicks grow, they should be exercised following each feeding session and as often as possible throughout the day. This will minimize musculoskeletal health problems such as slipped tendons. Access to larger, more complex enclosures should be provided as the chicks continue to develop. Containment for hand-reared chicks should follow recommendations made in Chapter 2, section 2.2. To minimize injuries, chicks should not be housed in enclosures with barriers and obstacles that the birds can impact or trip over. Whenever hand-reared chicks are introduced to a new enclosure, a familiar keeper should acquaint them to the new space immediately after releasing them by walking around with the birds and showing them the resources available within the enclosure (e.g., plants, fences, walls, dishes, etc.) (S. Hallager, personal communication). Complete day-to-day hand-rearing protocols for seriema chicks are summarized in Appendix G.

## 7.6 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.

When breeding is not recommended, eggs should be pulled as soon as they are laid, discarded, and replaced with dummy eggs. The pair should be allowed to sit on the nest until they desert it. Eggs that are pulled should always be replaced with dummies in order to stop the female from laying excessive eggs, and becoming calcium depleted. Seriemas are notorious for ejecting their eggs from nests. Dummy eggs constructed from wood or plaster that are successful under most other species, are often rejected by seriemas and kicked out of the nest. The best substitute is to blow out a real egg (if available), and fill it with sand or kitty litter, sealing the hole with plaster of Paris.

The American Veterinary Medical Association (AVMA) states that the neural tube of avian embryos has developed sufficiently for pain perception by 50% gestation, and so any bird embryos that have reached this stage or beyond should be euthanized using methods appropriate for hatched birds (AVMA, 2013). Since incubation is 27–28 days in seriemas, if the eggs are to be terminated, incubation should cease by day 13—preferably sooner.

## Chapter 8. Behavior Management

### 8.1 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 that evokes an innate, often reflexive, response (US). 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. The routine management of all seriemas should involve training birds to step on a scale, enter a shed for times when routine housing or exams are necessary, and crate training.

- **Scale training:** To avoid excessive handling, a small scale can be used to monitor weights of birds on a routine basis. The scale should be positioned in an area where the birds feel comfortable. If the scale is installed permanently, it should be located near a dry area where the scale indicator can be located. Indoor/outdoor carpet can be placed over the scale in order to hide the bright silver color of the scale, and provide the birds with good footing when they step on the scale. The process of scale training can begin by placing mealworms or some other favored food item on the scale to encourage the birds to step onto it. Once the birds feel comfortable stepping onto the scale, routine weighing can begin. Seriemas should maintain the same body weight year round. Seasonal weight fluctuations have not been reported. Routine weighing of birds is the best way to monitor the overall health of the bird. Any change in weight should be noted and reported.
- **Crate training:** Birds can be trained to enter a crate to retrieve a favored food item. This is advantageous for times when birds should be transported, as it reduces stress associated with a prolonged capture.
- **Shed training:** Birds can be easily trained to enter a shed for a favored food item. Shed training is advantageous for times when birds should be housed or captured, and/or feather trimmed, because it reduces the need to net the bird.

Seriemas are intelligent birds, and training is not difficult with the species. The following two tables list behaviors trained with seriemas at two AZA-accredited institutions.

Table 11. Sample 1: Husbandry and show behaviors trained with seriemas (K. Povey, personal communication)

<b>Husbandry behaviors</b>	<b>Bird show behaviors</b>
Trained to follow a target	Follows trainer on stage
Trained to station	Performs lizard slam behavior
Trained to step on a scale	Recall to kennel
Trained to kennel	Vocalize on cue
Holds on station for body exam	
Holds on station for intramuscular hand injections	

Table 12. Sample 2: Husbandry and show behaviors trained with seriemas (D. Pearson, personal communication)

<b>Husbandry behaviors</b>	<b>Bird show behaviors</b>
Station (scale, perch)	Slam a rubber lizard
Enters crate	Station (scale, perch)
Touch back (female only)	Recall to trainer
	Vocalize (male only)

Training a seriema for basic husbandry management (e.g., stationing, crating, and targeting) can prove important if the animal faces medical problems. Staff at one facility recognized the need to train husbandry behaviors that would facilitate medical procedures while minimizing stress. Successful training resulted in transitioning the seriemas station and target behaviors to a “hold” behavior, which greatly aided her medical examinations and successful treatment (Mattison et al., 2007).

All aspects of seriema husbandry are dependent on the basic design of the facilities. Institutions should design facilities that: minimize stress on animals by providing areas where birds can hide, and long runs where birds can properly exercise; allow for efficient handling and restraint (e.g., sheds where birds can be trained to enter for exams); provide access for emergency and routine procedures; maximize the potential for social interaction and separation through suitably sized pens; integrate enrichment into the daily husbandry routine; provide opportunities for specimens to display species-appropriate behavior; and provide for exhibition opportunities where applicable. Essential husbandry procedures, such as weighing, should be considered during enclosure design, and opportunities for these procedures to be optimized should be included (see section 2.1). Outdoor enclosures should be covered to allow birds to remain full winged and capable of reaching high perches.

Effective techniques for training seriemas include desensitization, acclimation, operant conditioning, and the use of positive reinforcement (e.g., using preferred food items). Animals can be approximated to specific sites through operant conditioning or strategic feeding. This can be useful in crate training. Target training can be useful for training animals to station for weights on a platform scale.

Scale training, crate training, and shed training can be effective and useful trained behaviors in the management of seriemas.

## 8.2 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 red-legged seriemas 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 red-legged seriemas should take into account the natural history of the species, individual needs of the animals, and facility constraints. The red-legged seriema enrichment plan should include the following elements: goal-setting, planning and approval process, implementation, documentation/record-keeping, evaluation, and subsequent program refinement. The red-legged seriema enrichment program should ensure that all environmental enrichment devices (EEDs) are “red-legged seriema” safe and are presented on a variable schedule to prevent habituation. AZA-accredited institutions must have a formal written enrichment program that promotes red-legged seriema-appropriate behavioral opportunities (AZA Accreditation Standard 1.6.1).

Red-legged seriema 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 specific staff members assigned to oversee, implement, train, and coordinate interdepartmental enrichment programs (AZA Accreditation Standard 1.6.2).

For seriemas, some variation in their environment is important to satisfy their natural curiosity and intelligence. With approval from institution veterinarians and nutritionists, food items normal to the diet may be offered as a form of enrichment (see Chapter 5.2 for additional information on food-based enrichment initiatives). Food enrichment can include feeding live insects, hiding mice, and presenting food items at different times of the day. Non-food enrichment initiatives can also be developed as part of a formalized enrichment program (e.g., see [www.animalenrichment.org](http://www.animalenrichment.org)), and should provide

### AZA Accreditation Standard

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

### AZA Accreditation Standard

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

opportunities for the birds to express their full range of behaviors (see Appendix H for a red-legged seriema ethogram). Keepers should observe the animals' interactions with enrichment initiatives to ensure that there are no health or safety concerns. Research is needed to determine the efficacy of enrichment (see Chapter 10.2).

The development of enrichment ideas for seriemas should be goal-oriented, proactive, based upon the animal's natural history, individual history, and exhibit constraints, and should be integrated into all aspects of seriema management. Senses important to seriemas should be involved in any enrichment program (e.g., sight, hearing, touch). Food should be accounted for in the animal's diet, and the exhibit display and its furnishings also should become part of the enrichment program. Successful enrichment techniques include variation of exhibit schedule, variation of feeding schedule, and modest re-arranging of the exhibit display. It is important that enrichment items are not merely thrown in an exhibit and allowed to stay for extended periods—an enrichment program is only successful and useful if actively managed and constantly reviewed to ensure that it encourages species appropriate behaviors.

The AAZK Enrichment committee provides the following general guidelines about enrichment: The goal of enrichment should be to maximize the benefit while minimizing unacceptable risks. All enrichment should be evaluated on three levels: 1) whether the enrichment item itself poses an unacceptable risk to the animals, 2) what benefit the animals will derive from the enrichment, and 3) whether the manner of enrichment delivery is apt to lead to problems. A written plan of action that eliminates the most dangerous risk factors while maintaining the benefits of a challenging and complex environment can help animal managers develop a safe and successful enrichment program. Keepers should evaluate new and creative enrichment ideas with their managers and staff from other departments (e.g., curatorial, janitorial, maintenance, veterinary, nutritional, etc.) to decrease the frequency of abnormal and stereotypic behaviors or low activity levels, and to fine-tune enrichment ideas. For enrichment to be safely provided, it is strongly recommended that each institution establish enrichment procedures, protocols, and a chain of command that keepers can follow. The AAZK Enrichment Committee provides an excellent cautionary list for the various types of enrichment provided ([www.aazk.org](http://www.aazk.org)). This list includes key questions that should be answered for all enrichment items or programs to assess potential hazards.

