

Orange-bellied Parrot Husbandry Guidelines



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1.0 Introduction

1.1 General Features

The Orange-bellied Parrot is one of six small grass parrots forming the genus *Neophema*. A bright grass-green bird with, royal blue leading edges to the wings light green to bright yellow underside, with a distinctive orange patch on the belly. It is a migratory bird, which breeds only in coastal southwest Tasmania and spends winter in coastal Victoria and South Australia. The Orange-bellied Parrot *Neophema chrysogaster* was one of the first Australian birds to be described by Latham in 1790 and is now one of Australia's rarest bird species, currently classified as Critically Endangered it is strictly protected by CITES and a variety of Australian Commonwealth and State legislations. The wild population of Orange-bellied Parrots is believed to number under 50 individuals.

1.2 History in Captivity

Although many parrot species have a long and well-documented history in captivity, due to their conservation status the Orange-bellied parrot is not currently found among aviculturists (Sindel & Gill 1992). A pair of Orange-bellied Parrots was exhibited at London Zoo in the early 1900s. In the late 1960s and early 1970s many Orange-bellied Parrots were illegally trapped and exported to Europe. In Australia the first authenticated documentation of breeding Orange-bellied Parrots in captivity was in South Australia in 1973 (Shephard 1994). In 1986 following the successful trail of two analogue species the Blue-winged Parrot *Neophema cryosostoma* and the Rock Parrot *Neophema petrophila* a captive breeding program under the control of Department of Lands, Parks and Wildlife in Tasmania commenced with Orange-bellied Parrots (Brown *et al* 1994).

Presently Orange-bellied Parrots are restricted and only held at three places; Healesville Sanctuary, Zoos Victoria, Department of Primary Industries and Water in Tasmania and Adelaide Zoo South Australia. All three groups are involved in captive breeding as part of the Orange-bellied Parrot Recovery Program.

1.3 Value as a tool for education, conservation and research

Captive breeding programs for threatened species play an important role in the recovery and future survival of that species. They act as a safeguard against catastrophic decline in the wild population, they increase wild population numbers through reintroductions and they provide opportunities for research and public education.

2 Taxonomy

2.1 Nomenclature

Orange-bellied Parrot

Class: *Aves*
Order: *Psittaciformes*
Family: *Psittacidae*
Genus: *Neophema*
Species: *chrysogaster*

2.2 Subspecies

No known subspecies or mutations.

2.3 Recent Synonyms

None

2.4 Other common names

Orange-breasted Parrot
Orange-bellied Parrakeet
OBP

3.0 Natural History

The Orange-bellied Parrot was formerly more abundant and widespread than it is now. During the late 1800s, and in the 1920s, the species was reported as being common in coastal southeastern Australia, the population has declined steadily since the 1920s (ORANGE-BELLIED PARROT RECOVERY TEAM 1998).

The Orange-bellied Parrot Recovery Team was established in 1983, to initiate conservation measures to protect this species and its habitat. Fragmentation and degradation of over-wintering habitats is the prime cause of decline in this species, along with predation by foxes and cats, competition for food from introduced finch species and competition for nest site with starlings (Smales et al 2000a). Other factors such as disease, and loss of genetic variation within the population are also likely to have had an impact on population declines (ORANGE-BELLIED PARROT RECOVERY TEAM 1998).

Most researched information on Orange-bellied Parrots pertains to their ecology, migratory habits, conservation status and the recovery of the species (Brown & Wilson 1981 & 1984), (Shepherd 1994), (ORANGE-BELLIED PARROT RECOVERY TEAM 1998) and (Stephenson 1991). The following research concentrates on captive breeding including re-introduction (Menkhorst 1997), (Shepherd 1994), (Sindel & Gill 1992), (Martin 1997), (Brown 1988), (Brown et al 1995), (Smales et al 2000a, 2000b). Disease issues of particularly Psittacine Beak and Feather Disease (PFBD), are covered by (Brown 1997) and (Riadal et al 1993). Orange-bellied parrots are also the topic of small population management modeling and research (Menkhorst et al 1990) & (Drechsler 1998a, 1998b, 2000).

In 1992, the Department of Genetics and Human Variation at La Trobe University developed a probe to identify genetic markers in DNA of Orange-bellied Parrot blood but unfortunately the project was

unfinished. A new project is being undertaken and it is hoped that results will be available in 2011 as this will be an important tool in determining and maintaining a genetically healthy captive population.

3.1 Morphometrics

The Orange-bellied Parrot is in the genus *Neophemas*, *Neo* from the Greek word for new and *pheme* from the Greek word for voice. The species name *chrysogaster* from the Greek words *chryos* for golden and *gaster* for belly (Sindel & Gill 1992).

The adult male Orange-bellied Parrot has bright green upper part, a blue frontal forehead band, edged with pale blue, yellowish-green face throat and breast and yellow abdomen with a central orange patch extending to the vent. The orange patch is often not visible when the bird is at rest. The adult female is noticeably duller than the male; she has a much duller frontal band, which lacks the paler blue upper edging. The females orange belly patch is also duller and often smaller than that of the males. The beak is greyish brown and the iris brown. Immature birds of this species show pronounced sexual differences as described, and are relatively easy to distinguish from about 8 months of age. An experienced aviculturalist should be able to distinguish the sexes in fledglings (Low 1986). The average weight of an adult bird is 45-50g and the length is 20cm.

Parrots of the *Neophema* genus are commonly referred to as Grass Parrakeets, known for their preferred diet of grass seed, their long tapering tail and their soft call. Grass Parrakeets feed on or close to the ground, and will often shelter close to the ground. They feed throughout the day as well as at dusk and dawn. They are usually sighted singularly, in pairs or small groups; they are difficult to approach and generally quick to take flight. When flushed they utter a distinct buzzing *zzit zzit* alarm call. They normally fly low just above vegetation height (Shephard 1994).

3.2 Distribution and Habitat

The Orange-bellied Parrot is a migratory species which spends spring and summer in Tasmania where it breeds, then departs for mainland Australia in autumn to spend the winter months there. The Orange-bellied Parrot has a single breeding population containing less than 200 mature adults in the wild (?). When breeding this species occupies an area of approximately 1600km² but during winter migration it is dispersed widely along the coastline of southeastern Australia (ORANGE-BELLIED PARROT RECOVERY TEAM 1998). Figure 1. Displays the breeding range and the annual migratory path of the orange-bellied parrot. The species breeding range is a narrow coastal strip of southwest Tasmania between Birch's Inlet, in Macquarie Harbour, and Louisa Bay. The breeding habitat is eucalypt forest and extensive moorland plains dominated by button grass and intersected by wooded tea-tree and paper-bark creeks, and river estuaries within the Tasmanian Wilderness World Heritage Area (ORANGE-BELLIED PARROT RECOVERY TEAM 1998).

