Husbandry Guidelines For

Rainbow bee-eater

Merops ornatus

Aves:Meropidae

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Occupational health and safety

Rainbow bee-eaters *Merops ornatus* are not aggressive birds. They cannot cause any harm to keepers with their beak or claws. And they do not have any diseases that can be transferred to keepers so Rainbow bee-eaters *Merops ornatus* are not an Occupational health and safety risk.

Introduction

The Rainbow bee-eater *Merops ornatus* is a brightly coloured small bird. It has long slender glossy black beak which is used for catching flying insects, such as bees. All bee-eaters are brightly coloured and all prey on flying insects. Males are identical to females except for two long central tail feathers where the female has very short ones. They are unlike the majority of birds in the way that they nest as they do not make nests in trees but underground where they excavate a burrow where the eggs are laid.
Rainbow bee-eaters *Merops ornatus* are fairly common in captivity. They are easily housed with other bird species and are relatively easy to keep.
As Rainbow bee-eaters *Merops ornatus* are not a threatened or endangered species and are not commonly known by a lot of people they are not generally used for education, conservation or research purposes.

1.1 ASMP Category

There is currently no ASMP category for Rainbow bee-eaters *Merops ornatus*

1.2 IUCN Category

The IUCN category for rainbow bee-eaters Merops ornatus is LC

1.3 EA Category

Rainbow bee-eaters *Merops ornatus* are not protected in any states of Australia and are not a threatened species as they are locally common.

1.4 NZ and PNG Categories and Legislation

There are no NZ or PNG categories or legislations available for Rainbow bee-eaters *Merops ornatus*

1.5 Wild Population Management

Rainbow bee-eaters *Merops ornatus* are not a threatened species so they do not have a population management scheme

1.6 Species Coordinator

There is no species coordinator for Rainbow bee-eaters *Merops ornatus.*

1.7 Studbook Holder

There is no studbook holder for Rainbow bee-eaters *Merops ornatus.*

2 Taxonomy

2.1 Nomenclature

Class: Aves
Order: Coraciiformes
Family: Meropidae
Genus: Merops
Species: Merops ornatus

2.2 Subspecies

No known sub-species

2.3 Recent Synonyms

N/A

2.4 Other Common Names

Australian Bee-eater, Rainbow Bird, Black-tailed Bee-eater, Pin-tailed Bee-eater, Golden Merops, Golden Swallow, Gold Digger, Gold Miner, Pintail, Pin Tail, Spinetail, Spine Tail, Needlebeak, Berrin-berrin

References:

HANZAB volume 4: parrots to dollarbirds, edited P J Higgins. pages 1209- 1223

Kingfishers, Bee-eaters and Rollers: A Handbook. Kathie Fry and C. Hillary Fry.

Readers digest Complete Book of Australian Birds pg 356. Published 1988, edited

Cuckoos, Nightbirds & Kingfishers of Australia. Edited Ronald Strahan, The national Photographic index of Australian Wildlife.

Natural History

History

- The rainbow bee-eater is the only species of bee-eater that is found in Australia
- The rainbow-bee eater is rarely mistaken with other birds because it is quite a unique bird, with its beautiful colours, distinctive tail streamers, and curved beak.
- The Rainbow Bee-eater breeds for life and are sometimes assisted by a varying number of auxiliary birds or 'helpers' that are usually male
- Both sexes excavate the burrow. At the end of the burrow is a chamber where nesting is done. The entrance holes for the burrows are found on embankments, slopes, cliff walls.
- Birds that live in southern areas of Australia migrate to more northern parts of Australia where birds that live in northern areas of Australia are thought to be residential, meaning they do not migrate from their location.
- When hunting for food the Rainbow bee-eater sits in open or dead trees and takes its prey on the wing, prey includes bees, wasps, beetles, moths, butterflies and dragonflies.
- When Bees or Wasps are caught the sting is rubbed against a perch to remove the sting before eating.

References:

HANZAB volume 4: parrots to dollarbirds, edited P J Higgins. pages 1209- 1223

Kingfishers, Bee-eaters and Rollers: A Handbook. Kathie Fry and C. Hillary Fry.