**Frequency of Enrichment Provision:** Factors that should be considered when determining how often behavioral or environmental enrichment is offered include the species and individual(s) involved as well as the physical characteristics of the exhibit. Large, complex exhibits with appropriate enclosure designs, substrates, and furnishings may offer ample opportunities for animals to exercise natural behaviors with infrequent enrichment (once daily). Other exhibits or individuals may require more frequent enrichment (multiple times per day). Husbandry staff should monitor all individuals in an exhibit and structure an enrichment schedule for the needs of those animals, providing them opportunities several times a day to interact positively with their environment. Enrichment should never be offered on a regular schedule—instead times, items, and delivery methods should be rotated so there is always an element of novelty associated with each item or activity. It is important to note that the provision of well-designed, complex environments is the foundation of a successful enrichment program. Enrichment should also be evaluated to see if it is achieving its goals. All enrichment items should be approved by the appropriate management staff, including the veterinarian, curator, horticulturist, and/or nutritionist.

### 8.3 Staff and Animal Interactions

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

Seriemas are not aggressive by nature. The main potential for injury to an animal caretaker from a seriema will be during capture and restraint of the birds, because the talons are very sharp and can easily puncture human flesh. Although seriemas rarely strike out with their bills, bouts of struggling during restraint procedures could result in a bird inadvertently pecking the face of its handlers. Goggles can be worn to minimize the risk of eye injuries during these procedures. Leather gloves can be worn to protect against talon puncture during restraint procedures if desired.

Seriemas are not usually aggressive, and unprotected free contact management of these animals is the most common form of interaction between the keeper and the bird.

Attention to the design of enclosures and facilities housing seriemas, and to the behavior of staff members working with these birds, is important to minimize trauma-related problems during human-

animal interactions, such as capture/restraint and animal training. In the daily management of seriemas, the likelihood of trauma to the birds can be reduced in the following ways:

- Using plastic coated foam padding to surround the sides of enclosures or pens, especially in areas where birds are regularly caught, such as in hospital or quarantine pens. Padding minimizes abrasion injuries to wingtips.
- Using shade-cloth or tension netting on the roof and sides of aviaries to cushion the impact that may result from birds flying within an enclosure (birds can still attempt flight whether they are flight restricted or not).
- Modifying behavior of the birds by habituating nervous individuals to common stimuli that may occur within the zoo environment (e.g., noises, presence of veterinarians, visitors, etc.), or housing such birds in naturalistic pens with plenty of cover to allow them to avoid potential negative stressors.
- Minimizing stress by reducing the number of non-essential people who enter seriema enclosures or the off-exhibit areas directly around these enclosures.

#### 8.4 Staff Skills and Training

Red-legged seriema staff members should be trained in all areas of red-legged seriema 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.

Animal care staff should have a complete understanding of the natural history, behavior, and biology of seriemas. Useful resources for gaining general knowledge about seriemas include the *Handbook of the Birds of the World: Volume 3* (del Hoyo et al., 1996).

The following list provides general recommendations for technical skills, knowledge, and experience for animal care staff working with seriemas:

- An in-depth understanding of the species natural history and the individual's history.
- An in-depth understanding of the individual's behaviors, an understanding of the function of those behaviors.
- Be able to recognize signs of illness and injury.
- Have the skills to safely capture or restrain a seriema.
- Have an understanding of the species natural diet and foraging style.
- Have an understanding of enrichment concepts and have a commitment to enhance the environments of seriemas on a consistent basis.
- Understand the concepts of animal learning and training, be able to use a variety of techniques (e.g., habituation, operant conditioning) to train the animals under their care, and to create a training plan (identifying training steps, cues, and criteria). See [www.animaltraining.org](http://www.animaltraining.org) for details.

## Chapter 9. Program Animals

### 9.1 Program Animal Policy

AZA recognizes many public education and, ultimately, conservation benefits from program animal presentations. AZA's Conservation Education Committee's Program Animal Position Statement (Appendix D) summarizes the value of program animal presentations.

For the purpose of this policy, a program 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.

Program 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 program animal presentations to develop an institutional program animal policy that clearly identifies and justifies those species and individuals approved as program animals and details their long-term management plan and educational program objectives.

AZA's 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, sound and environmental enrichment, access to veterinary care, nutrition, and other related standards (AZA Accreditation Standard 1.5.4). In addition, providing program 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, housing may be reduced in size compared to a primary enclosure as long as 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.

#### AZA Accreditation Standard

**(1.5.4)** A written policy on the use of live animals in programs should be on file. Animals in education programs must be maintained and cared for by trained staff, and housing conditions must meet standards set for the remainder of the animal collection, including species-appropriate shelter, exercise, social and environmental enrichment, access to veterinary care, nutrition, etc. Since some of these requirements can be met outside of the primary enclosure, for example, enclosures may be reduced in size provided that the animal's physical and psychological needs are being met.

The use of seriemas in educational programs and shows can be beneficial in promoting conservation messages about birds in general. Curators are encouraged to consult the AZA SSP Coordinator when considering the use of a seriema in a show, as some seriemas are more genetically valuable than other birds and are therefore better suited for placement in a breeding situation. Some institutions and private show contractors clip wing feathers to restrict flight in their seriemas, but many do not and instead rely on their knowledge of the bird's behavior.

Holding facilities for seriemas should allow for full range of movement, bathing, sunning, and choice of varied perching areas. Seriemas will spend time on high perching as well as the ground, and should have various perching levels available. Seriemas should have access to an adequately sized sandy area for dust bathing. Seriemas spend much time sunning and should have full access to sun and shelter from inclement weather. Contact with non-collection, native birds through co-mingling in the enclosure or scavenging of diet items can expose collection birds to disease. Attempts should be made to eliminate or to limit direct contact exposure to native species through enclosure mesh and roofing.

Seriemas are social and interactive and require a high level of mental stimulation and interaction. The ability to view con-specifics and other species and handlers throughout the day allows for many hours of stimulation. Seriemas trained with operant conditioning techniques and offered the opportunity to free fly or otherwise participate in educational programs have the ability to get additional exercise and conditioning. Birds imprinted on humans may choose to interact with humans directly through tactile stimulation and will typically engage in courtship and breeding behavior when sexually mature. Human imprints require a significant amount of human interaction in lieu of interaction with conspecifics. Size of housing varies depending on the bird's opportunities for outside access to exercise (i.e., free flight in programs). Full time housing can be smaller than exhibit housing when birds are given opportunity to fly and run outside of the enclosure. Enclosures smaller than 2.4 m x 1.2 m x 1.8 m (8 ft x 4 ft x 6 ft) are not

recommended due to the size of the bird's wingspan and need to move from perch to perch. Holding areas for program seriemas should follow the same guidelines as those for exhibit birds (Section 2.1). Being conditioned to enter and exit travel kennels voluntarily allows for daily weight collection, transport for educational programs/shows, as well as for veterinary procedures. Birds can also be crated for daily enclosure and exhibit servicing if needed to allow for thorough cleaning/disinfecting of housing areas. With imprinted birds that have a strong relationship with the handler's, physical examinations without restraint are possible.

Due to the social nature of seriemas, an educational/show facility can meet the needs of these birds due to the high level of interaction and activity on a daily basis. Through operant conditioning training technique, the birds are given the choice to experience a high level of variability in the environment. Whether they have con-specifics in the area, or other species altogether there is a high level of mental stimulation. Due to the all-day monitoring of birds in educational facilities, a wide variety of enrichment items can be offered and monitored for safety, interest, and activity level. With imprinted individuals who have relationships with trainers/keepers daily physical interaction is also offered for enrichment. Participating in educational programs/shows allows for daily variability and stimulation in the environment.

## 9.2 Institutional Program 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 program animals are required to develop their own Institutional Program Animal Policy that articulates and evaluates the program benefits (see Appendix E for recommendations). Program 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 program animal demonstration (AZA Accreditation Standard 1.5.3).

**AZA Accreditation Standard**

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

Facilities that maintain a collection of birds for educational programming provide daily attention and enrichment through training and servicing of the animals. A well-developed program designs its facility and schedule to meet the needs of highly social animals like seriemas. These facilities have staff available 365 days a year, 8–10 hours a day, and provide each bird's needs on a daily basis. Birds utilized in programs are closely monitored daily, and food intake can be monitored for each individual bird. Trained birds can be weighed daily and separated from other birds when necessary to ensure consumption of diet items. A variety of food can be offered and consumption closely monitored and recorded. Birds that are free flown in programs have the opportunity to fly and exercise on a regular or daily basis and are encouraged to participate through operant conditioning.

Daily record keeping systems should include daily diet intake, weight, behavior, comments on training sessions and interactions, and steps taken in training sessions. Courtship and breeding behavior or abnormal behavior should also be noted. Any aggression should be detailed and highlighted. Medical notes and observations, as well as any medications dispensed, should also be recorded. Any aggressive incidents should be communicated to staff through records and reports when involving bites to trainers or aggression directed toward bystanders. Any developing patterns of aggressive behavior should be thoroughly discussed and assessed.

