

Feed Guidelines for Native Birds in Rehabilitation

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Abstract

This paper outlines a project to develop scientifically-formulated feed guidelines for native birds in rehabilitation. Information on natural diets was sourced from published studies on wild birds. Captive diets were formulated to match the nutritional requirements of different species. Diets include a significant amount of natural-type foods where possible. Bird's energy requirements were calculated from metabolic equations and then scaled to account for adult maintenance or growth of chicks. Diet energy content was calculated from food composition data and from this daily feed estimates were determined. Information on chick growth and development was sourced from published studies of parent-reared birds, as well as the author's hand-rearing records. As a result of this work, species-specific feed guidelines and growth charts are now available to wildlife rehabilitators in a free publication - Feeding Guidelines for Native Birds.

Keywords: Australian native, bird, foods, feed guidelines, growth chart, insectivore, nectarivore

Introduction

There is little published research on the nutritional requirements of Australian birds in rehabilitation. Diets fed in care are often based on outdated home-made recipes and don't necessarily cater for birds' specific nutritional or physiological requirements. It is important for birds in rehabilitation to be fed a diet that is appropriate to their species, providing suitable nutrition for recovery, growth and development.

Natural Diets

Information on birds' natural diets was sourced from published studies on wild birds. Many of these studies are summarised in The Handbook of Australian, New Zealand and Antarctic Birds (HANZAB)¹. Broad nutritional categories used to describe different bird species are listed in Table 1. These categories relate to the primary diets consumed by adult birds, however most species do not strictly fall into a single category. For example, many nectar-eating birds like honeyeaters include a large proportion of insects in their diet.

Table 1. Nutritional categories of Australian Birds

Nutritional Category	Primary Diet	Main Energy Source	Examples
Insectivore	Insects and other invertebrates.	Protein	Swallows, Magpie-Lark, Magpie, Masked Lapwing, Tawny Frogmouth
Carnivore	Vertebrate prey: mammals, birds or reptiles.	Protein	Raptors, Owls
Piscivore	Fish and aquatic invertebrates	Protein	Seabirds, Cormorants, Penguins
Granivore	Seeds from grasses, herbs & trees.	Carbohydrate (starch)	Parrots, Cockatoos, Pigeons, Finches.
Frugivore	Native fruits.	Carbohydrate (sugars)	Fruit-doves, Figbird, Koel, Bowerbirds, Mistletoebird.

Nectarivore	Nectar and pollen from native flowers.	Carbohydrate (sugars)	Lorikeets, Honeyeaters, Sunbirds.
Herbivore	Plant material, grasses, shoots.	Carbohydrate (Plant cell contents)	Wood Duck, Black Swan, Swamphen.

From a nutritional point of view, birds can be defined by the main energy source in their diet – either protein or carbohydrate. Insectivores, carnivores and piscivores all have a high requirement for animal protein. By contrast, granivores, frugivores, nectarivores and herbivores obtain the majority of their energy from carbohydrates, which generally come from plants. Carbohydrates are further categorised as either simple sugars, which are easily digested (frugivores & nectarivores) or more resistant starches and plant cell contents that require a grinding gizzard and specific digestive enzymes (granivores, herbivores)². Carbohydrate-dependent birds still require a maintenance level of protein in their diet, and often supplement their intake with insects and invertebrates, particular when rearing young.

Captive Diets

In rehabilitation it is often impractical to provide the variety of food items consumed by birds in the wild. Therefore, commercially-formulated or home-made recipes are widely used as a significant proportion of the diet. In this case it is essential that the artificial diet mirrors as closely as possible the nutrient composition of the wild-type diet that birds have evolved to eat. For example, insectivorous and carnivorous birds have a high requirement for protein, so should not be fed large amounts of carbohydrates (such as grains or sugars). The practice of adding baby cereal, bran or breadcrumbs into “meat-mixes” is therefore not nutritionally appropriate for birds that are largely dependent on animal protein in their diet. While it is tempting to rely heavily on artificial diets, as much “natural” food should be incorporated as possible. These items vary depending on species as outlined in Table 2. Natural foods are essential to provide nutritional variety, environmental enrichment and stimulation of normal feeding behaviour.