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3.1 Morphometrics

3.1.1 Mass and Basic Body Measurements

Length: Males 25cm. Females 22cm. Both measurements include elongated tail feathers, males tail feathers are 2-6 cm long and females tail feathers are between 1 and 2 cm long. Wingspan in males is 34cm and 31cm in females.

Weight: Average weight is 27grams

3.1.2 Sexual Dimorphism

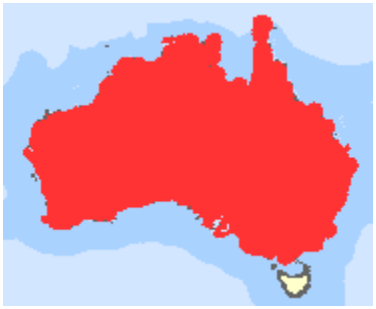
Males elongated tail feathers are longer and thinner than the females. No colour differences between males and females.

3.1.3 Distinguishing Features

The rainbow bee-eater is quite unique and is rarely confused with other birds, the most similar birds are sacred or azure kingfishers but these birds are plumper and have straighter beaks. The Rainbow bee-eater is also more colourful.

3.2 Distribution and Habitat

Distribution map for Rainbow bee-eater *Merops ornatus.*



The Rainbow bee-eater *Merops ornatus* is a migratory bird and during the winter months it migrates from the southern parts of Australia to more northern parts of Australia or even to New Guinea where the climate is much warmer.

The Rainbow bee-eater *Merops ornatus* habitat is open forest where there are plenty of available perches in dead trees or trees with little foliage so that prey can easily be spotted and captured without too much interference from branches.

The Rainbow bee-eater *Merops ornatus* is considered common and not under any threat from habitat loss or predation, this is because it is capable of building nests in sides of roads or waterways or embankments that are built by people. The main risk to young or nesting birds is flooding.

3.3 Conservation Status

The Rainbow bee-eater *Merops ornatus* is locally common and is not threatened or endangered.

3.4 Longevity

3.4.1 In the Wild

The age of birds in the wild is an estimated 7 – 10 years

3.4.2 In Captivity

Captive birds can live up to 15 years of age. Captive birds can live longer than wild birds because of a much easier life. Birds in captivity are more sheltered from the weather conditions and does not have to migrate long distances and find food.

3.4.3 Techniques Used to Determine Age in Adults

Age of adult birds is hard to determine without much stress caused to the bird. Young birds are aged by feather measurements

References:

HANZAB volume 4: parrots to dollarbirds, edited P J Higgins. pages 1209- 1223

Kingfishers, Bee-eaters and Rollers: A Handbook. Kathie Fry and C. Hillary Fry.

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Richard Webb and Michael Randy Featherdale Wildlife Park.

4. *Housing requirements*

4.1 Exhibit/Enclosure Design

Exhibit design for both adult and egg/baby Rainbow bee-eaters *Merops ornatus* are the same. Each exhibit should contain at least 2 perching areas for each bird. Perching areas are most easily made by placing in dead tree branches. This is where Rainbow bee-eaters would normally perch when in the wild. Branches should be placed in high and low positions and some in shelter and some not under shelter. A branch that has perching areas high and low would be ideal. This is so if a young bird is learning to fly it can rest and perch on lower level branches. Also in each enclosure a large mound of substrate such as red sand or dirt is needed. This is for adult birds for nesting. Each mound should be at least 60cm in height and at least 30 cm wide at its skinniest point (the top). This will allow the adult birds to have enough room to make the tunnel and chamber used to lay eggs and raise young. Each exhibit should also have enough flight area between perches so when throwing meal worms for feeding the birds have enough space to fly and capture food. Shelter is also needed on at least half of the enclosure and feeding stations should be under shelter. Air lock is recommended as these birds are very fast flyers.

4.2 Holding Area Design

Stages)

Holding area for Egg stage would be in an incubator. Once egg has hatched Baby Rainbow bee-eaters should be kept in a small box or even bucket with cat litter as substrate. The bucket or box should then be placed and kept inside a heat box. This way the temperature can be regulated and the baby will be warm as it would be in the nesting chamber.

