Brolga (*Grus rubicunda*)
Husbandry and Handraising

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1. Introduction.

The Brolga belongs to a worldwide group of cranes numbering 15 species; is one of 2 cranes native to Australia that also occupies a small area in New Guinea (Meine & Archibald 1996). Brolgas (Figure 1.) are tall stately grey birds; with a long neck, beak and legs and can be observed either singular, in pairs or flocks. Brolgas roost on the ground, are omnivorous feeding by day, preferring habitat with ephemeral or permanent water-bodies; and move from area to area depending on weather/breeding season and food availability. The only other native crane is the Sarus Crane (*Grus antigone.*) to which they can interbreed and hybridise in captivity. The resulting offspring called *Sarolgas,* are fertile and can produce young of their own (ICF 1999).

Weights:
Adult Males: 4.5 – 7.25 kg, Adult Females: 3.2 – 5.2 kg (ARKS. 2004)

Measurements:
Males: 1050 – 1250 mm, Females: 950 – 1150 mm. (Schodde & Tidemann eds. 1997).

Eggs:
Tapered-oval**,** roughly 92 x 61mm; basically cream with reddish-brown and lavender markings. (Schodde & Tidemann eds. 1997). Refer Figure 4.
Clutch size usually 2 eggs, 3 possible (Pizzey 1999).

Incubation Period:
28 – 36 days, mean 30 days (Ellis *et al.* 1996).

Sexing Methods:
Laparoscopy; DNA Analysis, Faecal, Steroid, Feather Pulp, or Vent Sexing. A natural way would be in observing the behaviour of the birds. In captivity the female usually is timid, showing neck-retracted submissive postures. The male is usually dominate, with a more erect and aggressive posture, spending a lot of time observing and approaching intruders (Ellis *et al.* 1996).

Note: Although it is usually the male that is the aggressive of the sexes, at Perth Zoo it was noted that their female Brolga was extremely aggressive (Robertson, H. pers.comm).

In a **pair situation,** the following **characteristics are more prominent.** Interpretation on the **Unison-call** (Figure 3.), the male stands with elevated wings and drooped primaries, while the female stands with her wings closed.

2. Taxonomy

2.1. Nomenclature

Class:	Aves
Order:	Gruiforms
Family:	Gruidae
Subfamily:	Gruinae
Genus Species:	*Grus rubicunda*

2.2. Subspecies:

None, the northern and southern Brolga are now regarded as discrete populations and are no longer subspecies (Ellis *et al.* 1996).

2.3. Other Common Names:

Australian Crane or Native Companion. (Ellis *et al.* 1996).

3. History

Brolgas still occupy most of its historical range, although in recent decades, there has been a decline in south eastern Australia mainly due to habitat loss and degradation. Other threats include collision with utility lines; subdivision and subsequent fencing of large private land holdings; and feral animals (mainly the Red Fox – *Vulpes fulva*).

3.1. Diagnostic Features. (Guesclin 2003).

Adults: Both sexes have same features, with the females slightly smaller in size. Light grey in colour, long necked, standing 1.8 metres tall, with dark grey/black legs and feet. Bill is long, straight and dark in colour, being relatively large in comparison to head. Head is conspicuous orange/red, with grey ear converts and a bare crown of greenish grey skin, and has a dark pendulous dewlap (Refer figure 1). Iris is yellow to reddish/orange. Wingspan is 1.7 – 2.4 metres.

Juvenile:

At 11 to 22 months their head feathering gradually disappears and attains the reddish colouring.

Immature:

Up to 10 months of age their iris is dark brown, with head fully covered in grey feathers (Figure 2).

3.2 Distributions and Habitat.

Brolga are found in open swamplands of coastal and sub-coastal tropical Australia, and into the eastern interior (Figure 5.). Small local populations occupy through Murray-Darling basin to western Victoria (with none in Tasmania). Vagrant to southern New Guinea, New Zealand, Coral Sea and south western Asia (Schodde & Tidemann eds. 1997),

Population trend and numbers of sub-tropical Northern Australia Brolgas far outweigh the South Australian population. Conservation Status of the Northern Australian population is considered at Lower Risk, with a population between 20,000 – 100,000 Brolgas, and the Southern Australian population considered Vulnerable with an estimate of 1,000 (Meine & Archibald 1996).

Brolga are non-migratory, but do move around in response to the seasonal rains. They are regarded as one of the most opportunistic of the cranes, evolved to use the weather to their advantage with an ability to exploit a wide variety of habitat types. Flocks with numbers up to several hundred forms out of breeding season, travelling long distances in search of food and reaching as far as the Simpson Desert. Northern populations concentrate during the dry season in coastal freshwater wetlands and in the wet they spread to breeding territories in freshwater and brackish marshes, wet meadows and other seasonal wetlands. Southern populations also move between wet season breeding territories and traditional dry season flocking grounds, although these areas are less marked. (Meine & Archibald 1996).

3.3. Breeding

Brolgas are seasonal layers, depending mainly on the rainy season. It was noted by the ICF, in USA (Luthin *et al.* 1986; Ellis *et al.* 1996), that Brolgas adjusted to Northern Hemisphere conditions and breed July to August. A sprinkler device that is turned on three times daily for half-an-hour is used to simulate rainy season conditions, thus stimulating the Brolgas to breed.
If anything happens to destroy their clutch, they will renest in a couple of weeks (pers.obs).
Sexual maturity occurs at 2 – 3 years of age. Last breeding is not well documented, but in other species of cranes, the age of still being able to breed is at 75 years of age for a Siberian Crane at ICF. (Ellis *et al.* 1996).