On mainland Australia the Orange-bellied Parrots current range is through coastal regions as far as South Gippsland district of Victoria and as far west as Lake Alexandrina in South Australia. Seventy percent of the population concentrates at three wintering sites around Port Phillip Bay and the Bellarine Peninsula in Victoria. (ORANGE-BELLIED PARROT RECOVERY TEAM 1998). Its preferred habitat on the mainland is saltmarshes, coastal heath, grasslands and pastures, estuaries and coastal sand dunes all within 10 km of the coast (ORANGE-BELLIED PARROT RECOVERY TEAM 1998).

3.3 Conservation Status

This species is classified as Critically Endangered by the IUCN and EPBC (1999).

3.4 Wild Diet

The Orange-bellied Parrot has been observed feeding on 32 different species of plants (Orange-bellied Parrot Recovery Team 2006). Of these the key species are within saltmarsh communities and include Beaded Glasswort *Sarcocornia quinqueflora*, Southern Sea-heath *Frankenia pauciflora*, Shrubby Glasswort *Sclerostegia arbuscula*, Buzzy *Acaena novae-zelandiae* and Sea Rocket *Cakile maritima*. However, in recent years a range of grassy or weedy pastures associated with coastal vegetation communities have increasingly been used by the species (Orange-bellied Parrot Recovery Team 2006).

3.5 Longevity

3.5.1 Wild

Mean life expectancy is 2.2 years but birds have been known to survive up to 10 years.

3.5.2 Captivity

Currently in the captive population birds have been known to survive for up to 13-14 years of age however the normal age is 8-10 years.

3.5.3 Techniques to Determine Age of Adults

Once adult size and after first moult, it is not possible to determine the age of an unmarked bird.

4.0 Housing Requirements

All aspects of enclosure design specifications must aim to exclude rodents from aviary.

4.1 Exhibit Design

Following are descriptions of existing breeding aviaries. Healesville and Adelaide Zoo also successfully display groups of Orange-bellied Parrots. Healesville Sanctuary in a medium size walk through aviary with a number of other bird species and Adelaide Zoo in a medium size display aviary again with a variety of other bird species.

At Healesville Sanctuary, Victoria the Orange-bellied Parrots are housed in off limit aviaries dedicated to endangered species. The aviaries are in two blocks of ten adjoining aviaries each measuring 2m wide x 4m long x 3m high for breeding pairs. There are also group cages measuring 3m wide x 4m long x 3m high which house 10 -15 fledgling birds prior to release. The display enclosure is a mixed species aviary containing Rose Crowned Fruit Doves, White Browed Woodswallows, Dusky Woodswallows, Eastern Whipbirds, Musk Lorikeets, Pallard Cuckoos, Yellow Robins and Painted Quail.

At DPIPWE facility breeding aviaries are XXXXXXXXXXXXXXXXXXXX



Adelaide Zoo currently house OBPs in two separated areas, one is a planted coastal theme exhibit aviary consisting of post reproductive individuals, the second (breeding) population is housed in a dedicated off-display breeding area with one pair housed per enclosure.

This off-display facility consists of a row of nine enclosures, seven aviaries measures 4m long by 1.50m wide and a height of 2.50m, with the other two being larger 4m wide, by 4m long and 2.5 high. The two larger enclosure can be used to house breeding colonies, with up to four pairs being housed in each one. The front panel consists of approximately 50% solid partition and 50% mesh access door with the rear panel being solid floor to ceiling (compressed cement sheet) at the far end of the flight. The dividers (aviary walls) comprise double mesh (¼ inch 1.2 gauge).

The display enclosure is a mixed display, housing Hooded Plovers (*Charadrius rubricollis*) Black-Winged stilts (*Himantopus himantopus*) Red browed finches (*Neochima temporalis*) Rainbow Bee-eaters (*Merops ornatus*), Superb fairy wrens (*Malurus cyaneus*) and a pair of Dusky Woodswallows (*Artamus cyanopterus*). There have been no compatibility issues recorded between the OBP and other species. The enclosure is a twin dome construction measuring 8.80m long, 6.80m wide and 3.70m at its highest. The mesh is ¼ inch hexagonal and the rear shelter consists of 3m lengths of clear corrugated sheeting. All aviary construction should meet local council building requirements.

Foundations

The aviary should be mounted on a solid foundation of concrete that should raise above ground and substrate level by approx 150mm this will prevent wire from rusting. Foundations should be sunken 600mm into the ground assist with vermin control. Ideally concrete floors with a minimum 2% fall should be considered to aid easy removal of substrate and cleaning.

Framework

The aviary frame should be constructed from non-galvanised stable steel square metal tubing for example aluminium, powder coated or stainless steel.

Walls

External cladding can be any commercially available product.

Colourbond tin sheeting, non-treated timber, plywood (where mites are not an issue), insulated coolroom panels, concrete rendered or cement board sheeting can be used for internal walls. Birds must not have any access to treated timber, plastic, insulation foam or other hazardous materials. Such surfaces are easier to clean if painted in good quality washable water based external house paint in light colours. Change this to 1/3 for walls and complete solid back wall.

Partitions

In the open area or flight area of aviaries the partitions can be made from nylon mesh fixed to a ply wood frame, this non-aggressive species does not require double partitioning. The sheltered area of the aviary where the nest boxes are should have a solid partition between aviaries, such as ply-board or cement sheeting. Solid partitions in these areas eliminate interference from neighbouring birds and provide a draught free secluded environment more conducive to breeding.

Roofing

Light coloured Colourbond roofing is recommended and where skylights are required maximum UV heat protection rating should be used. It is advisable to install insulation under the metal roofing to moderate the temperature within the aviary. Alternatively a double roof structure to allow airflow above the aviary or shade cloth sail over the roof can be used.