Seriemas are commonly involved in conservation/education programs outside of their enclosures, as well as in animal training demonstrations that zoo visitors can observe, whether out on exhibit or during 'behind the scenes' tours. The provision of enrichment to seriemas in the view of the public could also be considered an educational program based on the definition of "program animals" provided in section 9.1.

**Conservation Messages:** Neither species of seriema is considered threatened. However, exact counts of both species have not been conducted, so their true status is not really known. Further complicating

the matter is their far-reaching call, which may yield a false count of the actual numbers of birds in a particular area. Central Brazil is the stronghold of the red-legged seriema. Farther south, the species is found in the grasslands of southern Brazil, Uruguay, and Argentina. In Argentina, numbers range from abundant to scarce. It is considered a vanishing species in Uruguay. In northeastern and southeastern Brazil, illegal traders of live animals occasionally offer red-legged seriemas for sale (del Hoyo, 1996). Threats to both species habitat are in the form of agricultural development and hunting, although red-legged seriemas seem to have adapted to this threat and in fact have colonized certain deforested areas in Brazil (del Hoyo, 1996). Populations of both species should continue to be monitored given their precarious status in certain parts of their range.

Animal care and education staff should be trained in program animal-specific handling protocols, conservation, and education messaging techniques, and public interaction procedures. These staff members should be competent in recognizing stress or discomfort behaviors exhibited by the program animals and be able to address any safety issues that arise.

Seriemas have been utilized in various types of programming including educational presentations and formal free-flight bird shows. Due to the long lifespan of seriemas, 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 tethering equipment is not appropriate for seriemas. Seriemas are highly active foragers and should not be restricted in their movement with attached jesses or tethers. They should have freedom of movement when utilized in programs/shows. Only staff with considerable experience training seriemas should attempt to train an older bird with no previous exposure to a training environment. Experienced staff would need to monitor the behavior of an older bird through the training process to assess whether the training environment is appropriate and enriching to that bird or if the bird is exhibiting high levels of stress or aggression.

When trained by experienced trainers utilizing operant conditioning in an environment where aversive stimuli are avoided, the frequency of aggression can be decreased or eliminated altogether. Seriemas have the ability to build very strong relationships with handlers and are less likely to build new relationships later in life. Techniques intended to dominate a seriema should not be used and are likely to increase the frequency of aggression. It is recommended that seriemas should be trained to shift out of enclosures into a shift pen or crate for cleaning and servicing of the enclosure if volunteers, docents or less experienced staff are needed to complete these duties.

Seriemas should always be handled in a manner that creates a comfortable environment for the bird, with the choice to participate in the training program and activity or not to participate. Individual birds vary and some individuals are highly motivated by tactile reinforcement from trainers. Well socialized birds that have demonstrated a low level of aggressive tendencies, and that are under stimulus control through Operant Conditioning techniques, can be handled in areas close to the public. Birds that demonstrate aggression should be assessed for the potential of aggression towards the public. The topography of the behavior should facilitate the free flight of the bird over or near the public with a safe end/landing point that encourages the bird to successfully complete the behavior without interacting with the public. It is not recommended to allow guest contact with this taxon, as there is the potential for injury.

Indicators that a seriema is experiencing stress include flying at walls, running back and forth on the ground, mouth open, raised crest, vocalizing with a low "growl" and if spooked, may run and not focus on the trainer until a safe distance from the cause of their stress. An unclipped bird could potentially fly off if frightened enough. It is recommended that the public remain seated during demonstrations. When these signs are observed all housing factors (i.e. their proximity to activity, their noise levels) should be accessed to determine their affects. If activity in the area is causing high levels of stress (i.e. a construction project), and the bird's physical reactions are likely to result in injury, then action should be taken to calm the bird through visual barriers, temporary re-location or permanent relocation if desensitization is not possible or conducive to the situation. Thorough records should be kept documenting the behaviors.

Only animal caretakers that have received training within the institution relevant to working with seriemas should be involved in any animal training demonstrations, and specific protocols should be developed and implemented to ensure that animal care staff members remain safe and focused on the animals during any demonstrations. The presence of zoo visitors should not distract animal caretakers during interactions with the animals. Animal care staff members should be competent in recognizing stress or discomfort behaviors exhibited by any animals used in programs/demonstrations (e.g., increased aggression, vocalization, running, crouching), and be able to communicate these issues

effectively using institution-specific animal care protocols so that welfare or safety concerns can be specifically addressed. Animal care staff members involved in seriema “programs” should be trained in conservation and education messaging techniques and public interaction procedures.

Program 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 (AZA Accreditation Standard 1.5.5).

Animals leaving the facility for off-site programming should be fully protected from interaction with non-collection animals. Representatives from the facility should contact the destination (news station, hotel, event center, school, etc.) before event/arrival to determine that no other animals will share the facility just prior to or during the scheduled event. Furniture such as bath pans, carpets and perching utilized for the presentation should be brought with the collection birds. All diet items should also be brought from the home facility.

Disinfecting agents, water supplies (e.g., spray bottles for keeping animals cool), and hand sanitizer should be brought along. Guidelines should be in place outlining the event and the handling procedures. In the event that a program animal has come in contact with non-collection bird(s) and there is a possibility of disease transmission, it is recommended that the bird serve up to a week-long re-entry quarantine to allow for any testing or observation by veterinary staff to confirm the health of the bird.

Careful consideration must be given to the design and size of all program 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; AZA Accreditation Standard 1.5.2).

Similar consideration needs to be given to the means in which an animal will be transported both within the Institution’s grounds, and to/from an off-grounds program. 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 general public (AZA Accreditation Standard 1.5.11).

Operant Conditioning training techniques should be utilized to condition birds to enter and exit the enclosure. Transport carriers should be large enough for the bird to stand at full height, and turn around comfortably, and be designed for ease of entry and exit. Any openings should be covered if needed to protect feathers from damage while still allowing adequate air circulation. Fans should be mounted on travel carriers in hot temperatures.

Birds naive to a transport crate should be trained using approximations and desensitization with positive reinforcement. The bird should have the choice to enter and exit for reinforcement. 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. If the bird shows signs of discomfort while traveling, transport crates should be covered to give the bird a sheltered environment.

Custom made transport carriers of appropriate size should adequately contain the bird and prevent accidental release, and be inspected to ensure that no sharp edges or other potential hazards exist inside the crate. Birds that are trained to enter and exit transport carriers utilizing operant conditioning techniques can be transported for programs as well as crated for routine weighing, trips to the veterinarian, and while the enclosure is serviced. The bird should not be forced, chased or netted to enter the crate in lieu of training except in an emergency situation or evacuation.

#### 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

**(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; exhibit enclosures must include provisions for the behavioral enrichment of the animals.

#### AZA Accreditation Standard

**(1.5.2)** Animals should be displayed, whenever possible, in exhibits replicating their wild habitat and in numbers sufficient to meet their social and behavioral needs. Display of single specimens should be avoided unless biologically correct for the species involved.

#### 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 local, state, and federal laws must be adhered to. Planning and coordination for animal transport requires good communication among all involved 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

Birds that live in excessively hot or cold environments and are acclimated to the temperature will have a wider range of tolerance. A bird's behavior should always be monitored in hot climates and assessed based on physical signs of heat related stress. If birds are flying, or otherwise engaged in programs during hot weather, they should be monitored and removed from programs when needed. Fresh water should always be available, but handlers should be aware that birds may not necessarily utilize water elements to cool themselves when overheated. Hose spray, overhead mister systems, or air-conditioned areas should be utilized if birds appear to be suffering from heat related stress. Housing areas should offer shelter from sun and inclement weather giving the bird the option of sun or shade as well as wind, rain or snow.

Each bird is an individual and may have a longer or shorter attention span or desire for interaction. With operant conditioning training techniques, birds are given the choice to participate. It should be clear to the trainers that the bird is choosing to participate by giving them the ability to choose to approach trainers or retreat, exit the enclosure, or by entering or exiting the transport crate. During programs, the demonstrations should be designed so that the bird can choose to exit at any time into a safe environment (i.e., backstage, into a crate, back into the enclosure, etc.). Seriemas are medium sized birds, and long distance travel may involve being confined to a small space. On long journeys, the bird should have a larger enclosure available at the destination to allow for full wing extension, full range of movement, bathing and preening. All behavior should be documented in daily records and any aggression or avoidance behavior should be noted. If the bird is showing signs of stress or displacement, further travel or program involvement should be re-evaluated. As long as the bird is choosing to cooperate without being coerced, then the length of time will vary significantly from bird to bird. The bird's threshold for program involvement should be determined based on behavior, and may have seasonal variations and vary depending on whether the bird is parent raised or imprinted on humans.