Table 2. Food types for captive birds in rehabilitation

Bird Type	“Natural” Food items	Artificial Diet	Juvenile Diet
Small Insectivore	Mealworms, crickets, wild-caught insects.	Insectivore Egg-Mix (Appendix 1)	As per adult diet (wings, legs and exoskeleton of insects removed for very young chicks)
Large Insectivore	Mealworms, crickets, woodies, earthworms	Insectivore Meat-mix (Appendix 1)	
Raptor	Whole prey items (mice, day old chicks, quail, rabbit, crickets)	Not usually applicable	As per adult diet (chopped into smaller pieces)
Seabird	Whole fish, squid.	Seabird Emergency Diet (Appendix 3)	As per adult diet
Parrot	Seeding grasses, gum nuts, fruiting plants.	Budgie or small parrot seed mix.	Hand Rearing Food
Lorikeet	Native blossom, especially eucalyptus.	Lorikeet & Honeyeater Food (Appendix 2)	
Pigeons (granivorous)	Seeding grasses, plant material.	Budgie, small parrot or pigeon seed mix.	Hand Rearing Food with added High Protein Supplement
Pigeons (frugivorous)	Native fruits – figs, laurels, lilly-pilly etc.	Diced fruit mix with High Protein Supplement	

Honeyeaters	Native blossom, insects.	Lorikeet & Honeyeater Food (Appendix 2)	Insectivore Egg-Mix
Figbird	Native figs, insects.	Diced fruit mix with Insectivore	Insectivore Egg-Mix
Black Duck	Aquatic weeds, seeding grasses, invertebrates.	Crumbles/Chopped Greens/Insectivore Mix (Appendix 4)	As per adult diet but higher protein levels (Appendix 4).
Wood Duck	Grass, clover, aquatic weeds.		

Growing chicks have an increased requirement for protein, vitamins and minerals (eg calcium). This supports skeletal, feather and body tissue growth. Juvenile insectivorous, carnivorous and piscivorous birds have similar diets to adults, as these already contain high levels of protein. Other species require specific juvenile diets to supply the increased demands for growth (see Table 2). A useful high-protein diet for small, altricial nestlings is mashed hard-boiled egg mixed with Insectivore Rearing Mix (Appendix 1). This replicates the nutritional profile of a mixed insect/invertebrate diet and is easily fed to gaping chicks using tweezers. Once chicks are growing feathers they can be gradually weaned on to their adult diet (see example feed chart for Red Wattlebird – Appendix 7).

Feed Quantity

Birds eat to satisfy their energy requirements². The amount of food required for a given bird is calculated as follows:

$$\text{Food Quantity (g/day)} = \text{Bird Energy Requirement (kJ/day)} \div \text{Energy Content in Food (kJ/g)}.$$

Energy requirement is estimated from the Basal Metabolic Rate (BMR), which is the “baseload” energy expenditure of a resting bird at a thermoneutral temperature. This is calculated experimentally and varies as a function of body weight (W in grams):

$$\text{Passerines}^2: \quad \text{BMR (kJ/day)} = 480 \times W^{0.73}$$

$$\text{Non-passerines}^2: \quad \text{BMR (kJ/day)} = 308 \times W^{0.73}$$

$$\text{Raptors}^3: \quad \text{BMR (kJ/day)} = 265 \times W^{0.68}$$

From this it can be seen that passerines (eg honeyeaters, magpies) have a higher metabolic rate than non-passerines (eg waterbirds, parrots, kingfishers). Raptors are lower still and owls and frogmouths have some of the lowest metabolic rates recorded in birds⁴.

Actual energy expended by birds is estimated as a multiplier of BMR:

Maintenance (adult birds)	1.5 – 2.0 × BMR
Growth (juvenile or sick birds)	2.25 – 4.5 × BMR

The BMR multiplier used depends on environmental temperature, bird activity levels and growth rate. This can lead to highly variable estimates of energy requirements, because most of these factors are difficult to accurately determine in a rehabilitation setting. For young chicks the major factor is growth rate, and stage of development. For example, fast-growing altricial chicks (eg passerines, doves, parrots) have a higher BMR multiplier than slower growing, precocial birds (eg ducks, waterbirds).