Mesh

It is recommended that all mesh used in construction is BHP green mesh or stainless steel mesh. Mesh size should not exceed 13mm for both ss and bhp and it is recommended that if using BHP mesh that it be 1.3 gauge to ensure that aviary security is not compromised. Ensure that mesh is securely fixed to walls taking care to ensure no jagged edges remain. The internal aviary walls/roof should be constructed from soft nylon netting that is approx 13mm in size stretched taut 15cm in from the external wire mesh walls. This internal netting is to reduce the risk of trauma injuries to birds; both meshes are required as the nylon netting is not vermin proof and more prone to breaking.

Doors

Doors should be placed at sheltered end of aviary. Taking into account relevant OH & S policies. Doors should be only be as high and wide as required to allow convenient entry taking into account the need to service areas with wheelbarrows etc. Observation viewing window can be placed in doors constructed of solid material.

Walkways and service areas

A safety door system or service area is recommended as a safeguard against escapes. Fully roofed service corridors at the rear of the aviary complex provide easier feeding, cleaning and servicing of birds under all weather conditions. The service area must be of sufficient width to allow for wheelbarrows, ladders and nest boxes to be carried in and out of the aviary and allow for easy quick access and quick servicing for minimum disturbance of breeding pairs. Walkway substrate should minimise sound disruption.

Vermin proofing

Adequate vermin proofing is essential, without it the husbandry, hygiene and health of the birds will be compromised. Vermin proofing needs to be incorporated into the design and construction of the aviary. Mesh should be firmly fixed to foundations and set into the ground 600mm. Orange-bellied parrots will not eat dead mice, so rodent baits can safely be used outside aviaries (Hockley pers. comm.). Add Janine's comments re rodents.

Move baiting info to mgt section.

4.2 Holding Area Design

Should be the same as exhibit design.

4.3 Spatial requirements

The aviary should provide the birds with adequate room to exercise.

The typical Orange-bellied Parrot aviary is usually rectangular in shape and should be longer than it is wide, a minimum twice length to width ratio should apply. The minimum recommended internal size for Orange-bellied Parrots is 11.25 cubic metres per breeding pair. Ideally breeding aviaries should be 1.5m x 2.5m x 4m in size to house each breeding pair. For each additional bird it is recommended that aviary size be increased by a minimum of 2 cubic metres.

Generally fledglings and non-breeding adults are non aggressive and therefore can be housed together in groups where number of birds in an aviary is dependent on size of aviary according to above minimum dimensions. Observation of birds is essential to ensure that aggression is monitored and appropriate measures taken.

4.4 Position of enclosures

Site Selection – generally any site that is being considered for the housing of OBP's should be selected taking into account things that may cause night fright ie possums, cats, security, other noises ie fireworks. The aviary site should be both level and well drained. Away from large trees, which could drop leaves, block sunlight or fallen branches that could damage the aviary. Assess the prevailing weather conditions of the site. Maximum effects of morning sun and winter sun should be balanced with the minimum effects of hot afternoon summer sun and cold winter wind and rain. Depending upon the location this generally means that the aviary should have a northerly or easterly aspect (Shephard 1994). Requirements ie weather protection and heating.

4.5 Weather Protection

Aviary size and shape may vary but all aviaries should be totally enclosed on southern and western side to provide maximum protection from prevailing winds. This protection can be achieved with solid sheeting and sheltered areas. Flight paths across aviary should be broken up with shrubs thus slowing down flight speed and therefore reducing the risk of collision.(Sindel & Gill 1992).

4.6 Heating Requirements

This species breeds in Tasmania and migrates to mainland Australia for winter and does not require any form of heating in the aviary. The Orange-bellied parrot, particularly chicks suffer more from extremes of heat than cold and also from humidity.

Assess the prevailing weather conditions of the site prior to positioning the aviary. A portion of the aviary should be sheltered on both the roof and the back and sides. The internal walls of the shelter should be painted in a light colour such as cream, which reflects the light otherwise they are dark and dull inside. Alternative shade should also be provided in the outside flight area.

Care should be taken that the shelter does not get too hot in the summer, when the birds are breeding, insulation or a ventilation space between the aviary shelter and the aviary roof is recommended. Aviary temperature can reach extremes in summer in Victoria and South Australia therefore the installation of overhead mist sprayers is essential. Mist sprayers should be activated when the temperature inside aviary near nesting boxes exceeds 28°C. Alternatively when a carer deems it necessary to maintain the relative humidity at 60 - 80 % during breeding season. Any use of mist sprays should be carefully monitored to ensure that they are not overused as this can lead to othre problems such as Aspergillus. Consideration should be given to placement of nest boxes during the breeding season. Healesville Sanctuary has constructed an air-conditioned service corridor into which the nest boxes are placed to ensure that chicks do not overheat during summer.

4.7 Substrate

In small aviary situations a concrete floor that is covered with gravel or washed river sand substrate is recommended. Sand can be cleaned reasonably easily by raking top surface, but all substrates should ideally be replaced every 6 –12 months.

Alternatively well-planted larger aviaries are also acceptable as long as it is ensured that areas around feed stations and perching areas have easily cleaned substrate.

4.8 Nest boxes

Natural hollow logs or nest boxes will both be used by OBP's. Logs about 45cm long, with a min-20cm internal diameter, with both ends closed and a 5cm-entrance hole near the top of the log. Natural logs should be fitted with inspection holes and or removable lid to allow access to check birds and allow ease of cleaning. Nest boxes made of any untreated timber (internal dimensions of diagonally mounted boxes 70cm long x 15cm square as opposed to vertically mounted boxes which should be a min of 45 x 17 square), with side or end openings with natural wood entrance spouts, and an entrance hole that is no less than 4 cm in diameter. Nest boxes require an inspection door, either hinged or a removable slide above the nesting chamber. Tin end caps are not recommended as they heat up during hot weather. As the interior of the nest box is smooth and sloping, wooden slats or grooves are inside forming a ladder from the entrance hole to the nesting chamber. Nest boxes for orange-bellied parrots should be positioned under the sheltered or roofed area out of direct sunlight mounted with the nest entrance hole a minimum of 1.8m from the floor.

Nesting material such as rotten wood, partially decomposed sawdust or a mix of sawdust, wood dirt and peatmoss have been used. Depth of nesting material needs to take into account the type of material used and the type of box and the angle the box is placed at to ensure that the female is provided with enough material to form a scrape in which to lay the eggs.

4.9 Enclosure Furnishings

Low planted grasses or plants growing in removable planter pots are recommended for this ground dwelling species. Browse branches attached to the sides of the cage and a few perches are sufficient. Perches should be of natural stick and should be no closer than 30cm from roof or walls. Perches should never be placed directly above food or water dishes and should be replaced every 6 months.