Adult Rainbow bee-eaters can be kept in flights or temporarily in small cages. As long as there are small perches for resting on as their feet are small and quite weak and they may have trouble gripping medium sized perches. Must also be kept out of direct exposure to weather such as wind, rain and the sun.

4.3 Spatial Requirements

Rainbow bee-eaters need a large enough are for them to fly and capture food when on the wing, but because they are small birds this area does not have to be very big. An area around 1m square per bird is a good amount of area. When housing with other birds it is not recommended that they are housed with other aggressive birds such as honey eaters or robins as these birds are very

aggressive and larger than Rainbow bee-eaters. They can also easily kill or severely injure Rainbow bee-eaters

4.4 Position of Enclosures

The Position of the enclosure is not extremely important, but Rainbow bee-eaters do enjoy the morning sun so the unsheltered part of the enclosure could face either north-east or north, this will allow the birds to bask in the morning sun and throughout the day, be able to shelter from the sun when it becomes too hot, and still be able to bask in the sun in the afternoon when the sun is setting in the west.

4.5 Weather Protection

Each bird should have at least one dead branch perching area under shelter. The shelters should cover from the top, to protect from rain and hail and they should also protect from the sides to protect from winds. Each enclosure is not going to be covered at the front of the exhibit because then the public will not be able to see, so thick browse or plants can be used to protect from winds. If browse is being used grevilleas and other flowering plants can be used for enrichment and these flowers will also attract insects such as bees, allowing the bee-eaters to feed on their natural diet.

4.6 Temperature Requirements

Rainbow bee-eaters do not really like the rain or extreme wind or very cold conditions. So plenty of shelter is required to protect from these elements. Perches should also have enough space on at least 2 or 3 of them to allow the birds to roost next to each other to keep warm. Heat does not bother Rainbow bee-eaters to much as long as there is enough shelter for them to escape the direct sunlight.

4.7 Substrate

The best substrate to use is red brickies sand or dirt. These are good because they become hard and when building tunnel and nesting chamber it will not collapse on the young birds or adult birds when entering or exiting. If there is no intention on breeding Rainbow bee-eaters then any sand substrate is good to use such as course river sand, white sand or red sand.

4.8 Nest boxes and/or Bedding Material

Nest boxes or bedding material are not needed when breeding Rainbow bee-eaters. All that is needed is a mound of sand or dirt at least 60cm high and 30 cm wide at its skinniest point. A tunnel is made into this mound with a nesting chamber at the end. The chamber may be lined with dead insects which the birds will just gather from their daily diets. During breeding season food amounts should be increased, so if insects are used for lining of nesting chamber there should still be enough for a food source.

4.9 Enclosure Furnishings

Each enclosure should have at least 2 dead branches per animal for perching. Substrate should be sand preferably but dirt is ok. Should have mound for nesting, making sure it is at least 60 cm high and 30 wide at its skinniest point. Shelter needs to be over at least half of the roof area and shelter on at least 2 of the walls to protect from rain, wind and direct sunlight. Plants should also be planted to be used as barriers from wind and can also be used for perching. Feed stations should be placed under sheltered areas. A water bowl is needed. Areas for browse should also be available

References:

HANZAB volume 4: parrots to dollarbirds, edited P J Higgins. pages 1209- 1223

Kingfishers, Bee-eaters and Rollers: A Handbook. Kathie Fry and C. Hillary Fry.

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5. General Husbandry

5.1 Hygiene and Cleaning

Enclosure should be raked out every day and water bowl should be emptied and refilled every day. When raking enclosure that has seed for other animals in it seed should be raked into pile around the seed bowl and not through the rest of the enclosure so that grass does not grow from seed throughout the enclosure. Food should be emptied from bowls before new food is added and bowls should be replaced at least twice a week. When browse becomes old it should be removed or replaced.

Once a week the water bowl should be cleaned with bleach and scrubbed. Once scrubbed the bowl and surrounding areas should be thoroughly hosed out and refilled. Do not leave bleach in bowl unattended as a bird may try to drink or bath in it.

When cleaning feed bowls they should be scrubbed in warm water with detergent then rinsed in fresh clean water to remove any detergent from bowl.