The other aspect to calculating feed quantities is a determination of the energy content in the food consumed. Energy content is determined by the nutrient composition of the food (protein, carbohydrate and fat). Fat contains about twice the energy per gram than either protein or carbohydrate, so higher fat foods are more energy dense. For example, oil seeds such as sunflower have a higher energy concentration than low fat seeds like millet. Likewise, immature insects (eg mealworms) have a higher energy content than mature insects (eg crickets). Food digestibility also varies between species and food types. Many foods (eg whole prey diets for raptors) also contain significant indigestible material, so this needs to be accounted for when determining food energy content.

Due to the inherent inaccuracy of determining bird energy requirements as well as food energy content, the accurate calculation of an individual bird's daily food requirements is a complex task. Hence the feed charts calculated in this project provide estimates only and should be considered as a guideline for birds in care. Ultimately the best indicator of sufficient nutrient intake in adult birds is maintenance of healthy weight and body condition. For chicks, growth rates and physical development (eg feather growth) should ideally be in line with those of normal parent-reared birds. This highlights the potential usefulness of growth charts when hand-rearing chicks.

Growth Rates

As part of this project, a literature review of published data on growth rates of Australian birds was conducted. In most cases, data was recorded in parent-reared birds (wild or captive bred). This was taken as a basis for establishing growth targets for hand-reared birds.

Growth rates for most species follow a sigmoidal (s-shaped) curve, where initial growth is slow, followed by a linear growth phase, then a flattening out approaching adult weight (Figure 1).

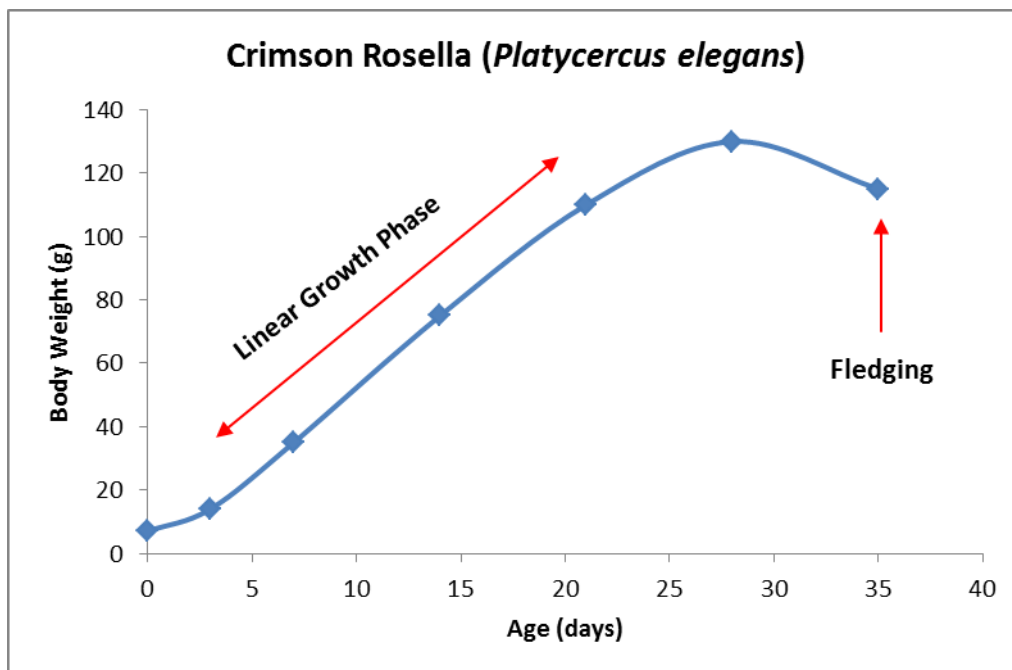


Figure 1. Growth curve for Crimson Rosella⁵

Fledging is the time when the chick makes its first sustained flight, and this may be preceded by a decrease in body weight of up to 15%. Some species leave the nest before they are capable of flight, spending time in or around the nest tree. This is referred to as the “brancher” stage and is seen in such species as the Australian Magpie, Tawny Frogmouth, raptors and owls.