### 9.3 Program Evaluation

AZA-accredited institutions which have Institutional Program Animal Plan are required to evaluate the efficacy of the plan routinely (see Appendix E for recommendations). Education and conservation messaging content retention, animal health and well-being, guest responses, policy effectiveness, and accountability and ramifications of policy violations should be assessed and revised as needed.

It's recommended that presentation and handling guidelines and protocols should be re-evaluated annually or bi-annually. All staff should have access to these guidelines and be provided with updates as needed. All new staff should be signed off on receiving and reading the standards and protocols during orientation and before commencing work in the area.

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 through verbal and/or written documentation and punitive measures taken when necessary.

Significant feedback can be gained through formal and informal surveying of shows and educational programs. Surveys should be designed to measure the impact of educational messaging, the benefits of utilizing live animals for programs, and gather useful information on the audience and demographics.

Standards of care can be measured through physical condition and behavior of collection birds. Physical condition of feet, feathers, and vitality should be assessed, as well as overall behavior through daily record keeping, and daily, monthly, and annual physical inspection.

Exit surveys are a valuable tool and can be designed to gather data on level of entertainment and educational value, impact of messaging, and revisitation. Content of programs should always be up to date and accurate and messages consistent. Guests should leave with an understanding of the animal's natural history, its relationship to humans, and a feeling of respect and responsibility towards the natural world and global conservation.

## Chapter 10. Research

### 10.1 Known Methodologies

AZA believes that contemporary red-legged seriema 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. This knowledge might be achieved by participating in AZA Taxon Advisory Group (TAG) or Species Survival Plan® (SSP) Program sponsored research, conducting original research projects, affiliating with local universities, and/or employing staff with scientific credentials (AZA Accreditation Standard 5.3).

For seriemas, this knowledge can be achieved in part by participating in any AZA Gruiformes TAG or Red-legged Seriema SSP sponsored research, conducting original research projects, affiliating with local universities, and/or employing staff with scientific credentials (AZA Accreditation Standard 5.3). 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 zoos and aquariums 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.

All sound research approaches should be viable for use on seriemas, as long as they are not too invasive, require extensive surgery, or cause pain or discomfort. Researchers can use the following methodologies to study seriemas:

- Behavioral observation
- Fecal hormone analysis
- Fecal DNA analysis

**Keeper research:** Keepers are in a great position to contribute to seriema management and husbandry advances and research, as they work with the species on a daily basis. Some areas where keeper input and participation can be very valuable include:

- Instituting scale training so that birds can be routinely weighed in order to assess body mass
- 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 pairs when feeding chicks
- Documenting molt patterns

AZA-accredited institutions are required to have a clearly written research policy that identifies the types of research being conducted, methods used, staff involved, evaluations of the projects, the animals included, and guidelines for the reporting or publication of any findings (AZA Accreditation Standard 5.2). Institutions must designate a qualified individual to oversee and direct its research program (AZA Accreditation Standard 5.1). 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 Taxon Advisory Groups (TAGs) or Species Survival Plans® (SSP) Programs.

#### AZA Accreditation Standard

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

#### AZA Accreditation Standard

(5.1) Research activities must be under the direction of a person qualified to make informed decisions regarding research.

#### AZA Accreditation Standard

(5.2) Institutions must have a written policy that outlines the type of research that it conducts, methods, staff involvement, evaluations, animals to be involved, and guidelines for publication of findings.

## 10.2 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 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 1.4: Little is known about the hearing sensitivity of seriemas, and additional research on hearing would provide some guidance for creating more objective recommendations for managing sound stimuli for this species.

### Chapter 2. Habitat Design and Containment

Section 2.1: Additional behavioral research that focuses on the behavior of wild seriemas, and that can be used to make general comparisons with the behavior of seriemas in zoos (e.g., based on daily activity budgets) in different social and physical conditions, will always be beneficial for improving appropriate animal management recommendations.

Section 2.2: Covered enclosures are strongly recommended if seriemas are allowed to raise chicks naturally, and it is also possible that completely covered enclosures may help to minimize the risk of avian flu transmission. Further research is needed to determine the role that covered aviaries can play in minimizing the transmission of diseases from wild birds.

### Chapter 4. Social Environment

Section 4.1: Group Structure and Size: The effect of housing several females together is unknown. Although the population rarely has surplus females in need of housing, further research on female-female compatibility would be useful in the event it is required.

### Chapter 5. Nutrition

Section 5.1: 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 seriemas.

More information is needed from blood samples collected from clinically "normal" seriemas. It is recommended that blood samples be taken opportunistically (e.g., during routine physicals), and analyzed for nutritionally related information that can be used to develop appropriate target serum and nutrient values.

Section 5.3: Huchzermeyer (1998) provides a scale (1–10) for scoring body condition in ostrich and Bailey (2008) provides descriptive text for assessing weight, hydration, cere, nares, beak, oropharynx, eyes, ears, pectoral muscle condition, neck, saccus oralis, body, coelomic space, vent, thoracic and pelvic limbs, feathers and skin. A grading system for overall body condition that takes into account the entire body of the bird should be developed for seriemas to assist in proper husbandry.

### Chapter 6. Veterinary Care

Section 6.5: Additional research on the welfare of flight restriction in seriemas is still needed in order to develop the most effective animal care recommendations for housing these animals in zoos.

Section 6.5: Medical Management of Molt: Further research is needed to determine the molt of seriemas and its relationship to the overall management of birds in zoos.

### Chapter 7. Reproduction

Section 7.1: More documentation of the physical development of chicks, including data collection on weight, specific diet ingredient intake (weighed amounts), morphometrics, and plumage changes would allow a better understanding of this crucial early life stage.

Hormonal monitoring of the reproductive status of seriemas has not been researched. This would prove a useful tool for managers to increase their understanding of seriema breeding and general reproductive physiology of the species.

Section 7.2: Further research is needed to appropriate protocols for the use of artificial insemination with this species.

### **Chapter 8. Behavior Management**

Section 8.2: Most zoos employ some form of enrichment with their seriemas. Research is needed to determine the efficacy of the enrichment as well as the required frequency.

## Chapter 11. Other Considerations

### 11.1 Additional Information

The use of seriemas in educational programs and shows can be beneficial in promoting conservation messages about birds in general and more specifically, seriemas. Curators are encouraged to consult the Population Manager when considering the use of a seriema in a show, as some seriemas are more genetically valuable than other birds and are therefore better suited for placement in a breeding situation.

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## Appendix A: Accreditation Standards by Chapter

The following specific standards of care relevant to red-legged seriemas are taken from the AZA Accreditation Standards and Related Policies (AZA, 2011) 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, and federal wildlife laws and regulations. It is understood that, in some cases, AZA accreditation standards are more stringent than existing laws and regulations. In these cases the AZA standard must be met.

### Chapter 1

- (1.5.7)** The animal collection must be protected from weather detrimental to their health.
- (10.2.1)** Critical life-support systems for the animal collection, 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. All mechanical equipment should be under a preventative maintenance program as evidenced through a record-keeping system. Special equipment should be maintained under a maintenance agreement, or a training record should show that staff members are trained for specified maintenance of special equipment.
- (1.5.9)** The institution must have a regular program of monitoring water quality for collections of fish, pinnipeds, cetaceans, and other aquatic animals. A written record must be maintained to document long-term water quality results and chemical additions.

### Chapter 2

- (1.5.2)** Animals should be displayed, whenever possible, in exhibits replicating their wild habitat and in numbers sufficient to meet their social and behavioral needs. Display of single specimens should be avoided unless biologically correct for the species involved.
- (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; and exhibit enclosures must include provisions for the behavioral enrichment of the animals.
- (11.3.3)** Special attention must be given to free-ranging animals so that no undue threat is posed to the animal collection, free-ranging animals, or the visiting public. Animals maintained where they will be in contact with the visiting public must be carefully selected, monitored, and treated humanely at all times.
- (11.3.1)** All animal exhibits and holding areas must be secured to prevent unintentional animal egress.
- (11.3.6)** Guardrails/barriers must be constructed in all areas where the visiting public could have contact with other than handleable animals.
- (11.2.3)** All emergency procedures must be written and provided to staff and, where appropriate, to volunteers. Appropriate emergency procedures must be readily available for reference in the event of an actual emergency. These procedures should deal with four basic types of emergencies: fire, weather/environment; injury to staff or a visitor; animal escape.
- (11.6.2)** Security personnel, whether staff of 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).
- (11.2.4)** The institution must have a communication system that can be quickly accessed in case of an emergency.
- (11.2.5)** 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 (sharks, whales, tigers, bears, etc.) 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. 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 prepared and maintained for five years from the date of the incident.

**Chapter 3**

**(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 local, state, and federal laws must be adhered to.

**Chapter 5**

**(2.6.2)** A formal nutrition program is recommended to meet the behavioral and nutritional needs of all species and specimens within the collection.

**(2.6.3)** Animal diets must be of a quality and quantity suitable for each animal's nutritional and psychological needs. Diet formulations and records of analysis of appropriate feed items should be maintained and may be examined by the Visiting Committee. Animal food, especially seafood products, should be purchased from reliable sources that are sustainable and/or well managed.