Once a month the walls of the sheltered areas in the aviary should be cleaned and scrubbed with MOMAR FAR OUT. MOMAR is a type of detergent. It should be mixed to the ratio of one part MOMAR 50 parts water. A soft bristle brush should be dipped in the mix then used to scrub the walls. Once finished the MOMAR can be hosed off the walls.

Annually the aviary should have a full change of substrate and perches. This will stop large build ups of faeces and will keep the aviary looking good.

5.2 Record Keeping

⇒ **Health problems.** Parasites, worms, avian Tuberculosis.

⇒ **Veterinary examinations with treatments provided.** Vet checks every 6 months or earlier if bird appears ill

⇒ **Behavioural problems.** Record if bird becomes aggressive towards keepers or timid towards keepers.

⇒ **Reproductive stage, condition or behaviour.** Breeding seasons, conditions when breeding (mostly dirty due to entrance and exiting of burrow).

⇒ **Changes in diet.** If diet changes birds must be monitored to make sure bird is not becoming skinny

⇒ **Movements within and between institutions.** Records are kept of where bird was, what aviary and where it is going to

⇒ **Weights and measurements.** Weights and measurements are usually taken annually or when birds diet changes or when first acquired.

5.3 Methods of Identification

The most common method used for identification of the Rainbow bee-eater *Merops ornatus* in zoos and wildlife parks is leg banding. This is used to tell males and females apart but can also be used to identify pairs by using matching coloured leg bands on different breeding pairs of birds. Leg bands are used because it is the easiest way to identify individuals and is much less invasive then having to microchip each bird. When birds are captured reading leg band numbers or looking at different coloured leg bands are easier and quicker than reading microchip numbers.
The easiest way though to tell males from females is by the extended tail feathers from tail where males have longer ones than females.
It is very hard to tell individuals apart just by body markings because males and females are both brightly coloured and have very similar to almost exact markings.

5.4 Routine Data Collection

Weighing the Rainbow bee-eaters *Merops ornatus* is really the only kind of routine data collection that can be done. This can be done each week if bird is newly acquired so that you know that the bird is eating well and the diet that you are providing them is adequate. Once it is clear that the bird is getting enough dietary requirements out of the food and is at a stable weight, weighing can be done every month to ensure the bird is not to skinny or to fat.

References:
Simpson and day field guide to the birds of Australia
Featherdale Wildlife Park manager Rick Webb
Featherdale Wildlife Park head bird keeper Michael Randy
www.birdsinbackyards.net
www.environment.gov.au
www.ozanimals.com

6 Feeding Requirements

6.1 Diet in the Wild

The Rainbow bee-eater *Merops ornatus* has a wild diet that mainly consists of insects. Most commonly eaten is bees and wasps. Other insects eaten include beetles, moths, dragonflies and flies. Other animal items include tadpoles, spiders and earthworms.

6.2 Captive Diet

Meal worms are the main staple diet for Rainbow bee-eaters in captivity. These are used because they are easily accessible and cheap. With the meal worms a mince mixture is given, this is just semi lean mince mixed with crushed up dog biscuits (dog dust) until the mince is in very small pieces and coating all the pieces of mince. Also in the mix is Wombaroo insectivore mix, both the dog dust and insectivore mix are good sources of protein. The mince mix is generally used when birds of different species are in the same aviary, the bee-eaters may eat a small amount though.

When feeding the meal worms should be placed in a 250mL jug. The amount of meal worms placed in the jug should be roughly 2cm thick or just under the 50mL line. This diet is for an aviary that has a pair of bee-eaters in it. The jug is filled the rest of the way with the mince mixture. The mince mixture is used mainly for other birds in the aviary. If just feeding a pair of bee-eater just use meal worms. If feeding single bird, half the mixture, if feeding more birds place more meal worms in jug according with how many extra birds are being fed.

The Wombaroo insectivore mix is easily obtained from any animal food supplier or even some pet shops. If Wombaroo insectivore mix is unavailable any insectivore mix will do. Bee-eaters can survive without insectivore mix but if main diet is meal worms than insectivore mix helps in keeping bee-eaters healthy.