3.4. Growth and Development

Crane chicks are precocial; feeding encouraged by parents, and then gradually enters a more independent foraging phase at 4-8 weeks. Chicks are first covered in grey natal down and during the first few weeks of growth, the legs and neck grow proportionally faster than the wings. Juvenile plumage replaces their down by the time it fledges, with all primaries completely grown by 4 – 5 months. Basic plumage is again replaced before they are a year old. Subsequent moults are yearly throughout the bird's life. (Ellis *et al.* 1996).
Fledging is at 90 – 100 days, staying with their parents until the onset of the next breeding season or for another breeding season if the parents did not re-nest (Guesclin 2003).

3.5 Longevity.

In captivity, 41 years of age (and still living) is the oldest recorded (SPARKS 2006), though there is no documentation found for longevity in the wild
A Siberian Crane has been documented to live to 70 years plus, with other species of cranes well into their sixties (Ellis *et al.* 1996).
There are no known techniques to determine ages of adult Brolgas.

4. General Husbandry

4.1. Housing Requirements

Predator proof area with recommended fence height 2.3 to 2.6 metres allowing sheltering for food and weather. If birds are able to fly, nylon flight roof netting is recommended. (Ellis *et al.* 1996).

Sheltering trees should suffice for weather protection, otherwise if trees are sparse, a shelter consisting of four posts and a roof, with soft substrates such as soil, grass, tussocks, and mulch.

A shallow water moat/pond or stream with aquatic plants to promote natural feeding is beneficial.

4.2. Hygiene and Cleaning Requirements.

(Ellis *et al.* 1996).

Holding facilities or pens need to be large enough to prevent build up of micro-organisms and parasites in soil and under shelters. To keep outdoor pens clean allowing the soil pathogens to die; more than one pen should be made available so as to rotate each year. If pens used for rotation are $50m^2$ of space, then the pens normally do not need to be cleaned. If there is an unusually high amount of pathogen load, then disinfecting can be done by tilling the topsoil and applying lime, formalin, or a commercial disinfectant effective against that particular disease.

Shallow pools are to have either a slow, continuous flow or need to be cleaned every 3 to *5* days (if a chick is in pen, then more frequently). If the water stagnates there is a possibility of lethal bacteria called *Clostridium botulinum* to flourish. Cranes need fresh drinking water at all times.

Feeders should be elevated to prevent contamination by vermin and are placed at least 1 m away from the water supply to prevent contamination. Provision of soft substrates will keep feet healthy.

4.3. Methods of Identification (ID).

Leg Bands: Metal (aluminium) and/or coloured plastic bands placed above the hock. The inside bands diameter is 16 – 18 mm. If the sex is known before permanent banding, the males can be banded on one leg and the females on the other. This gives ease of long distance sex identification. Metal bands are engraved with individual ID numbers. Coloured bands allow for individual long distant identification of a bird in a flock situation. Various colours and positions of one to three bands allow for a multitude of combinations. If using this method, an interlocking aluminium band positioned between two coloured bands prevents one colour band slipping over the other. (Ellis *et al.* 1996).

4.4. Record Keeping.

All records and dates relating to health; veterinary treatments; behavioural and reproductive observations; changes in diet; weights/measurements and growth; catching, handling and transport techniques; internal and external movements; necropsy record; need to be documented.

5. Feeding

5.1. Wild Diet.

Omnivorous, eating tubers of the Bulkuru Sedge *(E!eocharis du!cis)* which is their main diet in the dry season (in the northern parts of Australia); other wetland plants; upland plants (including cereal grains); insects; freshwater and saltwater molluscs; crustaceans and frogs (Meine & Archibald 1996).

5.2. Captive Diet.

Ellis *et al.* (1996) documents that Brolgas consume roughly 4% of their body weight per day. Most formulated diets are composed of less than 10% animal matter and the rest vegetable matter.

TWP Brolga Mix daily feed — 1 to 2 mice each, mixed grain, * Meat Mix, * Greens and Vegetable Mix. * Refer Appendices.

Auckland Zoo — Hand-rearing and Adult Diets refer Appendices.

Serendip Sanctuary — Hand-rearing and Adult Diets refer Appendices.

5.3. Supplements.

TWP - A couple of weeks prior to the start of the breeding season, mealworms or other insects are given as an extra, when available, roughly once a week. Taro plants (*Colocasia esculenta*) thrown in when available. Fish (pre-frozen) are given roughly once a month.

6. Handling and Transport

6.1. Timing of Catching and Handling.

Accomplished usually early as possible in the day, as this is the coolest time, the birds do not over-heat through stress and allows time for observations throughout the day after release. (pers. obs.).

6.2. Capture and Restraint Techniques.

As a safety issue it is wise to wear light glasses in case the Brolga attacks the eyes.

Capture at TWP: The best method to catch a territorial Brolga in a large space is with one person only. When you first approach and open the gate, the Brolga is usually close by and usually just stands and preens whilst assessing you, before he decides to attacks. Left hand is used to capture the head and the right hand is used to go over the right side of birds body and catch the shoulder /wing, at the same time drawing the bird in close to you with his back to you, and legs facing away from you. For catching timid Brolgas, the bird is herded by 2 or more persons into a smaller yard and caught by one person again, as they are too frightened to attack (pers. obs.). Upon capture a sock or hood is applied over heads of all brolgas to effectively quieten the bird.

Ellis *et al.* (1996) recommends that for capture of a Brolga, 2 – 4 people are needed to approach the bird slowly with arms outstretched, herding the individual into a corner. As soon as the bird about to escape past, catchers rush in and grab the bustle (rearward, protruding, elongate tertiaries), one wing (humorous) or both wings and the neck. Because Brolgas tend to jump, arms need to be angled upwards and outward when cornering and be prepared to grab a wing (and go a little with the bird) as the bird tries to jump over you.