5. General Husbandry

The daily husbandry routine consists of counting and checking all birds. Initial observations of each birds physical state, appearance and any changes in behaviour should be made on a daily basis (health is discussed in more detail in section 8). Also interactions with other birds should be noted to ensure that any aggression is monitored.

5.1 Hygiene and cleaning

It is critical to maintain the aviary in a clean and hygienic state. All faeces, seed, seed husks and decaying organic matter should be removed regularly.

Emptying out water dishes, scrubbing and replacing with fresh water.

Removing all food bowls and uneaten food, replacing with fresh food in clean dishes.

The substrate should be raked as required.

All solid surfaces and perches should be kept free of faecal build-up and washed or wiped down regularly using an appropriate disinfectant.

All aviaries undergo an annual clean when they are thoroughly scrubbed and the substrate and furniture is replaced, this occurs when the aviaries are empty prior to the breeding season. Furniture and perches should be replaced every six months.

Nest boxes are removed in April (post fledging), emptied out and scrubbed out using White King Bleach or another Sodium Hypochloride product, they are then left out in the sun and rain to “weather” for a few months prior to next breeding season.

It is recommended that during any cleaning routine that appropriate PPE is used as per individual institutions OH & S standards.

5.2 Record keeping

Keeping records is an important part of the daily husbandry. Information on health, behaviour, diet, and breeding should all be recorded for each individual.

All records for captive Orange-bellied Parrots are collated using an international record keeping software package ARKS (Animal Record Keeping System) and studbook information is collated on SPARKS software (Single Population Animal Record Keeping System). Not only does a record provide a complete captive history of an individual but is also provides important data for research and husbandry.

5.3 Methods of identification

Ideally all birds should be banded with leg bands for individual identification. Size 5 plastic or metal bands are recommended. Microchipping is not permitted with this species at this time.

5.4 Routine data collection

Annual breeding data is collected for all individuals in the captive breeding program to assess the fertility rate of the captive population. As are results from blood collected for DNA sexing and testing by La Trobe University to determine the genetic make-up of the captive population. Other information is to be collected as per the Recovery Team requests.

6. Feeding Requirements

6.1 Captive diet

Ideally the captive diet should closely mimic that of the wild. The composition and concentration of nutrients in the wild diet of most birds varies seasonally, highlighted by the fact that the orange-bellied parrot is a migratory bird. Aviary birds will also vary their nutritional requirements in relation to their breeding status. During breeding season food consumption will increase and therefore the provision of green feed and seeding grasses should be increased.

The orange-bellied parrot as with other *Neophema* species can be prone to obesity in captivity. To avoid obesity select non-oily, low protein, dry seed diet, such as millet. French white millet has been recommended as the preferred millet type for *Neophemas* (Sindel & Gill 1992). Dry seed should be clean, not dusty and stored in sealed bins in a cool dry location. Dry seed should always be supplemented with a fresh daily supply of green food, sprouted seed and vegetables.

The ideal captive diet for the orange-bellied parrot is green food, and sprouted seeds supplemented with a non-oily, low protein dry seed mix. Caution is advised with seed mixed high in Canary Seed as this has resulted in the deaths of a number of chicks in nest through apparent rupturing of the gizzard by the sharp end of the seed.

Greenfeed is highly nutritious, palatable and non-fattening food source, seeding grasses like winter grass, water millet, milk thistle, chickweed, dandelion, pigweed, also silverbeet, endives, chicory can all be used. These items should be provided ad lib during breeding season but from controlled sites to minimise the risk of poisoning.

Planter tubs of living plants can be rotated through the aviaries as a green feed supplement. Plants such as: Milk thistle Millet, winter grass, Chick weed, Panic Veldt Grass, Slender Pigeon Grass, and Barnyard Grass are ideal.

Sprouted seed provides a constantly available, highly nutritious food source that contains many essential vitamins such as niacin and riboflavin it is also very useful during the breeding season to prevent chick death from crop impaction by hard seed. Most variety of seeds can be sprouted safely by soaking for 24 hours in water with an added antibacterial, anti-fungal agent such as sodium hypochlorite (baby bottle sanitizers are suitable), Aviclen (Registered Trademark). There is no advantage in allowing sprouted seed to grow long shoots as the maximum nutritional value is reached when the shoot breaks out of the seed case.

Table 1. Plant species in orange-bellied parrot diet.

Common Name	Scientific Name	wild or captive diet
Sea Heath	<i>Tranfenia pauciflora</i>	W
Fat Hen	<i>Chenopodium album</i>	C/W
Beaded Glasswort	<i>Sarcocornia quinqueflora</i>	W
Shrubby Glasswort	<i>Sclerostegia arbuscula</i>	W
Sea Rocket	<i>Cakile maritima</i>	W
Button Grass	<i>Gymnoschoenus sphaercephalus</i>	W
Buzzies	<i>Acaena novaezealandiae</i>	W
Boronia	<i>Boronia spp</i>	W
Everlasting Daisy	<i>Helichrysum pumilum</i>	W
Milk Thistle	<i>Sorghus sp</i>	C
Barnyard Grass	<i>Echinochloa crus-galli</i>	C/W
Millet	<i>Millet spp</i>	C
Slender Pigeon Grass	<i>Setaria geniculata</i>	C/W
Winter Grass	<i>Poa annua</i>	C/W
Chick Weed	<i>Cerastium glomeratum</i>	C
Panic Veldt Grass	<i>Ehrharta erecta</i>	C
Common sow thistle	<i>Sorghus oleraceus</i>	C
Sorrel	<i>Rumex acetosella</i>	C/W
Dock	<i>Rumex spp.</i>	C/W
Capweed	<i>Arctotheca calendula</i>	C/W

6.2 Supplements

Dry seed is deficient in a number of minerals and trace elements, vitamins A, B and biotin are not present, and should not makeup the whole diet (Collier 1987). Calcium is important particularly prior to egg laying and while young are being reared, cuttlefish, shell grit, baked and crushed eggshells or mineral

blocks can supply this. A liquid supplementation (such as Calcivet) can also be added to soaked seed as not all birds take the other dry supplements. "Pickstone mineral blocks" are used for *Neophemas* by aviculturists (Robinson pers comm.) Charcoal, which is rich in iodine, is enjoyed by *Neophemas*; particularly while young are being reared (Martin 1997).
Providence of shell grit or any other natural substances should be from non-industrial areas to ensure that the item is not contaminated.