The linear growth phase corresponds to the maximum growth rate and highest energy demands in young birds. Average daily weight gains are calculated for the linear growth phase by dividing the total weight gain in this period by the number of days. In the case of the Crimson Rosella above, body weight increases from about 15 g on day 3 to 110 g on day 21. This produces an average daily weight gain of $(110 - 15) \div (21 - 3)$ or approximately 5 grams per day. This should be the target weight gain for a chick of this species that comes into care.

However, weight gain is highly variable between individuals, and body weight on its own is inaccurate in determining the age of young birds. In cases where other body measurements are available, these appear to be much more accurate in ageing young birds. For example, in Welcome Swallows (*Hirundo neoxena*) wing length is a reliable indicator in ageing chicks up until fledging⁶. Other useful body measurements are tail, tarsus (lower leg), bill or combined head-bill length.

As a result of this study, detailed growth and feed charts for a range of Australian bird species have been compiled (Table 3). Surprisingly there was no available published growth data on such common species as Australian Wood Duck, Pacific Black Duck and Red Wattlebird. In these cases, growth charts were compiled from the author’s own records (Appendices 5-7). For many species, even where body weight gains with age are available, corresponding body measurements are still required to assist in accurately ageing chicks (eg Rainbow Lorikeet, Tawny Frogmouth). More data from bird rehabilitators are required to validate the accuracy of the charts compiled in this study as well as generate new charts for species not listed in Table 3.

Table 3. Growth and Feed Charts compiled for Australian bird species in this study.

Species	Body Weight	Body Measurements
White-faced Heron (<i>Ardea novaehollandiae</i>)	Yes	Yes
Cattle Egret (<i>Ardea ibis</i>)	Yes	Yes
White Ibis (<i>Threskiornis molucca</i>)	Yes	Yes
Pacific Black Duck* (<i>Anas superciliosa</i>)	Yes	No
Australian Wood Duck* (<i>Chenonetta jubata</i>)	Yes	Yes
Black Swan (<i>Cygnus atratus</i>)	Yes	No
Nankeen Kestrel (<i>Falco cenchroides</i>)	Yes	Yes
Masked Lapwing (<i>Vanellus miles</i>)	Yes	Yes
Silver Gull (<i>Larus novaehollandiae</i>)	Yes	No
Crested Tern (<i>Thalasseus bergii</i>)	Yes	Yes
Crested Pigeon (<i>Ocyphaps lophotes</i>)	Yes	Yes
Peaceful Dove (<i>Geopelia placida</i>)	Yes	Yes
Bar-shouldered Dove (<i>Geopelia humeralis</i>)	Yes	Yes
Torresian Imperial-Pigeon (<i>Ducula spilorrhoea</i>)	Yes	No
Galah (<i>Elophus roseicapillus</i>)	Yes	Yes
Sulphur-crested Cockatoo (<i>Cacatua galerita</i>)	Yes	Yes

Crimson Rosella (<i>Platycercus elegans</i>)	Yes	Yes
Eastern Rosella* (<i>Platycercus eximius</i>)	Yes	No
Rainbow Lorikeet* (<i>Trichoglossus moluccanus</i>)	Yes	No
Scaly-breasted Lorikeet (<i>Trichoglossus chlorolepidotus</i>)	Yes	No
Southern Boobook (<i>Ninox boobook</i>)	Yes	Yes
Barn Owl (<i>Tyto delicatula</i>)	Yes	Yes
Tawny Frogmouth (<i>Podargus strigoides</i>)	Yes	No
Laughing Kookaburra (<i>Dacelo novaguineae</i>)	Yes	Yes
Dollarbird (<i>Eurystomus orientalis</i>)	Yes	No
Welcome Swallow (<i>Hirundo neoxena</i>)	Yes	Yes
Red Wattlebird* (<i>Anthochaera carunculata</i>)	Yes	Yes
Blue-faced Honeyeater (<i>Entomyzon cyanotis</i>)	Yes	No
Australian Raven (<i>Corvus coronoides</i>)	Yes	Yes
Australian Magpie (<i>Cracticus tibicen</i>)	Yes	Yes
Magpie-Lark (<i>Grallina cyanoleuca</i>)	Yes	Yes
Red-browed Finch* (<i>Neochmia temporalis</i>)	Yes	No

* Data from author's own records.