Restraint: (Figure 6, 7 & 9). Wings and legs restrained when caught then pull body of bird towards your own, and divert the head of Brolga away from you avoiding facial injury. If grasping legs above the hocks, always place one finger between the hocks to preventing legs abrading each other. If Brolgas legs must be folded, tarsi to be gently forced around, but if the bird locks its hocks rigidly, legs are not to be forced to fold. Instead, keep steady pressure on the tarsi until the bird allows you to fold its legs. Do not support Brolga's weight on their folded legs. When holding with folded legs, support the Brolga's weight with the arm holding its body. Legs are not to be kept folded for more than 30 minutes. (Ellis *et al.*1996.)

At Serendip Sanctuary Brolgas heads are hooded and then placed on material that is then wrapped around them gently and securely to keep them quiet and less stressed. (Figure 8). Velcro is used for securing in wraps & hood, with additional rope around shoulders & tail.

6.3. Weighing and Examination.

(Ellis *et al.* 1996).

Weighing: Chicks to be placed in cardboard boxes that are high enough to prevent escaping, with a carpet flooring for sound footing. A keeper should be there to place a hand on top of the box to keep it closed and to prevent tipping.

Brolgas > 2kgs can be weighed either on a platform scale, or while being held by a keeper on a smaller scale. Another method is to use a 10 – 15 kg capacity suspension spring scale with 0.1kg accuracy weighing birds held either in a weighing sling, or a cloth sack tail first, with the neck and head projecting from the bag. There have been injuries noted with weighing birds with the cloth sack method, as the legs have to be folded.

Examination: For holding the Brolga down on the ground with legs folded in a sitting position, without placing your weight on the bird, kneel down with your legs surrounding the birds' wings (Figure. 7). Hands are used if the bird struggles. This technique is handy for examining the head, dorsum or treatments such as force-feeding. Hooding can also be used.

6.4. Release.

Upon releasing a Brolga, allow its legs to touch the ground first before letting go of the wings and body. Holding the bustle or one wing whilst releasing the legs to keep it steady on its feet, moving forward a step or two with the bird. This is a leg injury prevention method except for birds that tend to thrash around violently on release, in which case it would be better to just let it go cleanly. (Ellis *et al.* 1996).

6.5. Transport Requirements.

(Ellis *et al.* 1996).

Adults: Move birds as little as possible to minimise stress.

- Moves less than 200 meters, carry the Brolga while walking to destination.
- Longer distance, hand carry the bird into a vehicle and hold it during transport. Use a hood or covering with a towel for nervous or aggressive birds.
- For longer distances a crate is recommended. The crate can be in an open truck, but needs to be tied down. Whilst driving, avoid bumps, abrupt turns, and sudden changes in speed.
- Shipping Brolgas by air, crate design and shipping arrangements should comply with International Animal Transfer Association (IATA) guidelines (refer Appendices).
- One Brolga per crate or a double crate with a solid divider for two birds.

Chicks: Young Brolgas (especially **<** 4mths old) should not be transported except for special purposes (refer Chapter 6.5.2), and even then is accompanied by a keeper. Added to this, young Brolgas are prone to leg and wing injuries during transport and need extra floor padding in their crate.

6.5.1. *Box design and materials.*

Should comply with International Air Transport Association (IATA) guidelines. IATA provides Live Animal Regulations for container requirements (Refer Appendix). Within container, 5cm layer of wood shavings placed on floor to absorb faeces.

6.5.2. *Water and Food.*

Adults: Food not needed during trips of less than two days. After one day of travel in cold to moderate temperatures the Brolga needs to drink. The higher the temperature the more water the bird drinks. Placement of a familiar water dish in the crate for 1/2 hour will give ample time for the bird to drink. Installation of a permanent water dish can cause injuries.

Chicks: Young Brolgas (especially **<** 4months old) are less tolerant to extreme temperatures and require one good feed a day with drinks of water every few hours, a lot different to the adult.

6.5.3. *Preventing Injuries.*

- Minimise wing injuries by fastening grip-able floor material fairly securely along its perimeter and eliminating rough edges inside crate.
- The groove of the sliding crate door should be made narrow as possible to prevent the Brolgas getting their toenails hooked during transport.
- When transporting young birds, minimise the crate size to prevent it from turning around. In general, the crate should be 12.5 cm wider than the bird with folded wings. Height and length should be proportionally adjusted.

6.5.4. *Timing of transportation.*

- Avoid airline shipments when temperatures are > 21° C (70° F) and **<** - 1° C (30° F).
- During a long hot road trip Brolgas need to be checked hourly or more often if stress is likely.
- Use the conditions of the natural environment to guide you for its tolerance to the heat and cold conditions of transporting.
- Allow for unseen events that may change transport schedules and jeopardise the bird.
- Transportation best done during the non-breeding time of year.

6.5.5. *Release from the Box.*

Never leave a Brolga in a crate for >10 minutes, when temperature are > 30° C (86°F). For release into a chosen quarantine pen, place crate in a shaded area and leave door open to allow Brolga to exit at will. The pen should not be occupied by any other species. An observation routine is important to ensure all is well.

7. Health Requirements

7.1. Daily health checks.

Personal observation on behavioural and physical changes of the Brolgas should be noted whenever they are within sight. Keepers should know individual's history and be familiar normal Brolga behaviour and physical appearance beforehand. Listlessness, going off food, dull appearance and lack of their usual personal habits are some of the signs of ill health. Observations of aggressive or submissive behaviour may indicate the need for separation (pers. obs.).

7.2. Detailed Physical Examination

Physical examination (Table 8.1) whilst restrained need to be brief but thorough.