During the winter season the amount of meal worms given are reduced. During spring time close to summer the amount of meal worms used in the mix is increased, this is because summer is breeding time for Rainbow bee-eaters. The amount of food is usually always increased during breeding season. This is to replicate what would happen in the wild as a lot more insects are available in the wild during summer and late spring, which is why the Rainbow bee-eaters breed at this time of year.

6.3 Supplements

Wombaroo Insectivore supplement mix. Insectivore mix is a good source of protein and amino acids. Ingredients are: Whey protein, soy protein, meat meal, fish meal, blood meal, cereal bran, lysine, methionine, vegetable oils, omega-3 and omega-6 fatty acids, vitamins A, B_1, B_2, B_6, B_{12}, C, D_3, E, K, nicotinamide, pantothenic acid, biotin, folic acid, choline, inositol, calcium, phosphorus, potassium, sodium, magnesium, zinc, iron, manganese, copper, iodine, selenium.

Minimum Crude protein 52%, minimum crude fat 12%, maximum fibre 5%, maximum salt 0.8%.

Supplements are needed because the main diets in captivity for Rainbow bee-eaters are meal worms. Meal worms are the larval stage of the Darkling beetle T*enebrio molitor*, so they are very fatty and do not have much protein or carbohydrates, which are needed in the diet of Rainbow bee-eaters.

6.4 Presentation of Food

Food is presented in a bowl, under shelter. The food bowl is elevated off the ground. The food should be mixed up in the bowl so that all the food, the meal worms, mince, and insectivore mix, is visible. This is so when the food is put into the bowl the meal worms that are moving on top, catch the eye of the Rainbow bee-eater. Then once all of the meal worms that were on top have been eaten it will take some time until the meal worms on the bottom can crawl out to be eaten, or the Rainbow bee-eater will dig through the mince to eat the meal worms on the bottom. This is important because if all the meal worms were just placed on top then they would be eaten all at once and would become boring for the bird. But if they are all on the bottom it may take some time for the Rainbow bee-eaters to notice where the food is, so by mixing it up it allows the bird to eat straight away and also have food for later on.

Meal worms can also be thrown into the air for the Rainbow bee-eaters to catch and eat. When throwing food stand in an open area and do a bluff throw to make sure the bird is aware of what is going on, if the bird seems interested then the meal worm can be thrown in the air slightly towards the bird. This is very good way to enrichment feed Rainbow bee-eaters and it is also good for member of the public to watch. I have found this method to also be good when a new bird is being fed. Some Rainbow bee-eaters, especially wild ones are not used to eating out of the bowls. So when feeding new birds this way, I throw food in the air to be caught but slowly throw them closer to me, then I try and get the new bird to take food from my hand, this is easier to do if there is already a Rainbow bee-eater in the enclosure that does this. When the new bird does take food from your hand the first time it will be as it flies over your hand or it will hover next to your hand to take the food. A short time after this step it may start to land on your hand quickly to grab a meal worm, this is when you should start feeding from your hand very close to the feed bowl and eventually the new Rainbow bee-eater will eat from the bowl.

Another enrichment feed could be done by having flies caught in a container with a small hole in it. The flies, whilst in the container could be cooled in the fridge or cool room then put in the enclosure, as they start to warm up again they will become active and start to leave the container through the hole, this will catch the eye of the Rainbow bee-eaters and they will begin to feed on the flies as they would in the wild.

7 Handling and Transport

7.1 Timing of Capture and Handling

The best time to capture Rainbow bee-eaters would be early morning. This is because the bird is most likely not very active at this time and it is not to hot like it would be in the middle of the day. The best way to handle a Rainbow bee-eater for movement or observation would be to hold around mid section of body with index and middle finger on either side of the head. This restrains the bird and does not danger the keeper in any way because Rainbow bee-eaters do not have sharp beaks or claws.

7.2 Catching Bags

Catching nets are preferred over catching bags when attempting to catch a Rainbow bee-eater. This is because they are very fast fliers and are very agile in the air. Catching bags are heavier than catching nets and when moving them around they catch the air and cannot be moved quickly, where as a net has holes so the air can pass through it easily and can be maneuvered much quicker. Another reason nets are preferred is because the bird can see through it, which is good when trying to catch an agile flying bird. The Rainbow bee-eaters will see through the net and think they can fly straight through whereas with a catching bag they cannot see through it and it appears to be solid so they tend to try and maneuver around it much more.