6.3 Presentation of food

Ideally in a properly rodent proofed aviary the food should be presented on or near to the ground this is particularly important for juveniles that may be released into the wild to stimulate natural feeding behaviour. Care should be taken not to place food or water dishes under perching places to avoid faecal contamination. Ideally one food bowl can be provided for family groups and a second bowl should be added for aviaries that contain more than 6 unrelated birds.

Table 2. Example of Orange-bellied Parrot Diet Sheet from Healesville Sanctuary

SPECIES: ORANGE BELLIED PARROT: *Neophema chrysogaster*

NATURAL DIET: Seeds from grasses found on Button Grass Plains, Saltmarsh, introduced plants and some foliage.

AD LIB: Water.

Cuttlefish.

Fine mineral grit

DAILY DIET (per animal):

Breeding Season (Aug-Feb)

10g	Sprouted OBP seed mix*
3g	Greens (Endive/ Spinach/ Silverbeet)
1g	Apple
1g	Pear
1g	Carrot
3g	Corn
1g	Peas
1g	Egg & Biscuit mix

Daily provision of local seeding grasses and any assorted native food plants.

Additional food offered to birds with young (per chick)

10g	Sprouted OBP seed mix*
1g	Finch softbill mix

* Note: Remove all hard or fine seed prior to first chick hatching.

Supplements

Mix 1 tsp Calcium Carbonate through 1kg of sprouted seed mix.

Calcivet added to sprouted seed as per manufacturer's instructions.

Soluvet added to greens as per manufacturer's instructions.

Non-Breeding Season (Mar-Jul)

10g Fine seed mix*.
3g Greens (Endive/ Spinach/ Silverbeet)
1g Apple
1g Pear
1g Carrot
3g Corn
1g Peas

Provision of seeding grasses, as above, no more than twice per week.

OBP SEED MIX

30% White millet
20% Red panicum
30% Japanese millet
10% Mung beans
10% Sunflower

7 Handling and Transport

7.1 Timing of capture and handling

Birds should not be held in transport boxes for longer than 24 hrs and should only be captured either 1 hour before dark or 1 hr after dawn. Transporting of birds must not be attempted during periods of extreme external temperatures.

7.2 Catching Bags

Birds that are only being held for short periods such as for a physical exam, for weighting or banding, can be held in calico cloth bags 30cm x 20cm.

7.3 Capture and restraint techniques

Hand nets are used to catch orange-bellied parrots in small aviaries. These are only practical in small aviaries that are not heavily furnished or planted. Lightweight hand nets with 60cm handle and 30cm diameter padded hoop with woven mesh (Figure 9.) are preferred over cloth nets as they move through the air easier and faster and they are not as visible to the bird. Care should be taken to avoid causing undue stress or trauma to the bird being caught. Soft nylon netting mesh aviary walls reduces the chance of trauma.

7.4 Weighting and examination

Firmly grip the bird around the shoulders and neck between the thumb and forefingers use your free hand to examine and manipulate the bird's wings and feet and palpate the keel. Birds are weighted by placing them in a cloth bag and placing them in an open container on small digital scales (the empty bag weight is deduced to give the birds weight). The average weight of an orange-bellied parrot is 45-50g. A detailed physical exam is discussed in section 8.2.

7.5 Release

Birds can be released into aviaries at anytime provided there is ample light for them to see their new surroundings, the earlier in the day the better as this gives the bird time to find food, water and shelter prior to roosting for the night.

7.6 Transport requirements

7.6.1 Box Design

All species of *Neophema* should be transported in well-ventilated, individually compartmented boxes, which should not be large enough to allow excessive fluttering that could lead to injury. The box should be dark in the inside, as birds will settle down quickly in a darkened environment. Only lightweight construction is necessary, due to the weight of the species and their limited chewing capabilities, three-ply sheet is ideal. Size = length of the bird x length of the bird x height of the bird + 25mm. Transport boxes used by Healesville Sanctuary (Figure 10.) dimensions are 65cm x 23cm x 18cm, each has three compartments with dimensions 20cm x 20cm x 16cm. Dry seed, and moist fruit (eg apple or Endive) are provided in the transport box for trips greater than 2 hours in duration. It is extremely important that the transport boxes containing live birds are labeled as such and that the receiving institution is notified when the shipment has been sent and when it is expected to arrive, all necessary permits should be obtained prior to transfers.

8. Health Requirements

8.1 Daily health checks

Animal Husbandry plays an important role in disease prevention. All staff should adopt high standards of personal hygiene. High standards of hygiene should be carried out in the cleaning of aviaries as well as in food preparation as good hygiene practices prevent the spread of infectious organisms and toxic materials.

A close daily observation of each bird by carers is essential. Carers are often able to detect slight changes in a bird that may be the only outward sign of illness. Observations of each birds physical state and appearance, any changes in behaviour, and whether or not it is eating, drinking, urinating and defecating normally should be made daily.

Any health concerns should be brought to the attention of a veterinarian, who may wish to conduct a detailed physical exam.

8.2 Detailed physical exam

Only a veterinarian or person who has a good knowledge of parrot physiology and is experienced at handling this species should conduct a detailed physical exam. Blood can be collected via the ulna or jugular (only recommended by vets) vein, either conscious or anaesthetised. Clear the feathers from the site and prick the vein with a 25G needle and collect drops of blood in a haematocrit tubes. Maintain pressure on the site to stop the bleeding (Miller 1995). A larger sample of blood can be obtained at the jugular vein on the right side of the neck.

Table 4. Detailed physical exam checklist.

Physical examination checklist for orange-bellied parrots

Observe the bird in cage prior to exam	- Note posture and demeanor and appetite, as well as that of cagemates
Check the birds identification	- Leg band and ARKS number.
Weigh the bird	- Place in cloth bag in container on digital scales.
Restrain the bird	- These small parrots may attempt to bite, but can be safely held with a bare hand, wings against body and head held between thumb and index finger.
Body condition	-Coat condition, feathers should be clean, groomed and glossy, note any change to plumage colour. -Examine breastbone, it should be convex. -Listen to heart rate with stethoscope (normal heart rate is 300 – 500 beats per minute). - Normal respiratory rate is 85 per minute.
Head – eyes, ears, face, mouth and beak	-Check top of head for feather loss or abrasions which could be signs of trauma. -Check ears for exudate, obstructions, or wounds. -Check eyes and nostrils for water discharge or eyelid thickening. -Check for eyes for pupillary reflex and cataracts. -Check beak (top and bottom) and cere for crusty lesions, swellings, fractures or deformity. -Check mouth and tongue for foreign objects, swellings and growths.
Body – crop, abdomen, wings and tail	-Palpate crop and abdomen for abnormal masses -Examine wings, joints and feather shafts. -Examine tail feathers, preen gland and vent.
Limbs – legs, toes and claws	-Check for joint movement, grip response, crusty lesions, lumps or swellings. -Check toenail length, trim if required.
Collect blood	-Via ulna vein or jugular veins (max. volume 0.45ml) use for haematology, biochemistry and DNA analysis.
Collect faeces	-Note colour and consistency. -Perform fecal floats to check for internal parasites.