Anaesthesia for more in-depth examinations such as radiographs; repair or surgery on wings, serious fractures of beaks, lacerations; endoscopic examinations for sexing or diagnosing respiratory and abdominal disorders; and ventriculotomy (foreign body removal). (Ellis *et al.* 1996).

Table 7. Physical Examination (Ellis *et al.* 1996).

Head & Eyes	Eyes checked – swollen lids, discharge, squinting, or a change in colour of the globe. Possible cause – infection, injury, foreign bodies, or swollen tissues. Dilated pupils may indicate shock, blindness, or concussion. Bleeding in the anterior chamber of eye often due to head trauma. A small light source is used to check pupillary response. Pupils respond individually in birds. An Ophthalmoscope is used for deeper examination of eyes by the vet, if abnormalities are suspected. Atropine will not cause pupil dilation (as in mammals), because of their striated rather than smooth muscle in the iris and ciliary body.

Beak & Mouth	Beaks grow several centimetres a year, so need checking for evenness of wear, bite and overgrowth. If over grown, beaks may need constant trimming every 2 – 4 months. If trauma is suspected, the beak is to be palpated for fractures or other damages. Nares are checked for any plugs or discharges. Beaks often open in vocalisation upon inspection of mouth to allow viewing of inside, if not, then gently pry with the index finger on one side and the thumb on the other side. Mucous membranes are usually bright pink, but some cranes have black or grey-pigmented tissues on the mucous membranes. Based on the moistness of the mucous membranes, level of hydration can be estimated.
Auditory Canal & Neck	Check auditory canal (ear), which are covered in small, fine feathers; for exudates, blood, and infection. Trauma of the canal from aggression can be observed as partially closed, swollen, and filled with blood. Neck, oesophagus and trachea palpated for the presence of liquids, solids, or air. Lower section of the cervical oesophagus called the crop (unlike other bird groups) is undeveloped as a storage area, with liquids and food passing quickly to the proventriculus, so that the oesophagus should be empty upon examination. Gross distension indicates blockage or impaction.
Thorax.	Examined by palpation and listening to the heart. Some cranes infrequently develop subcutaneous emphysema. Trauma, with rupture of an air sac and leakage of air under the skin, is suspected as the general cause, and frequently no wound can be detected.
Body Condition Index	Body Condition Index (**BCI**), can be determined palpating the pectoral muscles and keel to get an estimate the degree of development or atrophy of the birds condition. (Figure 7). Generally birds with an amputated wing will show a loss of pectoral muscle on the amputation side of body. BCI is best determined with the comparison evaluation of the individual, not between birds. Taking an evaluation every time the bird is handled could accomplish this.
Abdomen	Gently palpate for internal masses, ovulated eggs, and fluids. Vent area should be checked for growths, lesions, protrusions, and for urates or faeces accumulating on the feathers. The preen gland above the tail base is checked for enlargement, possibly caused by impaction or infection.
Skin & Plumage	Elasticity of skin indicates general level of hydration. Check for parasites, skin swellings, and missing/damaged feathers. Feathers with dull, frayed, split or with stress bars across may indicate nutritional deficiencies, stress, or hormonal imbalances. Skin irritation and broken feathers or an area of missing feathers are an indication of possible self-mutilation. Similarly, this condition is often associated with reproductive activity in males after being handled for artificial insemination (AI).
Wings	Check all bones and joints while assessing muscle tone and extension. Swellings, abrasions or bruising are common on the carpus. In subcutaneous haemorrhages, green pigment discolouration will develop as the red blood cells (RBC) are destroyed.
Legs	Check as for wings, also broken/missing nails or for swollen areas on toes or plantar foot. Toe swellings occur with dislocations, fractures and Bumblefoot.
Auscultation	The vet uses a stethoscope to determin heart rate, rhythm and location; to detect sounds including heart murmur, and to assess the respiratory system. Crane respiration, unlike smaller birds, produces distinct sounds normally louder on inspiration than expiration.

Temperature.	Unlike smaller birds, cranes appear to have constant body temperatures of 40.5° - 41.1° C. Although cranes are understood to have higher temperatures when not well; cloacal temperature monitoring is not normally used in physical examinations.

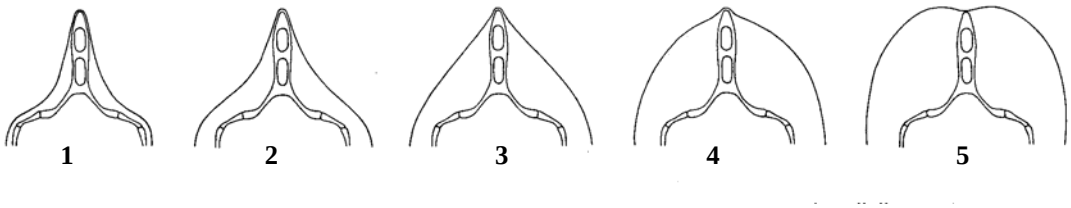

Figure 7. ***BCI, an indicator of nutrition.*** *(Ellis et al. 1996).*
Cross-section through mid sternum of Sandhill Crane (spaces are tracheal cavities).

A on a scale of 1 – 5 the BCI of:

- 4 or 5, indicate a well-muscled or plump bird and the pectoral muscles will be rounded convexly from the keel. When assessing the BCI of the bird, visualising the pectoral muscle will help assess if bird is plump or well muscled
- 3 — have a flat profile to the pectoral muscles.
- 2— have a concave shape to the pectoral musculature.
- 1 — indicates severe muscle atrophy and emaciation.

7.3. Routine Treatments.

Annual health checks including physical examinations and a faecal parasite analysis will help to pick up health problems early.