**(2.6.1)** Animal food preparations must meet all local, state/provincial, and federal regulations.

**(2.6.4)** The institution should assign at least one person to oversee appropriate browse material for the collection.

**Chapter 6**

**(2.1.1)** A full-time staff veterinarian is recommended. However, the Commission realizes that in some cases such is not practical. In those cases, a consulting/part-time veterinarian must be under contract to make at least twice monthly inspections of the animal collection and respond as soon as possible to any emergencies. The Commission also recognizes that certain collections, because of their size and/or nature, may require different considerations in veterinary care.

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

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

**(1.4.6)** A staff member must be designated as being responsible for the institution's animal record-keeping system. That person must be charged with establishing and maintaining the institution's animal records, as well as with keeping all animal care staff members apprised of relevant laws and regulations regarding the institution's animal collection.

**(1.4.7)** Animal records must be kept current, and data must be logged daily.

**(1.4.5)** At least one set of the institution's historical animal records must be stored and protected. Those records should include permits, titles, declaration forms, and other pertinent information.

**(1.4.4)** Animal records, whether in electronic or paper form, including health records, must be duplicated and stored in a separate location.

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

**(1.4.1)** An animal inventory must be compiled at least once a year and include data regarding acquisitions and dispositions in the animal collection.

**(1.4.2)** All species owned by the institution must be listed on the inventory, including those animals on loan to and from the institution. In both cases, notations should be made on the inventory.

**(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.

**(2.7.3)** Quarantine, hospital, and isolation areas should be in compliance with standards or guidelines adopted by the AZA.

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

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

**(11.1.3)** A tuberculin testing and surveillance program must be established for appropriate staff in order to ensure the health of both the employees and the animal collection.

**(2.5.1)** Deceased animals should be necropsied to determine the cause of death. Disposal after necropsy must be done in accordance with local/federal laws.

**(2.4.1)** The veterinary care program must emphasize disease prevention.

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

- (2.3.1)** Capture equipment must be in good working order and available to authorized, trained personnel at all times.
- (2.4.2)** Keepers should be trained to recognize abnormal behavior and clinical symptoms 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, keepers should not evaluate illnesses nor prescribe treatment.
- (2.3.2)** Hospital facilities should have x-ray equipment or have access to x-ray services.
- (1.5.8)** The institution must develop a clear process for identifying and addressing animal welfare concerns within the institution.

#### **Chapter 8**

- (1.6.1)** The institution must have a formal written enrichment program that promotes species-appropriate behavioral opportunities.
- (1.6.2)** The institution must have a specific staff member(s) or committee assigned for enrichment program oversight, implementation, training, and interdepartmental coordination of enrichment efforts.

#### **Chapter 9**

- (1.5.4)** A written policy on the use of live animals in programs should be on file. Animals in education programs must be maintained and cared for by trained staff, and housing conditions must meet standards set for the remainder of the animal collection, including species-appropriate shelter, exercise, social and environmental enrichment, access to veterinary care, nutrition, etc. Since some of these requirements can be met outside of the primary enclosure, for example, enclosures may be reduced in size provided that the animal's physical and psychological needs are being met.
- (1.5.3)** If animal demonstrations are a part of the institution's programs, an education and conservation message must be an integral component.
- (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 collection from exposure to infectious agents.
- (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; and exhibit enclosures must include provisions for the behavioral enrichment of the animals.
- (1.5.2)** Animals should be displayed in exhibits replicating their wild habitat and in numbers sufficient to meet their social and behavioral needs. Display of single animals should be avoided unless biologically correct for the species involved.
- (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 local, state, and federal laws must be adhered to. Planning and coordination for animal transport requires good communication among all involved 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.

#### **Chapter 10**

- (5.3)** Institutions should maximize the generation of scientific knowledge gained from the animal collection. This might be achieved by participating in AZA TAG/SSP sponsored research when applicable, conducting original research projects, affiliating with local universities, and/or employing staff with scientific credentials.
- (5.2)** Institutions must have a written policy that outlines the type of research that it conducts, methods, staff involvement, evaluations, animals to be involved, and guidelines for publication of findings.
- (5.1)** Research activities must be under the direction of a person qualified to make informed decisions regarding research.

## Appendix B: Acquisition/Disposition Policy

**I. Introduction:** The Association of Zoos and Aquariums (AZA) was established, among other reasons, to foster continued improvement in the zoological park and aquarium profession. One of its most important roles is to provide a forum for debate and consensus building among its members, the intent of which is to attain high ethical standards, especially those related to animal care and professional conduct. The stringent requirements for AZA accreditation and high standards of professional conduct are unmatched by similar organizations and also far surpass the United States Department of Agriculture's Animal and Plant Health Inspection Service's requirements for licensed animal exhibitors. AZA member facilities must abide by a Code of Professional Ethics — a set of standards that guide all aspects of animal management and welfare. As a matter of priority, AZA institutions should acquire animals from other AZA institutions and dispose of animals to other AZA institutions.

AZA-accredited zoological parks and aquariums cannot fulfill their important missions of conservation, and science without living animals. Responsible management of living animal populations necessitates that some individuals be acquired and that others be removed from the collection at certain times. Acquisition of animals can occur through propagation, trade, donation, loan, purchase, capture, or rescue. Animals used as animal feed are not accessioned into the collection.

Disposition occurs when an animal leaves the collection for any reason. Reasons for disposition vary widely, but include cooperative population management (genetic or demographic management), reintroduction, behavioral incompatibility, sexual maturation, animal health concerns, loan or transfer, or death.

The AZA Acquisition/Disposition Policy (A/D) was created to help (1) guide and support member institutions in their animal acquisition and disposition decisions, and (2) ensure that all additions and removals are compatible with the Association's stated commitment to "save and protect the wonders of the living natural world." More specifically, the AZA A/D Policy is intended to:

- Ensure that the welfare of individual animals and conservation of populations, species and ecosystems are carefully considered during acquisition and disposition activities;
- Maintain a proper standard of conduct for AZA members during acquisition and disposition activities;
- Ensure that animals from AZA member institutions are not transferred to individuals or organizations that lack the appropriate expertise or facilities to care for them.
- Support the goal of AZA's cooperatively managed populations and associated programs, including Species Survival Plans (SSPs), Population Management Plans (PMPs), and Taxon Advisory Groups (TAGs).

The AZA Acquisition/Disposition Policy will serve as the default policy for AZA member institutions. Institutions may develop their own A/D Policy in order to address specific local concerns. Any institutional policy must incorporate and not conflict with the AZA acquisition and disposition standards.

Violations of the AZA Acquisition/Disposition Policy will be dealt with in accordance with the AZA Code of Professional Ethics. Violations can result in an institution's or individual's expulsion from membership in the AZA.

**II. Group or Colony-based Identification:** For some colonial, group-living, or prolific species, such as certain insects, aquatic invertebrates, schooling fish, rodents, and bats, it is often impossible or highly impractical to identify individual specimens. These species are therefore maintained, acquisitioned, and disposed of as a group or colony. Therefore, when this A/D Policy refers to animals or specimens, it is in reference to both individuals and groups/colonies.

**III. Germplasm:** Acquisition and disposition of germplasm should follow the same guidelines outlined in this document if its intended use is to create live animal(s). Ownership of germplasm and any resulting animals should be clearly defined. Institutions acquiring or dispositioning germplasm or any animal parts or samples should consider not only its current use, but also future possible uses as new technologies become available.

IV(a). General Acquisitions: Animals are to be acquisitioned into an AZA member institution's collection if the following conditions are met:

1. Acquisitions must meet the requirements of all applicable local, state, federal and international regulations and laws.
2. The Director or Chief Executive Officer of the institution is charged with the final authority and responsibility for the monitoring and implementation of all acquisitions.
3. 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.
4. Animals that are acquired for the collection, permanently or temporarily, must be listed on institutional records. All records should follow the Standards for Data Entry and Maintenance of North American Zoo and Aquarium Animal Records Databases<sup>®</sup>.
5. Animals may be acquired temporarily for reasons such as, holding for governmental agencies, rescue and/or rehabilitation, or special exhibits. Animals should only be accepted if they will not jeopardize the health, care or maintenance of the animals in the permanent collection or the animal being acquired.
6. The institution must have the necessary resources to support and provide for the professional care and management of a species, so that the physical and social needs of both specimen and species are met.
7. Attempts by members to circumvent AZA conservation programs in the acquisition of SSP animals are detrimental to the Association and its conservation programs. Such action may be detrimental to the species involved and is a violation of the Association's Code of Professional Ethics. All AZA members must work through the SSP program in efforts to acquire SSP species and adhere to the AZA Full Participation policy.
8. Animals are only to be acquired from sources 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. Any convictions of state, federal, or international wildlife laws should be reviewed, as well as any previous dealings with other AZA-accredited institutions.
9. When acquiring specimens managed by a PMP, institutions should consult with the PMP manager.
10. Institutions should consult AZA Wildlife Conservation and Management Committee (WCMC)-approved Regional Collection Plans (RCPs) when making acquisition decisions.