Conclusions

A good understanding of a bird's natural diet should provide the basis for its captive diet in rehabilitation. Captive diets need to cater for the nutritional requirements of different species and may combine a range of natural foods as well as appropriate artificial diets. Accurate determination of feed quantities involves a complex calculation of bird energy expenditure and food energy content. For young growing birds, growth rates and physical development should ideally match those of healthy parent-reared birds

As a result of this study, species-specific feed guidelines and growth charts are now available in the free publication *Feeding Guidelines for Native Birds**.

More work needs to be done, and wildlife rehabilitators are encouraged to keep accurate records of diets and growth rates, in order to further improve our state of knowledge in the rehabilitation of Australian birds.

*Available by contacting info@wombaroo.com.au ph (08) 8391 1713.

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Appendices

Appendix 1 – Insectivore Diet

Appendix 2 – Nectarivore Diet

Appendix 3 – Seabird Emergency Diet

Appendix 4 – Duck Feeding Guidelines

Appendix 5 – Australian Wood Duck Growth & Feed Chart

Appendix 6 – Pacific Black Duck Growth & Feed Chart

Appendix 7 – Red Wattlebird Growth & Feed Chart

Appendix 1 – Insectivore Diets

Guidelines are based on using Wombaroo Insectivore Rearing Mix™. Do not add vitamin, mineral or concentrated food supplements to the following diets as this may significantly alter the balance of nutrients. Insectivorous & carnivorous birds require high levels of protein, but low levels of carbohydrate. Avoid supplementing with products containing grains, starches or sugars (eg bran, baby cereal, bread etc).

Insectivore Meat-Mix

Mix 10 g (1 scoop) of Insectivore powder per 20 g of minced meat or fish.

A little extra water may be necessary to moisten the preparation. Meat mix may be rolled into small balls or “worms” to facilitate hand-feeding.



Insectivore Egg-Mix

Mix 20 g (2 scoops) of Insectivore powder with one mashed hard-boiled egg (40 g).

Egg should be well mashed first using a fork. A little extra water may be necessary to moisten the preparation.

Generally larger insectivores and carnivores (eg magpies, kookaburras etc.) are fed **Meat-Mix** and small birds (nestling honeyeaters, swallows etc.) and waders (eg Masked Lapwings) are fed **Egg-Mix**. However, these preparations contain similar nutrient profiles, so can be interchanged.



Feeding:

Dependent chicks or non-feeding adults: feed small pieces directly to the bill of gaping young chicks using tweezers. Force feed sick or inappetant adults birds (eg Tawny Frogmouth), by pushing food deep into the oesophagus. Always offer extra drinking water using a syringe, as hand-fed birds are prone to dehydration.

Self-feeding Birds: Offer food in a clean bowl. Live insects or invertebrates (mealworms, crickets, earthworms etc.) should be mixed in with these foods to encourage intake (see right). Always have fresh water available in a separate bowl.

Storage:

Store prepared food refrigerated for a day or frozen for up to 2 weeks. Small quantities can be frozen into ice cube trays (5-10 g per cube) and thawed out as required.



Appendix 2 – Nectarivore Diet

Guidelines are based on using Wombaroo Lorikeet & Honeyeater Food™. This is a formulated complete food which replicates the consistency and composition of nectar, with a protein profile similar to that of pollen.

Directions:

To make 100 mL of food mix 30 g of powder (3 level scoops) with 80 mL of warm, pre-boiled water.

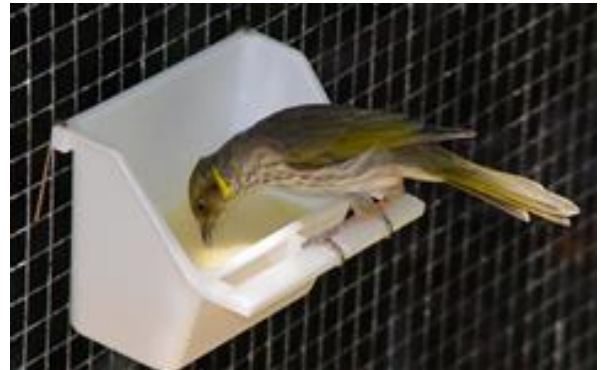
Food should be made up at the correct dilution, otherwise the calculated feed volumes will not apply. This concentration of solids (300 g per litre) is also the optimum nectar concentration for nectar feeding birds, as it minimises spoilage.