Worming procedures at the TWP depend on if the Brolgas have a problem with worm infestation. If the birds are normally free of worms, faecal tests are executed every 6 months. If there is a problem then faecal tests are executed every 3 months, with treatment followed by a faecal test. If negative, then a second faecal test is conducted the following fortnight. Faecal checks are then started again 3 months later if all are clear. If at any one of those faecal test checks turns up positive, we treat and start over again.

7.4. Known health problems.

(Ellis et al. 1996).

- For all birds that are sick or injured, a heated environment 30 – 32° C (85 – 90° F) is helpful.
- Prior to assessment, it is often imperative to initiate some form of therapy. Of all therapies, fluid therapy is the most significant except in the cases of severe anaemia or hypoproteinemia.
- Stress can contribute to the outbreak and spread of bacterial diseases.
- Chicks are more susceptible to *Aspergillus* and other pathogens than adults.

Problem: **Vitamin A Deficiency**
Cause: Lack of Vitamin A, occurs more in with birds kept in artificial conditions and on artificial diet, disallowing the birds to pick up natural foods from the soil
Signs: Can appear as proliferative, plaque-like lesions on the epithelium of the alimentary mucosa, ear canal, skin, eyelids, or conjunctiva.
Treatment: Vitamin A injection
Prevention: Green feed, vitamin supplement, or a well balanced diet. (Cutter pers. comm.).

Problem: **Bacterial Pneumonia** (Cutter pers. comm.).
Cause: *Aspergillus fumigatus* (Cutter pers. comm.).
Signs: Respiratory problems. Using a stethoscope, sounds are unilateral and dull. Fails to respond to standard antibacterial therapy. (Ellis *et al.* 1996)
Treatment: Itraconazole, though treatment not generally successful (Cutter pers. comm.). Maintain in a non-stressful, warm environment of 21 – 29° C or 70 – 85° F. (Ellis *et al.* 1996)
Prevention: Sound hygiene (pers.obs.)

Problem: **Ectoparasites** (Ellis *et al.* 1996).
Cause: Outside contamination (pers. obs.)
Signs: Skin irritation, excessive preening, behavioural signs of stress and discomfort (Ellis *et al.* 1996). Visible parasites (Cutter pers. comm.).
Treatment: Fipronil, Derris Dust or Carbaryl powder (use with caution, ensure dust is not inhaled by bird), Ivermectin (Cutter pers. comm.).
Prevention: Constant monitoring (pers. obs.)

Problem: **Helminth Parasites**, including Trematodes, Cestodes and Nematodes (Ellis *et al.* 1996).
Cause: Ingestion from eating contaminated foods (pers. obs.), and wild birds (Cutter pers. comm.).
Signs: Faecal tests (direct smear, floatation, and sedimentation). Large infestation – progressive anorexia, weight loss. (Ellis *et al.* 1996).
Treatment: Fenbenanzole, Ivermectin, Moxidectin or Praziquantel (Cutter pers. comm.).
Prevention: Correct hygiene. (pers. obs.)

Problem: **Thrush** (Cutter pers. comm.).
Cause: *Candida a!bicans* (Cutter pers. comm.).
Signs: Thick white raised plaque-like lesion covering the mucosa within the oral cavity and may extend into the oesophagus, proventriculus and such. Lesions also noted for beak erosion (Ellis *et al.* 1996).
Treatment: Nilstat (Nystatin), Amphotericin B (Cutter pers. comm.).
Prevention: Sound hygiene (pers. obs.)

Problem: **Coccidia** (Ellis *et al.* 1996).
Cause: Protozoan (Ellis *et al.* 1996).
Signs: Oocytes found in faecal test. Large infestation — dysentery, anorexia, depression and dehydration (Ellis *et al.* 1996).
Treatment: Baycox (Totrazuril) and Trimethroprim/sulfa (Cutter pers. comm.).
Prevention: Hygiene and ongoing monitoring. (pers. obs.)

Problem**: Avian Pox infection**
Cause: Avian Pox virus – through biting insects, mainly mosquitoes
Signs: Proliferative lesions (lumps) around bare-skin areas and feet
Treatment: Self-limiting
Prevention: Mosquito prevention (Cutter pers. comm.).

Problem: **Orthopedics *Bumblefoot*** (Ellis *et al.* 1996).
Cause: Foot wounds infected by *Staphy!ococcus aures* (Ellis *et al.* 1996) and other bacteria (Cutter pers. comm.).
Signs: Swelling at base of foot (Cutter pers. comm.).

Treatment: Surgical debridement, antibiotic therapy – Enrofloxacin, Amoxycillin/Clavulanic acid, Trimethroprim/sulfa, Lincomycin and antiflamitory eg, Meloxicam (Cutter pers. comm.).
Prevention: Soft substrate, good hygiene and early treatment to wounds (Ellis *et al.* 1996).

Problem: **Shock** (Ellis *et al.* 1996).
Cause: Trauma, injury and or disease (Ellis *et al.* 1996).
Signs: Dilated pupils, shock and/or abnormal, slow behaviour (Ellis *et al.* 1996).
Treatment: Lactated Ringer's solution or normal saline (Ellis *et al.* 1996), cortiosteroids, oxygen (Cutter pers. comm.).

Problem: ***Salmonella* spp** (Cutter pers. comm.).
Cause: Carriers of *Salmonella* (Cutter pers. comm.).
Signs: Cultured from faeces (Cutter pers. comm.).
Treatment: Either of the following antibiotics based on culture and sensitivity results – Trimethroprim/sulfa, Tetracycline or Ampicillin (Ellis *et al.* 1996).
Prevention: Find and eradicate carriers (Ellis *et al.* 1996).