IV(b). Acquisitions from the Wild: The maintenance of wild animal populations for education and wildlife conservation purposes is a unique responsibility of AZA member zoos and aquariums. To accomplish these goals, it may be necessary to acquire wild-caught specimens. Before acquiring animals from the wild, institutions are encouraged to examine sources including other AZA institutions or regional zoological associations.

When acquiring animals from the wild, careful consideration must be taken to evaluate the long-term impacts on the wild population. Any capture of free-ranging animals should be done in accordance with all local, state, federal, and international wildlife laws and regulations and not be detrimental to the long-term viability of the species or the wild or captive population(s). In crisis situations, when the survival of a population is at risk, rescue decisions are to be made on a case-by-case basis.

V(a). Disposition Requirements – living animals: Successful conservation and animal management efforts rely on the cooperation of many entities, both within and outside of AZA. While preference is given to placing animals within AZA member institutions, it is important to foster a cooperative culture among those who share the primary mission of AZA-accredited facilities. The AZA draws a strong distinction between the mission, stated or otherwise, of non-AZA member organizations and the mission of professionally managed zoological parks and aquariums accredited by the AZA.

An accredited AZA member balances public display, recreation, and entertainment with demonstrated efforts in education, conservation, and science. While some non-AZA member organizations may meet minimum daily standards of animal care for wildlife, the AZA recognizes that this, by itself, is insufficient to warrant either AZA membership or participation in AZA's cooperative animal management programs. When an animal is sent to a non-member of AZA, it is imperative that the member be confident that the animal will be cared for properly.

Animals may only be disposed of from an AZA member institution's collection if the following conditions are met:

1. Dispositions must meet the requirements of all applicable local, state, federal and international regulations and laws.
2. The Director or Chief Executive Officer of the institution is charged with the final authority and responsibility for the monitoring and implementation of all dispositions.
3. Any disposition must abide by the Mandatory Standards and General Advisories of the AZA Code of Professional Ethics. Specifically, "a member shall make every effort to assure that all animals in his/her collection and under his/her care are disposed of in a manner which meets the current disposition standards of the Association and do not find their way into the hands of those not qualified to care for them properly."
4. Non-domesticated animals shall not be disposed of at animal auctions. Additionally, animals shall not be disposed of to any organization or individual that may use or sell the animal at an animal auction. In transactions with AZA non-members, the recipient must ensure in writing that neither the animal nor its offspring will be disposed of at a wild animal auction or to an individual or organization that allows the hunting of the animal.
5. Animals shall not be disposed of to organizations or individuals that allow the hunting of these animals or their offspring. This does not apply to individuals or organizations which allow the hunting of only free-ranging game species (indigenous to North America) and established long-introduced species such as, but not limited to, white-tailed deer, quail, rabbit, waterfowl, boar, ring-necked pheasant, chukar, partridge, and trout. AZA distinguishes hunting/fishing for sport from culling for sustainable population management and wildlife conservation purposes.
6. Attempts by members to circumvent AZA conservation programs in the disposition of SSP animals are detrimental to the Association and its conservation programs. Such action may be detrimental to the species involved and is a violation of the Association's Code of Professional Ethics. All AZA members must work through the SSP program in efforts to deacquisition SSP species and adhere to the AZA Full Participation policy.
7. Domesticated animals are to be disposed of in a manner consistent with acceptable farm practices and subject to all relevant laws and regulations.
8. Live specimens may be released within native ranges, subject to all relevant laws and regulations. Releases may be a part of a recovery program and any release must be compatible with the AZA Guidelines for Reintroduction of Animals Born or Held in Captivity, dated June 3, 1992.
9. Detailed disposition records of all living or dead specimens must be maintained. Where applicable, proper animal identification techniques should be utilized.
10. It is the obligation of every loaning institution to monitor, at least annually, the conditions of any loaned specimens and the ability of the recipient to provide proper care. If the conditions and care of animals are in violation of the loan agreement, it is the obligation of the loaning institution to recall the animal. Furthermore, an institution's loaning policy must not be in conflict with this A/D Policy.
11. If live specimens are euthanized, it must be done in accordance with the established policy of the institution and the Report of the American Veterinary Medical Association Panel on Euthanasia (Journal of the American Veterinary Medical Association 218 (5): 669-696, 2001).
12. In dispositions to non-AZA members, the non-AZA member's mission (stated or implied) must not be in conflict with the mission of AZA, or with this A/D Policy.
13. In dispositions to non-AZA member facilities that are open to the public, the non-AZA member must balance public display, recreation, and entertainment with demonstrated efforts in conservation, education, and science.
14. In dispositions to non-AZA members, the AZA members must be convinced that the recipient has the expertise, records management practices, financial stability, facilities, and resources required to properly care for and maintain the animals and their offspring. It is recommended that this documentation be kept in the permanent record of the animals at the AZA member institution.
15. If living animals are sent to a non-AZA member research institution, the institution must be registered under the Animal Welfare Act by the U.S. Department of Agriculture Animal and Plant

Health Inspection Service. For international transactions, the receiving facility should be registered by that country's equivalent body with enforcement over animal welfare.

16. No animal disposition should occur if it would create a health or safety risk (to the animal or humans) or have a negative impact on the conservation of the species.
17. Inherently dangerous wild animals or invasive species should not be dispositioned to the pet trade or those unqualified to care for them.
18. Under no circumstances should any primates be dispositioned to a private individual or to the pet trade.
19. Fish and aquatic invertebrate species that meet ANY of the following are inappropriate to be disposed of to private individuals or the pet trade:
  - a. species that grow too large to be housed in a 72-inch long, 180 gallon aquarium (the largest tank commonly sold in retail stores)
  - b. species that require extraordinary life support equipment to maintain an appropriate captive environment (e.g., cold water fish and invertebrates)
  - c. species deemed invasive (e.g., snakeheads)
  - d. species capable of inflicting a serious bite or venomous sting (e.g., piranha, lion fish, blue-ringed octopus)
  - e. species of wildlife conservation concern
21. When dispositioning specimens managed by a PMP, institutions should consult with the PMP manager.
22. Institutions should consult WCMC-approved RCPs when making disposition decisions.

V(b). Disposition Requirements – dead specimens: Dead specimens (including animal parts and samples) are only to be disposed of from an AZA member institution's collection if the following conditions are met:

1. Dispositions of dead specimens must meet the requirements of all applicable local, state, federal and international regulations and laws.
2. Maximum utilization is to be made of the remains, which could include use in educational programs or exhibits.
3. Consideration is given to scientific projects that provide data for species management and/or conservation.
4. Records (including ownership information) are to be kept on all dispositions, including animal body parts, when possible.
5. SSP and TAG necropsy protocols are to be accommodated insofar as possible.

VI. Transaction Forms: AZA member institutions will develop transaction forms to record animal acquisitions and dispositions. These forms will require the potential recipient or provider to adhere to the AZA Code of Professional Ethics, the AZA Acquisition/Disposition Policy, and all relevant AZA and member policies, procedures and guidelines. In addition, transaction forms must insist on compliance with the applicable laws and regulations of local, state, federal and international authorities.

## Appendix C: 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 red-legged seriemas:

*Red-legged seriemas:*

Required:

1. Direct and floatation fecals
2. Vaccinate as appropriate

Strongly Recommended:

1. CBC/sera profile
2. Urinalysis
3. Appropriate serology (FIP, FeLV, FIV)
4. Heartworm testing in appropriate species

## Appendix D: Program Animal Policy and Position Statement

### Program Animal Policy

*Originally approved by the AZA Board of Directors – 2003*

*Updated and approved by the Board – July 2008 & June 2011*

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

For the purpose of this policy, a Program 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 Program Animals on a full-time basis, while others are designated as such only occasionally. Program Animal-related Accreditation Standards are applicable to all animals during the times that they are designated as Program Animals.

There are three main categories of Program Animal interactions:

1. On Grounds with the Program Animal Inside the Exhibit/Enclosure:
  - i. Public access outside the exhibit/enclosure. Public may interact with animals from outside the exhibit/enclosure (e.g., giraffe feeding, touch tanks).
  - ii. 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 Program Animal Outside the Exhibit/Enclosure:
  - i. Minimal handling and training techniques are used to present Program Animals to the public. Public has minimal or no opportunity to directly interact with Program Animals when they are outside the exhibit/enclosure (e.g., raptors on the glove, reptiles held “presentation style”).
  - ii. Moderate handling and training techniques are used to present Program Animals to the public. Public may be in close proximity to, or have direct contact with, Program Animals when they're outside the exhibit/enclosure (e.g., media, fund raising, photo, and/or touch opportunities).
  - iii. Significant handling and training techniques are used to present Program Animals to the public. Public may have direct contact with Program Animals or simply observe the in-depth presentations when they're outside the exhibit/enclosure (e.g., wildlife education shows).
3. Off Grounds:
  - i. Handling and training techniques are used to present Program Animals to the public outside of the zoo/aquarium grounds. Public may have minimal contact or be in close proximity to and have direct contact with Program 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 Program Animals and the periods during which the Program Animal-related Accreditation Standards are applicable. In addition, these Program Animal categories establish a framework for understanding increasing degrees of an animal's involvement in Program Animal activities.*

*Program 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 program animal presentations to develop an institutional program animal policy that clearly identifies and justifies those species and individuals approved as program 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 program 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 program 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.*

## **Program 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 program 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 program 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 and Hodgkinson, 1999). The use of program 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.