(Shephard 1994, Stone 1982)

8.3 Routine Treatments

8.4 Known health Problems

Neophemas are prone to the same range of diseases as other birds, infectious and non-infectious, a number of these are detailed below along with symptoms, causes and treatments. The following diseases and health problems have been observed in captive orange-bellied parrots.

- Psittacine Cirroviral Disease PCD (previously termed Psittacine Beak and Feather Disease PFBD) was endemic in the first captive breeding group in Tasmania in 1986. It is not known if it was brought in with wild caught specimens or not, as PCD is widespread in a range of wild populations of Australian parrots. A vaccine for PCD is currently under development. Presently captive orange-bellied parrots are screened for PCD and most have been found to have antibodies (and therefore immunity against) PCD and are not infectious. It is possible that this immunity is passed from parent to chick.
- Obesity, which has adverse effects on the birds' fertility and egg laying ability and can promote heart disease. This is fully controlled with correct diet and adequate exercise.
- Internal (particularly Ascarids) and external parasites, which are controlled by regular faecal checks and with bi-annual drenching and external parasite dusting
- Zinc poisoning - on a couple of occasions high levels of zinc were found on necropsy, suggesting death from zinc toxicity, which may also be a cause of poor fertility. Galvanized aviary wire of low quality causing zinc-oxide accumulation was thought to be the most likely cause, and has been replaced with nylon mesh (Smales et al 2000).
- Feather plucking, has been an affliction of a few individuals and is discussed further in section 9. Severe cases of feather plucking have been treated with sedatives.

8.5 Quarantine Requirements

Quarantine is an important preventative medical measure, as it is always easier to prevent disease than to attempt to diagnose and treat it. Quarantine should be conducted on all new specimens. Orange-bellied parrots are quarantined for a 30-day period during which they should return two negative faecal floats.

9. Behaviour

9.1 Activity

Orange-bellied parrots are most active early morning and late afternoon. When undisturbed they spend a good deal of time on the floor of the aviary. However they are easily alarmed and take flight quickly.

9.2 Social Behaviour

Orange-bellied parrots like other *Neophemas* are generally non-aggressive, placid birds. They naturally congregate in small groups of 15-20.

9.3 Reproductive behaviour

Courtship displays have been observed where the male stretches high, squares the shoulders of the wing, and then extends the feathers of the orange belly-patch at right angles to the body, which accentuates the bright orange patch, which attracts the female (Sindel & Gill 1992). Prior to copulation the male will present the female with food and feed her, he will also feed her at the nest entrance while she is nesting.

9.4 Bathing

A water container should be supplied for bathing, a solid tin or ceramic rectangular dish 20 x 15cm, 3-5cm deep is sufficient. The Orange-bellied parrots also enjoy a bath under the overhead mist sprayers on hot days.

9.5 Behavioural Problems

Feather plucking has been a behavioral problem in a few captive individuals, often in the same individuals each year; they pluck themselves prior to the breeding season. New feathers return normally when they moult at the end of the breeding season. Particularly bad feather plucking individuals have been isolated and treated with sedatives although with limited success. (Hockley pers. comm.)

A few instances of chick plucking have been noted where a parent bird plucks a chick, the reasons for this are unknown. In severe cases the chick dies, in at least one instance the cock bird was the aggressor (Holdsworth pers. comm). Regular checks of nestlings and removal for hand rearing or cross fostering maybe required.

9.6 Signs of Stress

9.7 Behavioural Enrichment

The aviary, diet and husbandry should supply the birds with all their behavioral needs. Correct groupings of either breeding pairs or small groups of 10-20, ample cage length for flight and exercise, adequate and interesting diet, with a changing variety of greenfood, perches, branches and planter boxes of assorted plants should adequately enrich orange-bellied parrots.

9.8 Introductions and removals

General there are no problems removing or introducing orange-bellied parrots to each other, but it is always worth monitoring introductions. Each year all the fledglings are housed together in groups of 10-12, and no significant problems have been noted (Hockley pers. comm.).

9.9 Interspecific compatibility

Orange-bellied parrots are non territorial and can and have been displayed with other bird species. Other smaller non-aggressive species are compatible, such as finches, softbills and small pigeon species. Orange-bellied parrots can also be displayed with other smaller parrots of a different species, but it is not recommended that they be housed with other Neophemas, due to the risk of hybridization.

9.10 Intraspecific compatability

Orange-bellied parrots are generally non-aggressive and have been housed in a variety of group sizes and sex ratios including batchelor groups of several males (Hockley pers.comm.)

10. Breeding

Orange-bellied parrots are monogamous and breed from December to January, average clutch size is 4-5, incubation period is 20-21 days, chicks fledge 28-35 days after hatching and are independent from parents post fledging after 21 days (Shepherd 1994).

10.1 Mating systems

Orange-bellied parrots breed best in single pairs in small adjoining aviaries, with mesh partitions to stimulate a colony situation, Pairs are chosen based on studbook recommendations. Compatibility of pairs in most instances is unimportant, however the group situation can stimulate breeding from individuals that previously have not breed well (Hockley pers. comm.) Fertility Rates of orange-bellied parrots have improved by using the single pair breeding system (Holdsworth pers. comm.). Preferably pairs should be placed together with installed nest boxes a least one month prior to the normal commencement of the breeding season.

10.2 Ease of breeding

The Orange-bellied Parrot has proven to be a more difficult species to breed in captivity compared with other Neophemas. A number of fecundity issues have been identified for orange-bellied parrots:

- 1) High percentage of infertile eggs being laid.
- 2) Difficulty in raising more than 3 or 4 chicks per clutch.
- 3) Low percentage of double clutching.
- 4) Reproductive productivity declines after six years.
- 5) Possible genetic issues causing reduced fertility.