Problem: **Avian Tuberculosis** (Ellis *et al.* 1996). (Ellis *et al.* 1996).
Cause: *Mycobacterium avium* (Cutter pers. comm.).
Signs: Bone problems (Ellis *et al.* 1996).
Clinical Signs: Anorexia, weight loss, abdominal organ enlargement, presence of masses on radiograph, and an elevated WBC count (Ellis *et al.* 1996).
Diagnosis: Laparoscopy, faecal culture, and liver biopsy (Ellis *et al.* 1996).
Treatment: Difficult to treat and usually unsuccessful (Cutter pers. comm.).
Prevention: Quarantine, identification and removal of carriers, and good hygiene (Cutter pers. comm.).

Problem: ***Escherichia coli* in chicks** (Ellis *et al.* 1996).
Signs: Over abundance of bacteria in gastrointestinal tract, diarrhoea or death (Ellis *et al.* 1996).
Treatment: Antibiotics – Enrofloxacin, Clavulanic acid and Trimethroprim/sulfa amoxcillin (Cutter pers. comm.).
Prevention: Good Hygiene (Cutter pers. comm.).

Problem: **Osteomylitis**
Cause: Can be secondary to open fractures contamination during or before surgical procedures or in Bumblefoot.
Signs: Limb problems, also shows up in radiographs.
Treatment: Antifungal or antibiotics, chosen by sensitivity and culture testing. (Ellis *et al.* 1996).

7.5. Quarantine requirements.

Ideally, quarantine facilities should be situated at least 1 km away from other crane pens. Any contaminated soil-areas should be left a year before re-use. For cranes entering or leaving, implement 30 – 60 day quarantine with disease screening. Prophylactic treatment for parasites and vaccination for TB and Botulism is advocated to meet the needs of the birds. Using an antibiotic (antibacterial or antiviral) footbath can reduce cross contamination between pens. The footbath is a shallow container at least 40cm in diameter containing 6 – 10cm . (Ellis *et al.* 1996).
TWP veterinarian does not consider vaccinations are necessary. Vaccinations have not been administered or needed in the history of TWP.

8. Hand rearing of Brolga chicks

8.1. Diet and Feeding Routine

Chick diets (Refer Appendices) should take note to use vegetable protein only. Diets containing too high content of sulphur amino acids are associated with the development of more wing and leg abnormalities than diets with low levels of sulphur amino acids. Care needs to be taken, as they are not easy to coax to drink water, they have to be taught this before dehydration takes hold. (Ellis *et al.* 1996).

8.2. Handling Requirements (Figure 9)

Crane chicks are very fragile, and improper handling can lead to broken or damaged bones, lacerations and ruptured yolk sac, all of which can be fatal. (Ellis *et al.* 1996).

8.3. Hygiene.

- Regular veterinary examinations especially during the first critical week
- Flooring cleaned daily
- Fresh food and water daily or whenever contaminated.

8.4. Behavioural Considerations.

- When chicks are cold they shiver and call.
- Over heated chicks pant and/or hold their wings away from body.
- Have access to cooler areas throughout day, but need to be coaxed back or returned to warmer area when chilled and for the night.
- Brolgas like wading, so a shallow, non-slip flat dish of water to be made available, or under supervision, have the chick go for a swim (if it likes), which is also excellent for exercise.
- In the wild parents teach the chick to eat by offering food on the tip of their bill. When hand-rearing chicks, similar methods must be applied. Crane chicks' best respond to thin, long, red shapes. Red plastic spoons, red tape attached to the bill of a puppet, red-tipped dowels, taxidermic head, or feeding syringes may all be used in training the chick to drink and eat. It is best to prevent a Brolga chick to imprint to a human, as this would cause social and breeding problems in the future. For Imprinting prevention techniques, refer to "Cranes: Their Biology, Husbandry, and Conservation", Ellis *et al.* (1996).
- At Serendip Sanctuary they feed the chicks with tweezers through a feather duster. This feather duster is kept in with the Brolga chick to act as security, for them to snuggle up to or hide in (M. Smith. pers. comm. 2005).

8.5. Weights of Hand Reared Chicks

Ellis *et al.* (1996) states that at hatching Brolga chicks usually weigh between 100 – 130 gms and a weight loss of 10 – 15 % is normal in the first 3 – 5 days. If more than 15% of their body weight is lost, chicks should be monitored closely and encouraged to eat. If weight loss continues or lethargy sets in, support with subcutaneous injection of fluids and gavage feeding will be required. Excessive weight gains are quite common in hand rearing cranes during the most rapid growth period of approximately 10 – 14 days. Continuous weight gains exceeding 10 – 15% per day can be troublesome (refer Appendix on Food Rationing for Hand reared Chicks). Even chicks under 10 days, or whose weight gains are less than 10%, occasionally suffer leg deformities; therefore, daily monitoring is paramount. Unlike hand reared chicks, parent raised chicks rarely suffer from leg and wing deformities. Exercise is one of the preventing factors, so it is advisable that exercising the chick to be encouraged (e.g. walking, running and swimming).

Table 8: An example of **Percent Weight change over one week periods** below (Ellis *et al.* 1996).

Wk 1	**35**	Wk 2	**85**	Wk 3	**61**	Wk 4	**60**	Wk 5	**46**
Wk 6	**45**	Wk 7	**38**	Wk 8	**32**	Wk 9	**18**	Wk 10	**13**
Wk 11	**8**	Wk 12	**5**	Wk 13	**4**	Wk 14	**3**		

8.6. Temperature and Rehabilitation Procedures

First week, hand raised Brolga chicks are required to be kept in temperatures of 35 – 37 ° C, monitoring not only temperature but behaviour also. Temperatures can be decreased by 3 ° C each week for healthy chicks, but take care not to drop below 21.5 ° C until the chicks are at least 3 weeks of age. (Ellis *et al.* 1996).