Feeding:

Provide in a clean bowl or sipper tube. Feed according to body weight of bird as per feed tables.



Lorikeet feeding from sipper tube



Honeyeater feeding from plastic bowl.

To keep the food as fresh as possible it is recommended to divide the daily feed volume into two feeds (morning & afternoon). This also replicates the natural feeding times of wild lorikeets and honeyeaters. Also offer a range of native blossom, especially eucalyptus.

Storage:

Store prepared food refrigerated for a day or frozen for up to 2 weeks. Small quantities can be frozen into ice cube trays (10-15 ml per cube), and thawed out as required.



Appendix 3 – Seabird Emergency Diet

This is used in initial care when debilitated seabirds are unable to digest whole fish properly and require a readily-digestible pureed diet. Hill’s a/d™ (canine/feline recovery formula) is used as the base for this diet and is readily available from most vets. Added to this is **Wombaroo Insectivore Rearing Mix™** and **Passwell Good Oil for Birds™** which adjusts the nutrient profile to be more in line with a whole fish diet.

- 1 x tin (156 g) Hill’s a/d Urgent Care
- 100 mL water (or electrolyte solution)
- 40 g Wombaroo Insectivore Rearing Mix™
- 3 mL Passwell Good Oil for Birds™



Directions: Mix thoroughly into a slurry and tube feed at about 35°C. Once the bird is strong enough it can be assist-fed with whole fish.

Supplementing whole fish: This mix can be injected into whole fish (10 mL per 100 g of fish) to improve their nutritional content. This replaces the need to supplement frozen fish with seabird vitamin tablets.

Storage: Store prepared food refrigerated for a day or frozen for up to 2 weeks. Small quantities can be frozen into ice cube trays (15 ml per cube) and thawed out as required.

Feeding Guide:

Body Weight (g)	Feed (g/day)		Body Weight (g)	Feed (g/day)	
	Maintenance	Growth		Maintenance	Growth
100	26	40	1800	215	325
200	43	65	2000	230	350
300	57	85	2500	270	400
400	70	105	3000	310	465
500	85	125	3500	350	525
600	95	145	4000	380	570
700	110	165	4500	415	625
800	120	180	5000	450	675
900	130	200	6000	515	775
1000	140	210	7000	575	860
1200	160	240	8000	630	950
1400	175	265	9000	700	1000
1600	200	300	10000	750	1100

Appendix 4 - Duck Feeding Guidelines

Ducks and waterfowl are categorised as being mainly herbivorous (grazers, aquatic plants), mixed feeders (plants & invertebrates) or insectivorous (insects & aquatic invertebrates):

Diet	Herbivorous	Mixed	Insectivorous
Species	Wood Duck, Shelduck, Whistling-Duck, Black Swan, Pygmy-Goose, Magpie Goose, Cape Barren Goose.	Black Duck, Grey & Chestnut Teal, Hardhead, Blue-billed Duck, Freckled Duck.	Pink-eared Duck, Australasian Shoveler (filter feeders) Musk Duck (invertebrates)
Protein	Low (15-18%)	Moderate (18-21%)	High (>22%)

Protein levels generally increase the higher the proportion of insects & invertebrates in the diet. However, excessive protein has been implicated in causing kidney damage and in the development of “angel wing” in growing ducks (Brown 1998). We recommend feeding a base diet of **Passwell Crumbles™** (which has a moderate protein level of 15%) mixed with chopped greens (lettuce, spinach, endive, bok choy, sprouts etc) and **Insectivore Rearing Mix™**. The proportions of greens and Insectivore are varied to modify the protein content of the final diet to suit the species type and growth stage:

Passwell Crumbles	Chopped Greens	Insectivore Rearing Mix	Protein (Dry Basis)	Duckling Age		Adults (7+ weeks)
				0-2 weeks	2-7 weeks	
1 cup (150g)	2½ cups (100 g)	0	17%			Herbivorous
1 cup (150g)	2 cups (80 g)	1 scoop (10 g)	19%		Herbivorous	Mixed
1 cup (150g)	1 ½cup (60 g)	2 scoops (20 g)	22%	Herbivorous	Mixed	Insectivorous
1 cup (150g)	1 cup (40 g)	3 scoops (30 g)	24%	Mixed	Insectivorous	
1 cup (150g)	0	4 scoops (40 g)	26%	Insectivorous		

Directions:

Blend together and add sufficient water to make a moist crumbly mix. Amount of water added can be varied, but always ensure sufficient drinking water is also provided. Feed out 2 to 3 times a day to avoid food becoming contaminated.