10.3 Reproductive Condition

Both sexes are sexually mature and will breed at 12 months of age.

10.4 Techniques used to control breeding

Separation of the sexes is the easiest method of controlling breeding. Other methods would involve removal or pricking of eggs. At this point there is no reason to control the breeding of Orange-bellied Parrots in captivity and all breeding that occurs is based on Studbook recommendations.

10.5 Occurrences of hybrids

Hybrids have been recorded between this species and the Rock Parrakeet *Neophema petrophila* (Sindel & Gill 1992) as well as the Blue-winged Parrot *Noephema chrysostoma* (Holdsworth pers.comm).

10.6 Timing of breeding

Wild orange-bellied parrots return to Tasmania in October and early November, and commence nesting in late November, with chicks fledging in late January. In captivity this species breeds in October, a full month before the wild population, with the first chicks leaving the nest in mid to late December. They are annual breeders, wild individuals are known to return to the same nest site each year. (Brown *et al* 1995).

10.7 Age at first breeding and last breeding

Most Neophemas are fertile at one year of age and both sexes breed in their first year. In captivity reproductive productivity declines after six years (ORANGE-BELLIED PARROT RECOVERY TEAM 1998). In captivity the oldest recorded fertile animal was 13 years old.

10.8 Ability to Breed every year

Orange-bellied Parrots are able to breed annually.

10.9 Ability to breed more than once per year

Orange-bellied Parrots can produce a second clutch within one breeding season although the incidence of this being a fertile clutch is very low. There is no record of them breeding outside the recognised season (Sept - February).

10.10 Nesting requirements

In the wild they prefer to nest in hollows in eucalypt trees, Figure 12. Orange-bellied parrots have been found to breed just as frequently in artificial nest boxes as in natural logs (Brown *et al* 1995). As artificial nest boxes are easier to inspect and clean they are preferred. Refer to section 4.7 for nest box information.

If a hen continually examines a nest box but does not breed, she is probably satisfied with the nest but not the position, and a position change or angle change may be all that is required to encourage her to nest (Shephard 1994).

10.11 Breeding diet

The breeding diet should increase the volume of protein, calcium and fats of the normal diet and should commence in August. See Captive Diet section 6.2.

Sprouted oily and fattening seeds such as sunflower, canary and oats should be limited during non breeding season, and gradually increased a few weeks prior to breeding to help stimulate breeding, then fed on an unlimited basis when young are being reared (Sindel & Gill 1992).

10.12 Incubation period

21 days (21-24 days)

The female carries out incubation, the cock will feed the hen at the entrance of the nest box, and the hen will usually leave the nest to feed and drink during the late afternoon.

10.13 Clutch size

Three to six rounded oval eggs are laid per clutch (average 4-5 eggs), usually laid at two-day intervals. Chicks hatch with an off-white down. The female, who has a preference for seeding grass heads, carries out most of the feeding of the young. (Sindel & Gill 1992).

10.14 Age at fledging

Chicks fledge at four to five weeks of age.

10.15 Age at removal from parents

Chicks are fully independent and can be removed from parents' two weeks after fledging at approximately seven weeks of age, when they are moved into larger group cages, housing 10-12 fledglings together.

11 Artificial Incubation and rearing

Hand raising is not the preferred option and you should attempt cross fostering first as this genus cross fosters very well. Artificial incubation and hand rearing is not generally a desired method as the success rate is much lower than cross fostering or natural breeding options. Hand rearing takes experience, dexterity and a great deal of equipment and time. Avoid taking newly hatched chicks for hand rearing if at all possible, as chicks fed by their parents or foster parents for even just a few days have a much better chance of survival. Chicks at pinfeather stage adapt more quickly to their new environment and diet, require less feeds per day and little artificial heat (Sindel & Gill 1992).

11.1 Incubation Methods

Always thoroughly clean the incubator and all equipment prior to commencement of incubation. Run the incubator for at least 24 hours prior to use and test and make any necessary adjustment prior to placing eggs in incubator. It is not advisable to put eggs straight into an incubator at full temperature; they should be started at five to six degrees below the recommended incubation temperature and be gradually warmed over a few hours to 36.9 C. The correct incubation temperature for parrots is 36.9°C ± 0.5°C with 50% humidity (Stoodley 1983). Healesville Sanctuary uses a Marsh Rolex fan-forced incubator for incubation of small bird eggs (Miller 1995).

Eggs should be weighted prior to being placed in the incubator. Care should be taken when handling eggs not to cause undue shock to the embryo. Eggs should be labeled and dated. Incubator racks made to accommodate small *Neophema* eggs, with blunt end uppermost and inclined on a 45° angle to the horizontal. If the incubator does not have an automatic turning device, the eggs need to be turned manually from 45° inclination in one direction to 45° in the other, commencing 24 hours after the start of incubation. (Sindel & Gill 1992). Eggs should be marked with an arrow on each side, so correct rotation can be achieved, if eggs are continually turned in the same direction the suspensory ligaments (chalazae) that hold the yolk in the centre would lose their centering effect on the yolk, resulting in embryonic death. Each turn of the egg brings the germinal disc into contact with fresh nutrient, which is essential, before the embryo has developed blood vessels to provide nourishment and oxygen (Stoodley 1983).

The generally accepted weight loss incurred during incubation period is 16%. This is calculated by dividing the initial weight of the egg by 6.25 to obtain the preferred 16 % overall weight loss, which in turn should be divided by the number of days in the normal incubation period which is 21 days for orange-bellied parrot. This information should be calculated for each egg prior to incubation (Sindel & Gill 1992). Eggs should be candled at five days and again at 8 days to determine fertility. Regular weighting will help determine whether eggs are progressing at the correct pace. Turning of eggs should cease four days prior to hatching, and the egg should be removed from the incubator and placed in a brooder box lined with paper towel. About two to three days before hatching the chick pierces the membrane between it and the air space of the egg. This is called internal pipping, temp should be dropped by 1 to 1.5 C and humidity increased, during this period the chick breaths from the air space and begins to use its lungs (Stoodley 1983).