Winton of New Zealand (2003) documented for chicks

- 3 days age, leave the brooder to an environmentally controlled indoor pen.
- 14 days age, their diet changed from crumbles to pellets.
- 21 days age, left outside during the day, brought in at night.
- 45-72 days age left outside day and night.

At Serendip Sanctuary of Victoria (Helman pers. comm.).

- After 24 hrs in brooder, placed in a totally enclosed room with a heater close by within.
- 2 days old to 4 – 5 mths old, placing in larger areas as progressively growing, with the heater being raised higher in height.
- 4 – *5* mths old, placed permanently outside in a fully open enclosure, but still has access to warmth from a heater until they no longer need it.

9. Acknowledgments.

Michael Helman, Serendip Sanctuary, Victoria, for advice and comments; and allowing me to stay and learn at the Sanctuary for 2 weeks.

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Personal Comments

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Smith, M. (2005). Ranger, Serendip Sanctuary, Lara, Victoria. 3212. Australia.
Email: msmith@parks.vic.gov.au

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12. Glossary (Makins, M. 1993)

Auscultation – listening to various internal sounds made by the body, usually with the aid of a stethoscope.

Atrophy – wasting away of an organ or part of body.

Carpus – wrist area.

Concave – curving inwards.

Convexly – curving outwards.

Diurnal – active during day.

Emaciation – to become abnormally thin.

Ephemeral – *transitory*; short-lived.

Fledging – able to fly.

Monogamous – having only one partner.

Musculature – the arrangement of muscles in an organ or a part of body.

Nares – nostrils.

Omnivorous – eating any type of food category.

Patagium – membrane of skin attaching the wing to the shoulder.

Pectoral Muscle – either of two large muscles of the chest, that assists with the movement of the shoulder and wing.

Plantar – Sole of foot.

Precocial – upon hatching chicks are covered in down and are capable of leaving the nest within a couple of days.

Tarsi – ankle area.

Vagrant – bird of passage, drifter, itinerant, have no fixed address, is a wanderer.

Galleria – a wax moth larvae.

Figure 1. Adult male Brolga. (Photo – Tegan Christophersen, TWP.)

Figure 2.
Brolga Chick – 50 Days old.
(Photo - Winton 2003).

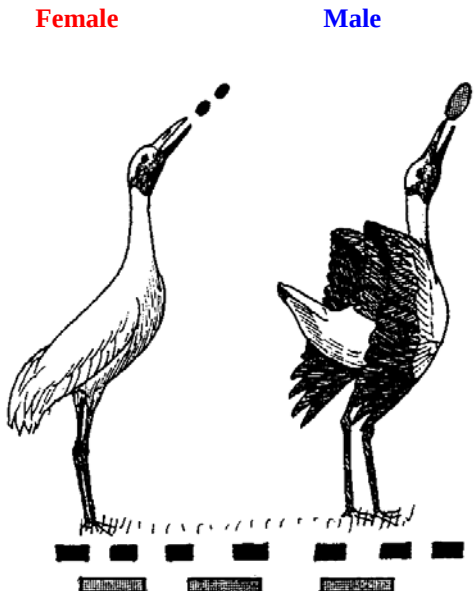

Figure 3. Unison-call (Ellis et al.)
Shaded bars (male) & **black bars** (female) indicate duration of vocalisation. **"Balloons"** indicate typical number of female per male calls.

Figure 4.
Brolga eggs colour variations. (Photo author)

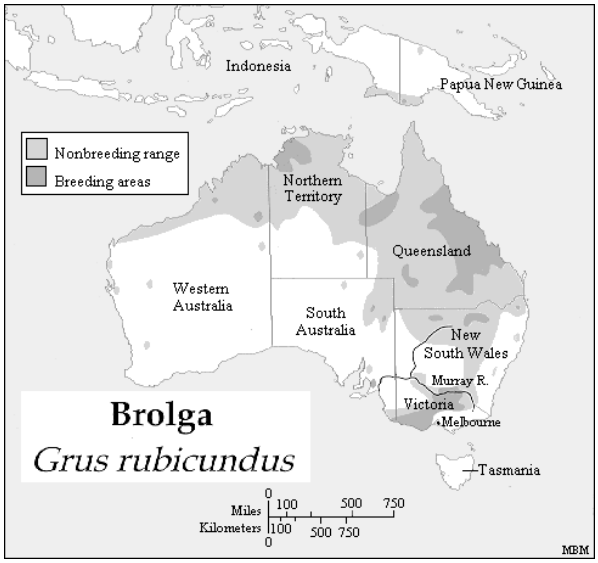

Figure 5. Brolga Distribution (Meine & Archibald 1996)

Figure 6. Above.

Figures 6, 7 & 9. (Ellis et al. 1996).
Methods of holding a Brolga and a chick.

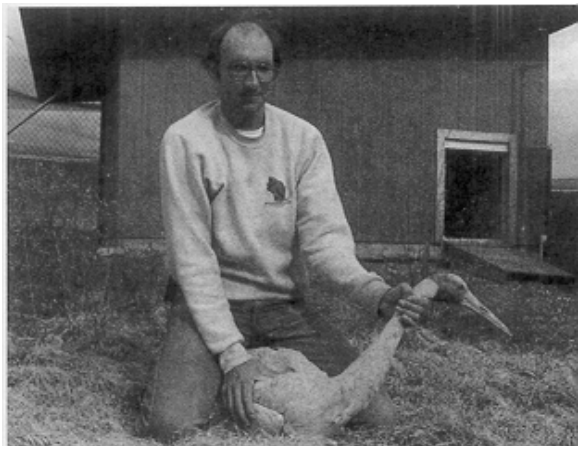

Figure 7. Above right.