All waterfowl should have ad lib access to aquatic vegetation (eg duckweed). Grazing species should have free access to lawn or pasture.

A note on using Chick & Turkey Starter

Commercial poultry foods (ie “starter” crumbles) are often used as the basis for rehabilitation duck diets, but caution needs to be taken when using these products. Chick Starter typically contains around 20% protein and Turkey Starter 28%. Hence for some species or stages of growth these higher levels of protein may be excessive. Since commercial poultry diets are designed for maximal growth of meat-producing birds, the levels of many nutrients such as vitamins & minerals may be excessive for rehabilitation diets.

Reference: Brown, D. (1998). *A Guide to Pheasants & Waterfowl*. ABK Publications.

Appendix 5 – Australian Wood Duck (*Chenonetta jubta*) Growth & Feed Chart

Adult weight: 700 -950 g

Natural Diet: Mostly plant material (> 99%), particularly grass, clover & other green herbage.



Secondary Diet: Insects (< 1% of adult diet).

Captive Diet: **Passwell Crumbles** mixed with chopped greens. Supplement with grass, herbage and aquatic vegetation. Free access to lawn/pasture, clumps of grass if possible.

Juvenile Diet: As per adult diet but supplemented low levels of **Insectivore Rearing Mix** for growth. Note this species may be susceptible to “angel wing” if fed excessive protein levels.

Growth & Feed Chart

Age (weeks)	Developmental Stage	Bill (mm)	Tarsus (mm)	Weight (g) ^a	Feed (g/day)	Protein (%) ^b
Hatch	Brown & off-white down. Characteristic double face stripe & pinkish bill tip. Egg tooth may be present in newly hatched young	12	29	28	8	22
1		14	35	65	16	
2		18	45	140	28	19
3	Scapulars & spotted body feathers emerging.	22	54	250	42	
4	Primary pins approx. 50 mm, starting to unsheathe	25	59	400	60	
5	Body fully feathered, primary feathers growing	26	63	540	75	
6	Primaries ½ grown – preening & flapping.	27		680	70	
7	Primaries mostly grown – exercising wings often.	28		750 ^c	65	
8	Able to fly – prepare for release		60	17		
Adult	Sizes varies between individuals.	28			750	60
					850	65
				950	70	

- Weight is not an accurate indicator of age. Average weight gain from 1-7 weeks is 10-25 g/day.
- Refer to Appendix 4 for diet components at varying protein levels.
- Weight varies significantly between individuals. Weight may reduce slightly prior to gaining flight.

Adult Diet

850 g adult requires 65 g/day (620 kJ/day)

- **40 g Passwell Crumbles (¼ cup)** – some proportion may be replaced with budgie seed.
- **25 g Chopped greens (⅓ cup)** – lettuce, spinach, endive, bok choy, sprouts etc.

➔ Mix together and add sufficient water to make into a moist, crumbly mix.

Provide ad lib aquatic weeds and grazing on grass, clover or other pasture.

Appendix 6 – Pacific Black Duck (*Anas superciliosa*) Growth & Feed Chart

- Adult weight:** 800 -1300 g
- Natural Diet:** Plant material (70-95% by volume), particularly seeds of aquatic vegetation.
- Secondary Diet:** Aquatic insects, snails & crustaceans (5-30% by volume).



Captive Diet: **Passwell Crumbles** mixed with chopped greens & **Insectivore Rearing Mix** (Appendix 4). Supplement with aquatic plants, seeding grasses, insects & budgie seed.

Juvenile Diet: As per adult diet but supplemented with higher levels of **Insectivore Rearing Mix** for growth. Note this species is susceptible to “angel wing” if fed excessive protein levels.