Program animals are powerful catalysts for learning for a variety of reasons. They are generally active, easily viewed, and usually presented in close proximity to the public. These factors have proven to contribute to increasing the length of time that people spend watching animals in zoo exhibits (Bitgood, Patterson and Benefield, 1986, 1988; Wolf and 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 and 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 program animals in shows or informal presentations can be effective in lengthening the potential time period for learning and overall impact.

Program 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 program animals. A growing body of evidence supports the validity of using program 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 a program 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

Program 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 program 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 program animals are an important tool for conveying both cognitive and affective messages regarding animals and the need to conserve wildlife and wild places.

## Acknowledgements

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## Appendix E: Developing an Institutional Program Animal Policy

*Last revision 2003*

*Re-authorized by the Board June 2011*

### 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 **Program Animal Position Statement** describes the research underpinning the appropriate use of program 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 program animals conveys intended and/or conflicting messages and to modify and improve programs accordingly and to ensure that all program animals have the best possible welfare.

When utilizing program 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 taxons' and/or species' biological and social needs and developing Animal Care Manuals (ACMs) that include specifications concerning their use as program animals.

However, even the most exacting standards cannot address the individual choices faced by each AZA institution. Therefore, each institution is required to develop a program animal policy that articulates and evaluates program benefits. The following recommendations are offered to assist each institution in formulating its own Institutional Program Animal Policy, which incorporates the AZA Program 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 staff (if in a separate department)
- departments that frequently request special program 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 Program 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, as long as:

1. The use and setting is appropriate.
2. Animal and human welfare is considered at all times.
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 program animal policies should include a philosophical statement addressing the above, and should relate the use of program animals to the institution's overall mission statement.

### **II. Appropriate Settings**

The Program Animal Policy should include a listing of all settings both on and off site, where program 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:

- I. On-site programming
  - A. Informal and non-registrants:
    1. On-grounds programming with animals being brought out (demonstrations, lectures, parties, special events, and media)
    2. Children's zoos and contact yards
    3. Behind-the-scenes open houses
    4. Shows
    5. Touch pools
  - B. Formal (registration involved) and controlled settings
    1. School group programs
    2. Summer Camps
    3. Overnights
    4. Birthday Parties
    5. Animal rides
    6. Public animal feeding programs
- II. Offsite and Outreach
  1. PR events (TV, radio)
  2. Fundraising events
  3. Field programs involving the public
  4. School visits
  5. Library visits
  6. Nursing Home visits (therapy)
  7. Hospital visits
  8. Senior Centers
  9. 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 Program Animal Policy address compliance with appropriate regulations and AZA Accreditation Standards.

### IV. Collection Planning

All AZA accredited institutions should have a collection planning process in place. Program 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 program animals:

1. Listing of approved program animals (to be periodically amended as collection changes). Justification of each species should be based upon criteria such as:
  - Temperament and suitability for program use
  - Husbandry requirements
  - Husbandry expertise
  - Veterinary issues and concerns
  - Ease and means of acquisition / disposition according to the AZA code of ethics
  - Educational value and intended conservation message
  - Conservation Status
  - 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 Program Animal Policy should address the specific messages related to the use of program 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 program 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 program 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 program 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., handwashing 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 Program 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 program 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. Where ever 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 program animals is consistent with that of other animals in the collection.
7. Whenever possible have a “cradle to grave” plan for each program animal to ensure that the animal can be taken care of properly when not used as a program animal anymore.
8. If lengthy “down” times in program 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 program 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 or not 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 numbers 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 a number of logistical issues related to program animals, including:

1. Where and how the program 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 Program 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 Program 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.

## Appendix F: Red-legged Seriema Hematological Reference Values

Test	Units	Mean	St. Dev.	Minimum Value	Maximum Value	Sample Size	Animals
White blood cell count	*10 <sup>3</sup> /μl	14.27	9.308	3	52.6	30	20
Red blood cell count	*10 <sup>6</sup> /μl	2.34	0.42	1.55	3.13	16	9
Hemoglobin	g/dl	13.1	2.3	11.5	14.7	2	2
Hematocrit	%	41.8	5	29	50	29	20
Mcv	fL	178.3	29.7	120.1	225.8	16	9
Mch	pg/cell	47.5	0	47.5	47.5	1	1
Mchc	g/dl	31.1	3.3	28.8	33.4	2	2
Heterophils	*10 <sup>3</sup> /μl	8.569	7.238	0.733	38.4	30	20
Lymphocytes	*10 <sup>3</sup> /μl	3.702	3.072	0.186	13.1	30	20
Monocytes	*10 <sup>3</sup> /μl	0.845	0.818	0.048	3.29	25	17
Eosinophils	*10 <sup>3</sup> /μl	1.26	0.994	0.096	3.525	27	18
Basophils	*10 <sup>3</sup> /μl	0.298	0.185	0.122	0.868	16	13
Calcium	mg/dl	10.6	2.1	6.8	17.4	22	15
Phosphorus	mg/dl	5.2	2.5	2.5	9.4	8	4
Sodium	mEq/L	309	466	145	1552	9	7
Potassium	mEq/L	3.8	1	2.1	6	9	7
Chloride	mEq/L	133	37	114	199	5	5
Carbon dioxide	mEq/L	13	0	13	13	1	1
Blood urea nitrogen	mg/dl	3	0	3	3	2	1
Uric acid	mg/dl	7.8	3.8	2.8	18	24	17
Total bilirubin	mg/dl	0.2	0.1	0	0.3	6	3
Glucose	mg/dl	268	120	0	382	15	10
Cholesterol	mg/dl	91	79	0	138	3	2
Creatine phosphokinase	IU/L	508	236	179	906	12	7
Lactate dehydrogenase	IU/L	744	340	211	1310	17	12
Alkaline phosphatase	IU/L	831	504	209	2118	17	11
Alanine aminotransferase	IU/L	16	22	5	86	12	10
Aspartate aminotransferase	IU/L	224	251	63	1114	22	16
Total protein (colorimetry)	g/dl	4.6	0.9	2.6	6.5	27	16
Globulin (colorimetry)	g/dl	2.6	0.5	1.9	3.4	8	4
Albumin (colorimetry)	g/dl	1.8	0.3	1.4	2.1	8	4
Fibrinogen	mg/dl	170	157	0	400	10	4

International Species Information System. (2002). J. A. Teare (Ed.). Physiological Data Reference Values 2002 Conventional U.S.A. Units.

## Appendix G: Handrearing Protocol

Recommended hand-rearing protocol for seriemas (S. Hallager, personal communication)

Day	Diet	Enclosure	Miscellaneous
1–10	<p><u>Day 1–5: Feed 5x/day</u></p> <p>First feeding should be offered at 12–18 hours post hatch. Healthy chicks should attempt to grab offered food items (e.g., pinkies [halved or thirds], soaked dog chow, vionate, vitamin supplement, and calcium carbonate. Add cricket abdomens on day 2. If chicks are not attempting to eat, it may be a sign they are dehydrated. To ensure proper hydration, water should be given via a syringe (no needle) at every feeding, and all food should be dipped in water prior to feeding.</p> <p><u>Day 6–10: Feed 4x/day</u></p> <p><u>Day 7:</u> Add bird of prey diet.</p> <p><u>Day 10:</u> Add one-week-old mice w/o heads.</p> <p>(Night feedings are not necessary unless chicks are not growing properly. Chick weights should be recorded before the first feeding of each day from day 1–30.)</p>	<p>Brooder temperature should be 34.4–35 °C (94–95 °F), and can be lowered to 33.3 °C (92 °F) on day 3.</p> <p>Recommended dimensions for the brooder are 69.85 cm x 33 cm x 35.5 cm (27.5 in. x 13 in. x 14 in.).</p> <p>Floor should be carpeted and a feather duster hung in a corner to simulate the mother. Single chicks should be given a mirror. A towel formed in the shape of a nest will help the chick feel secure when placed in it.</p>	<p>Weight gains should be consistent after day 5. Daily weight gains of 10–15% are optimal.</p>
11–29	<p><u>Day 11–16: Feed 4x/day</u></p> <p>Day 12: Add whole two week old mice cut in half.</p> <p><u>Day 17–22: Feed 3x/day</u></p> <p><u>Day 23–25: Feed 2x/day</u></p> <p>Leave food in overnight</p> <p>Day 26: Decrease hand-feeding, but birds start eating on own.</p> <p>(Ensuring that chicks continue to defecate normally is important.)</p>	<p>A carpeted nursery area should be provided: 0.5 m x 1 m (19.5 in. x 39 in.).</p> <p>Area should contain a small/medium towel lined bowl or artificial nest.</p> <p>Three heat bulbs should be suspended from the ceiling so that 3 separate sections of the floor are kept at 35 °C (95 °F).</p> <p>Several feather dusters should be suspended near the heat bulbs.</p> <p>Single chicks can be given a mirror.</p>	<p>Chicks should continue to be encouraged to move about throughout the day. If outdoor temperatures are 24 °C (75 °F), chicks may be taken outside for exercise if they have started to walk. Once chicks have been given access to outside yards, they should be carefully monitored for the ingestion of foreign material that could result in impaction. At week 3–12 chicks should be moved into a wire cage with newspaper substrate and straw nest. Heat lamp added for warmth.</p>
31+	<p>Chicks should be on the adult diet after 31 days.</p>	<p>Chicks should be moved outside to a covered yard measuring 5 m x 15 m (16 ft x 49 ft), and the pen set-up should be similar to that of an adult. They should be housed in a heated shed at night.</p>	