Figure 8. Brolga Wrap & Hood (Photo – author)

Figure 9. Scoop method of newly hatched chick.

Appendices

TWP. Diets

Meat Mix:
1kg Horsemeat (minced).
3 hard-boiled eggs grated or broken up (shells included)
400 gms Dog Kibble Biscuits (crushed)
150 gms Unprocessed Flaky Bran
Plus supplements∗

∗Supplements:
8 gms Balanced Calcium Powder
4 gms Ornithon Vitamin Supplement
All the above mixed to a moist crumbly/lumpy consistency, but not too fine (bite size).

Greens and Vegetable Mix:
Carrots
Sweet potato
Sometimes apple
Green leafy vegetables. If using lettuce, not too much, as it turns the mix slimy.
Parsley (a small amount)
Corn on the cob kernels (loves this)
Zucchini
Sometimes capsicum
The above is of roughly even proportions, chopped to bite sized pieces, then mixed.

Serendip Sanctuary Diets (Helman pers. comm.)

For 2 adult Brolgas per day:
9-litre bucket ½ full of Wheat and Layer Pellets.
Cricket sized ball size of mash mix each. *

Brolga chicks kept with parents:
Mealworms thrown in with food.

For hand reared Brolga chicks between 1 —3 or 4 mths old.
Wheat and Mash mix. *

For hand reared Brolga chicks 2 days to 1 mth old.
Small amount of Mealworms twice a day to increase activity, also to get them pecking and eating.
Turkey crumbles ad libitum.

**** Mash mix:***
1 kg Turkey Crumble
1 kg Mince
500g Parrot mix
500g Meatmeal (blood and bone)
All above mixed with water to a soup consistency then add 500g Lucerne Chaff, and mix.

Auckland Zoo Hand-rearing and Adult Diets.

Chick diet, first two weeks

2 T Turkey starter crumble
½ t Wombaroo Insectivore mix
½ shelled boiled egg, white and yolk
1 t grated cheese
Sliced finely silverbeet
Live food
Meatworms, galleria, small locust crushed and small earthworms
First two days, small or white mealworms
Feed three times a day
Live food ab lib

Chick diet, after 14 days

½ Insect container Turkey 'grower' pellets *(Estimate weight of pellets = 220-225g)*
100 grams Wombaroo Insectivore mix
I boiled egg chopped finely
2 – 3 t grated cheese
Silverbeet, sliced finely
Feed three times a day
Live food five times a day

Adult Brolga diet

Feed I insect container full per bird, twice daily.

Base mix:

60 grams wheat
60g maize
60 g oats
40 g sunflower seeds
40 g peanuts (in shell)
60-g peanuts (husked)
60g Peck-n-lay poultry pellets
60g cat biscuits (science diet)
3 – 4 slices wholemeal bread cut into small squares
I apple, diced
2 raw sprats, chopped into chunks
Raw meat, chopped into chunks
2 boiled eggs, whole or cut into quarters

Extras for variety
Boiled root vegetables (potato, kumera)
Husked nuts
Live invertebrates (mealworms, locusts)
Fruit
Freshly killed mice
Silverbeet
Cheese, diced into small squares

Food Rationing for Hand-reared Chicks

For over weight Brolga chicks, a food management program to be used along with exercise (Ellis *et al.* 1996).

Some birds gain excessively even with regular exercise. In such cases, the following food withholding techniques can be used to limit weight gain.

1. Remove food only at night. Usually chicks do not consume much food at night so removal limits only the amount of food available to them in the early morning hours when cranes normally feed.
2. Provide food four times a day for 15 – 60 minute intervals, then leave it in the pen overnight. This is the preferred method for most chicks, because the chick still has access to enough food to grow properly, to stem its hunger, and to prevent it from developing vices such as eating bedding or faeces.
3. If the chick is eating pelleted food, provide either crumbles only or a mixture of crumbles and pellets so the chick has to expend more time and energy to eat the same amount of food.
4. Remove food at night and provide it three or four times a day for an hour at a time. On this regime, chicks may become frantic or consume bedding in which case using one of the other options must be implemented.

Regardless of which technique is used, food-rationing ends as soon as the chick's weight gain slows for several days or abnormal behaviour develops. Weight gain should be monitored daily, however, until the period of rapid growth is over.

In a group-rearing situation, if even one chick is showing excessive weight gain, the entire pen should be rationed or the bird of concern can be temporarily removed to limit its feeding opportunities. However, carefully monitor the social interactions of the chicks because deprivation of food can result in increased aggression.

List of Suppliers.

Balanced Calcium (Calcium and Phosphorus).
Mavlab
33 Rowland Street
Slacks Creek
Queensland 4127
Australia.
www.maylab.com.au

Dog Kibble
Country Kennel, Meat & Vegetable.
Bayer Australia
875 Pacific Highway
Pymble
NSW. 2073
Toll free: 1800 678 368

Insectivore Mix
Wombaroo Food Products
Mount Baker Road
Glen Osmond
South Australia, 5064
Australia.

Ornithon Vitamin and Mineral Drinking Water Supplement for Aviary Birds
INCA (flight) Company Pty Ltd
22—24 Forthorn Place
St Marys
NSW 2760
Australia
Ph: 02 8331728.

Unprocessed Flaky Bran
Local Produce Supplier

IATA Contact

Dr.J. Gardner Murray
Agriculture , Fisheries and Forestry (AFFA).
GPO Box 858 Canberra ACT 2601.
Ph: (61 – 26) 2725848/2725438
Fax: (61 – 26) 272569
Email: gardener.murray@affa.gov.au