Growth & Feed Chart

Age (weeks)	Developmental Stage	Weight (g) ^a	Feed (g/day)	Protein (%) ^b
Hatch	Brown & yellowish down. Egg tooth may be present in newly hatched young	28	8	24
1		70	17	
2	Tail feathers just emerging	150	29	22
3	Body feathers coming through	250	42	
4	Scapular feathers present	400	60	
5	Half grown, primary feathers in pin	550	75	
6	Body fully feathered, primaries growing	700	70	
7	Flapping and preening, primaries $\frac{3}{4}$ grown	800 ^c	65	
8	Able to fly – prepare for release		60	
Adult	Size varies between individuals. Hybrid Mallards may be larger.	800	60	19
		1000	70	
		1200	80	

- Weight is not an accurate indicator of age. Average weight gain from 1-7 weeks is 10-25 g/day.
- Refer to Appendix 4 for diet components at varying protein levels.
- Weight varies between individuals. Weight may reduce slightly prior to gaining flight.

Adult Diet

1000 g adult requires 70 g/day (700 kJ/day)

- **40 g Passwell Crumbles** ($\frac{1}{4}$ cup)
- **20 g Chopped greens** ($\frac{1}{2}$ cup) – lettuce, spinach, endive, bok choy, sprouts etc.
- **7 g Budgie Seed** ($1\frac{1}{2}$ teaspoons)
- **3 g Insectivore Rearing Mix** ($\frac{1}{3}$ scoop)

➔ Mix together and add sufficient water to make into a moist, crumbly mix.

Provide ad lib aquatic weeds (duckweed etc.) into water tray as well as seeding grasses.

Appendix 7 – Red Wattlebird (*Anthochaera carunculata*) Growth & Feed Chart

<u>Adult Weight:</u>	90-140 g, males heavier.
<u>Natural Diet:</u>	Nectar from native plants especially <i>eucalyptus</i> , <i>banksia</i> , <i>grevillea</i> , <i>callistemon</i> .
<u>Secondary Diet:</u>	Insects, spiders, manna, lerp, honeydew.
<u>Captive Diet:</u>	Wombaroo Lorikeet & Honeyeater Food (LHF – Appendix 2). Native flowers. Supplemental insects, Insectivore Egg-Mix (Appendix 1).
<u>Juvenile Diet:</u>	Insectivore Egg Mix and Lorikeet & Honeyeater Food. Mealworms & small crickets. Increasing proportion of Lorikeet & Honeyeater Food from 7 days onwards.



Growth & Feed Chart

Age (days)	Developmental Stage	Head & Bill (mm)	Wing (mm)	Weight ^a (g)	Feed ^b	
					Egg Mix (g/day)	LHF (ml/day)
Hatch	Eyes closed. Mostly naked, fine grey down on back & head.	18	10	6	3	1.5
3		23	15	13	5	3
7	Eyes just open. Pin feathers on wings.	30	32	27	7	6
10	Wing feathers unsheathing. Tail starting to grow.	35	48	39	8	11
14	Body mostly feathered. Tail approx. 20 mm	41	72	54	9	18
18	Fledging. Tail approx. 40 mm	45	92	64	8	24
21	Self-feeding on LH Food. Tail approx. 60 mm	48	105	71	4	30
28	Wattle visible. Tail approx. 90 mm	53	130	85	-	37
42	Independent – prepare for release. Tail > 120 mm	57	138	100	-	40
Adult	Size depends on geographical variation and sex (males generally larger).	59	145	110	-	45
		63	156	130	-	50

- Weight is not an accurate indicator of age. Average Weight Gain in first 28 days is 2-4 g/day.
- Feed based on a combination of Insectivore Egg Mix and Lorikeet & Honeyeater Food (LHF).

Adult Diet

110 g Red Wattlebird requires 210 kJ/day

- 45 mL **Lorikeet & Honeyeater Food** (3 x 15 mL ice cubes)
- 2 g live insects (moths, flies, mealworms & crickets) or **Insectivore Egg-Mix** (½ teaspoon).
- Ad lib flowering *eucalyptus*, *banksia*, *grevillea*, *callistemon*