## Growth rates of four chicks: Days 1–30 (M. Macek, personal communication)

Day	Bird A Weight g (oz)	Bird B Weight g (oz)	Bird C Weight g (oz)	Bird D Weight g (oz)
Day 1	63 (2.2)	60 (2.1)	54 (1.9)	60 (2.1)
Day 2	62 (2.2)	64 (2.3)	55 (1.9)	63 (2.2)
Day 3	62 (2.2)	75 (2.6)	67 (2.4)	71 (2.5)
Day 4	75 (2.6)	86 (3.0)	80 (2.8)	86 (3.0)
Day 5	82 (2.9)	95 (3.4)	102 (3.6)	101 (3.6)
Day 6	95 (3.4)	110 (3.9)	123 (4.3)	125 (4.4)
Day 7	122 (4.3)	126 (4.6)	153 (5.4)	151 (5.3)
Day 8	138 (4.9)	148 (5.2)	183 (6.5)	174 (6.1)
Day 9	162 (5.7)	168 (5.9)	206 (7.3)	208 (7.3)
Day 10	178 (6.3)	184 (6.5)	236 (8.3)	231 (8.1)
Day 11	221 (7.8)	205 (7.2)	270 (9.5)	264 (9.3)
Day 12	244 (8.6)	225 (7.9)	292 (10.3)	291 (10.3)
Day 13	278 (9.8)	231 (8.1)	310 (10.9)	313 (11.0)
Day 14	300 (10.6)	261 (9.2)	335 (11.8)	340 (12.0)
Day 15	333 (11.7)	294 (10.4)	370 (13.1)	366 (12.9)
Day 16	347 (12.2)	315 (11.1)	390 (13.8)	402 (14.2)
Day 17	368 (13.0)	340 (12.0)	414 (14.6)	439 (15.5)
Day 18	403 (14.2)	359 (12.7)	444 (15.7)	476 (16.8)
Day 19	432 (15.2)	376 (13.3)	471 (16.6)	493 (17.4)
Day 20	465 (16.4)	410 (14.5)	493 (17.4)	517 (18.2)
Day 21	489 (17.2)	465 (16.4)	542 (19.1)	538 (19.0)
Day 22	512 (18.1)	478 (16.9)	528 (18.6)	568 (20.0)
Day 23	536 (18.9)	504 (17.8)	568 (20.0)	566 (20.0)
Day 24	622 (21.9)	510 (18.0)		598 (21.0)
Day 25	638 (22.5)	548 (19.3)		
Day 26	688 (24.3)	562 (19.8)	690 (24.3)	682 (24.1)
Day 27	712 (25.1)	602 (21.2)		
Day 28	754 (26.6)	622 (21.9)	700 (24.7)	716 (25.3)
Day 29	784 (27.7)	660 (23.3)		
Day 30	796 (28.0)	692 (24.4)		

## Appendix H: Red-legged Seriema Ethogram

### Red-legged seriema ethogram (Padgett, 2012)

A red-legged seriema ethogram was developed from naturalistic behavior observations of 22 seriemas in zoos. Ethogram behaviors have been grouped into six categories, including locomotion, functional, resting/ stationary, maintenance, reproductive, and vocalizations and include a description of 47 basic behaviors and vocalizations.

#### Locomotion

- Walking: Alternating movement of legs at a steady rate.
- Running: Alternating movement of legs at a rapid rate.
- Flying: Extension of wings, with flapping, with no body part touching substrate.
- Jumping: Legs are bent, then extended, and both feet leave the ground simultaneously without wing flapping.
- Chasing: Running while directing body toward an animate object.
- Hock walking: Bird has tarsi on the ground and the tibias are vertical, with belly not touching the ground and from this position moves forward using legs.
- Pacing: Walking back and forth repeatedly along the same track.
- Kicking: Jump and thrust both legs forward.
- Startle: Tensing of the body followed by a jump and/or wing flapping.

#### Functional

- Prey capture: Chasing flying or crawling insects or small vertebrates and detaining them with beak.
- Feeding: Pecking, using beak, to consume foliage or may repeatedly drop and shake pieces of food over and over, followed by tearing food, while using beak to tear and feet to hold and then consuming by tilting head back to swallow food.
- Digging for prey: Using beak to burrow into substrate to find and obtain prey.
- Allofeeding: Adults bring food to each other and pass back and forth between beaks several times before being consumed.
- Whack food or objects: Throwing food or inanimate objects on ground repeatedly using beak to hold and neck to thrust.
- Object pass: Delivering inanimate items back and forth between individuals using beaks.
- Drinking: Consuming water, while standing, using a repeated scooping motion with beak with head tilted back to swallow.
- Foraging: Scanning the ground for food while walking.
- Pecking: Using beak to investigate substrate, enclosure, another bird, plants, prey, or other objects.
- Bill Wiping: Individuals rub the sides of their beak on the ground or other objects.
- Defecation: Excreting feces from a standing position with tail feathers raised away from the cloaca.
- Looking: Attenuate head and eyes toward observer or a moving object located outside enclosure.
- Skyward Looking: Extending neck and using one or both eyes to look upwards. If using only one eye, the head is tilted.
- Listening: Attenuate head and extend neck in the direction of a sound.

#### Resting/Stationary

- Standing perch: Body is positioned in a stationary stance unipedally or bipedally on an elevated object.
- Lying perch: Body is positioned in a lying position on an elevated object.
- Hock sitting: Sitting position, in which the bird has tarsi on the ground and the tibias are vertical, with belly not touching the ground.
- Lying: Legs folded and tucked under body with belly touching the ground.
- Head tuck: Standing with the head tucked against the back of the neck with body feathers fluffed.

**Maintenance**

- Scratching: Using the talons on the feet to rub a body area.
- Stretching: Leg and wing on the same side of the body are extended backward simultaneously and may include the upward extension of wings.
- Body fluffing: Feathers on the body, neck, and wings are erected for a few seconds.
- Ruffling: Shaking the body in a wavelike manner, from head to tail.
- Preening: Grooming feathers using beak to peck, pull, and clean feathers, with or without the use of the preening gland, which is located at the base of the tail.
- Dust bathing: Lying on substrate, usually dirt or sand, rubs body, wings, head, and neck on ground and may also roll onto the side of the body.
- Sun bathing lying: Lying on belly in direct sunlight with wings extended and spread on the ground, while lying very still.
- Sun bathing standing: Standing in direct sunlight with wings dropped to the sides to expose the back of the body.
- Bill gaping: Beak is opened wide and then shut.
- Bill open: The beak is held partially open while standing or walking.
- Coughing/Sneezing: Air is expelled from the lungs noisily and suddenly, voluntarily or involuntarily.
- Choke: Beak is opened wide and held open while extending neck forward. Debris may or may not be expelled.

**Reproductive**

- Copulation: Male climbs onto the back of the standing female to allow transfer of sperm.
- Nest building: Collecting of leaves and sticks by a male/ female pair and consolidating them in a bush or tree.
- Incubation: Male and female parents alternate positioning their bodies over the nest, in a lying or standing position.

**Vocalizations**

- Purr: Very quiet, low frequency, short-range sound.
- Single note: Short, loud, vocalization that consists of a "whoop" sound.
- Primary call: Loud vocalization given from a stationary, standing position that begins with U notes and increases in intensity and structure through the climax, involving L and T notes. The beak is pointed upward, while the head and neck move up and down. Head may touch the back of the body.
- Hiss: Short-range vocalization directed at non-threatening intruders or nuisances.