11.2 Hand rearing Requirements

Hygiene is vitally important, more chicks die from poor cleanliness than any other cause. Chicks can be weighed to check their progress, but this needs to be carried out at the same time during the normal daily routine daily for it to be an accurate account (Stoodley 1983). Evaluation of chick progress should not be done solely on weight, understanding the normal physical appearance of a chick is vital to clinical assessment and early disease recognition

Parrots chicks are not able to regulate their own body temperature for the first few weeks of their life, so should be reared in a brooder box. A good brooder box should have the following features: easy to clean and disinfect, Perspex front for viewing without opening, thermostatic temperature control heating pad (chicks should not be able to come into direct contact with the heat source) and adequate ventilation. (Clubb et al 1992).

Chicks being reared in a brooder box should be kept at 36.1° C with 30 % humidity for the first two to three days, which can then be gradually dropped to 32.2 °C over the next three weeks. (Stoodley 1983). If temperatures are too high, the chick may exhibit panting, unrest, hyperactivity, or poor growth rate, the skin may appear red. If the temperature is too cold it may cause: poor gut mobility, crop stasis, digestive disorders, failure to feed or beg, inactivity, shivering, increased risk of respiratory disease, or death (Clubb et al 1992).

At Healesville Sanctuary a few orange-bellied parrot chicks have been hand reared, unfeathered chicks are kept in an esky brooder at ~30°C, once they are feathered and moving about they are moved to a more conventional brooder box and kept at ~ 28°C. Imprinting problems can arise when hand rearing, particularly single chicks, it is better to hand raise orange-bellied parrot chicks in groups of two or more. (Hockley pers. comm.).

11.3 Hand Rearing Diets

Most hand rearing failures are not from incorrect formula, but bacterial infection due to poor hygiene, or poor brooder facilities (Sindel & Gill 1992). Cleanliness is very important for hatchlings, as their immune system is immature and not able to withstand common bacteria. Hands and all equipment should ideally be washed between feeding each chick. All equipment should also be sterilised between each feed. This can be done using a variety of methods including soaking in commercially available sterilising solutions or steaming in a commercially available baby bottle sterilising unit.

The basic rules in parrot hand rearing diets are; 1) it needs to be simple to prepare, 2) should not contain any ingredients that will deteriorate or promote bacterial or fungal growth when stored, 3) Provides all the nutritional requirements to rear healthy chicks, 4) Has 15-20% protein content, which is the optimum range for rearing *Neophema* chicks (Sindel & Gill 1992).

A number of hand rearing diets are listed in Appendix 1.

Vitamin supplements do not appear to be necessary in a correct hand rearing diet. Formula should be fed a 37-38°C, too hot may burn the chicks crop, too cold, it may be refused or chill the chick causing crop stasis. (Clubb et al 1992). The formula should be the consistency of thick soup. If the formula is too diluted, the chick will receive inadequate nutrition and stunting may occur. If the formula is too thick it can result in slow gut transit time and dehydration. A more watery solution is recommended for the first few days. Fasting for the first day after hatching is not required for psittacines. Chicks 0-2 days old should be fed 6 times daily, as the crop stretches, allowing more volume per feed, chicks can be reduced to four daily feeds within 3-4 days. Chicks can be further reduced to three feeds once the crop emptying time is prolonged. As feathers emerge and digestion is again prolonged, chicks can be reduced to two feeds until weaning. If large amounts of food remain in the crop when it should be empty, this disorder should be investigated (Clubb et al 1992).

Parent-raised chicks grow more rapidly in the first few weeks, but healthy hand-reared chicks will catch up as weaning approaches. Weaning is a normal physiological response, when birds are old enough and have adequate weight gain, they will wean rapidly. Weaning should not be attempted too early as chicks may lose too much weight and become malnourished and are more susceptible to disease. Learned behaviour skills may be required for weaning; some chicks learn that persistent begging results in continued hand feeding rather than becoming self-reliant. Younger chicks that are housed with older ones will usually self-feed earlier. Weaning should begin after the chick has reached an age and level of behaviour at which it is physically ready to wean. At this time the chick should have gained their maximum weight, and have most of body feather except crop and back at pinfeather stage. Chicks are usually ready to sample solid foods at this time. A variety of soft foods should be offered at weaning time. Water is also required. Weight loss of 10-20% is considered normal during weaning, but hand feeding should resume if chicks become thin. (Clubb *et al* 1992). Weaning is not difficult, hand raised orange-bellied parrots chicks tend to start picking at the floor of the brooder box at about 3 ½ weeks at which time they are offered soaked seed, once they are eating soaked seed well they are introduced to hard seed mix. (Hockley *pers. comm.*).

Figure 13. Orange-bellied parrot chicks. (Photo M. Holdsworth)

11.14 Use of foster species

Fostering between the *Neophema* group is widely practiced in Aviculture, overall the genus makes good foster parents, fostering at all stages from fresh eggs to hatchlings to babies at any stage provided that the clutch into which they are being fostered is a similar stage of development. (Sindel & Gill 1992). Of the genus *Neophema*, the most behaviourally similar to the orange-bellied parrot are the Elegant parakeet *Neophema elegans*, Blue-winged Parrakeet *Neophema chrysostoma* and Rock Parrakeet *Neophema petrophila*.

At Healesville Sanctuary cross fostering of Orange-bellied Parrots has been attempted (through necessity) with Red-rumped Parrots *Psephotus haematonotus* with limited success (Hockley *pers. comm.*).

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Appendix.

***Neophema* hand rearing diets**

Diet #1 – Healesville Sanctuary

1 part heinz High protein cereal
1 part Canary starter
1 part ground Eukanuba dry dog food
Mix with boiled water, allow to cool to body temperature before feeding.

Diet # 2 – Martin (A) – for chicks up to pin feather stage

110g High Protein baby cereal
110g Egg & biscuit mix
60g full cream milk powder
1dsp of equal quantities: maize meal, ground rice, arrowroot biscuit, millet meal.

Mix with water, feed whenever crop empty.
(Martin 1997).

Diet #3- Martin (B) – for older chicks

225g High Protein baby cereal
60g Sunflower meal
110g crushed arrowroot biscuits
110g unprocessed wheatgerm
1tsp Glucodin
1dsp of equal quantities: maize meal, ground rice, arrowroot biscuit, millet meal.
1 drop/chick – Pentavite – vitamins.

Mix with water, feed four times daily.
(Martin 1997).

Diet #4 – Stan Sindel

1 part ground chicken starter crumble
1 part ground egg & biscuit (canary rearing food)
1 part sunflower meal
1 part Farex baby cereal
1tsp/4cups mix multivitamin & mineral powder
1tsp/4cups mix calcium supplement

Mix with hot water.
(Sindel & Gill 1992).