7.3 Capture and Restraint Techniques

Capturing of Rainbow bee-eaters is hard because they are very fast and agile fliers. If the enclosure is quite large it is recommended that two keepers go in to attempt the capture. I recommend trying to catch them as they are flying from their perch. This is because they are not at full speed in flight yet. To do this, try and position yourself side on to the bird, with the net in your stronger hand. Have the net ready, but down low so not to scare the bird away. Then with your other hand try and encourage the bird to fly off the perch in the direction of your net, and then as the bird starts to fly raise your net to capture it. It is not a good idea to try and capture the bird on the perch as you may crush it but you will most likely get the net caught on a piece of the perch and the bird will fly away.
To restrain the bird hold it around the body with your index finger and middle finger either side of its head, this restrains the wings and the head all with one hand. If the bird needs to be examined to people are recommended, to cause less stress to the bird and less time it is being handled

7.4 Weighing and Examination

Weighing can be done by placing Rainbow bee-eater in a bag then weigh from hanging scale. Be sure to tare the weight of the bag to get an accurate reading. And be sure to do this as quickly as possible to reduce stress to the bird

Examination: scats or regurgitated pellets can be examined to see what the Rainbow bee-eater is eating. When examining the bird the main things to check for is colour of feathers, beak condition, condition of feet and whether feathers are complete. When checking the body it is important to check underside and topside of wings. To do this firmly hold the bone in the wing at the elbow joint and slowly pull wing away from body. Examine feathers and whether there is any mites or any other parasites. Checking under feathers on body is also important. Do this by blowing on feathers and using fingers to help separate the feathers. When doing this check skin but more importantly check pectoral bone to see how skinny or fat the bird is. Also check vent to see if there is any traces of faeces on the feathers.

7.5 Release

To release a Rainbow bee-eater into an enclosure or into the wild it is recommended that it is done early morning. This is so it can become used to its surroundings and can see where it is going. This is very important when releasing into an enclosure because if the bird is let out late afternoon and becomes stressed and flies into the sides of the enclosure or is attacked by other birds that may be in the enclosure there will be no one to see or keep an eye on the bird. When releasing from a box, the box doors can be left open and allow the bird to exit when it is ready. If caught in a net and it needs to be released it should be caught from the net by hand first then released, because if trying to make it fly out of the net it can cause a lot of damage, especially because Rainbow bee-eaters are such small birds.

7.6 Transport Requirements

7.6.1 Box Design

The box can be made from ply wood. There should be a lockable door at each end of the box; one should also have a piece of rubber with a cross cut into it on the inside of the door. There should be two perches, one at each end, making sure they are not too thick. Along the front of the box there should be plenty of ventilation. On the back of the box there should also be a ventilation hole incase front is covered by a solid object during transport. The ventilation holes should be covered by mesh. Then if needed the mesh can be covered by hessian. This is a good idea if bird is travelling a long distance, usually not needed if travelling short distances. The box should have a handle on the top of the box and also plenty of room for stickers that are needed such as this way up stickers and flight details.

The box needs to be at least 30cm in length but no longer than 50cm, at least 15cm wide and needs to be at least 50mm above the head when standing, so this depends on how high the perches are set in the box.

7.6.2 Furnishings

Inside the transport box there needs to be at least two perches. Not too thick though because Rainbow bee-eaters do not have very strong feet or sharp claws so they may have trouble gripping onto a thick perch when being moved around.

7.6.3 Water and Food

Food is not needed during transport. A larger portion of food should be given the day before transport and on arrival of destination. Water can be given by having a wet sponge in a bowl and should be offered normally, in a bowl, upon arrival of destination.

7.6.4 Animals per Box

Two animals per box is a good number. More can be added but box size would have to increase in width. The box needs to be wide enough so the amount of birds in each box can all rest on the same perch side by side. The length still needs to be at least 30cm but if a large amount of birds are being transported the box should be made longer so that another perch can be placed inside the box

7.6.5 Timing of Transportation

The best time to transport is during the cooler parts of the day and preferably morning. It also depends on where the Rainbow bee-eaters are being transported to. If it is in the park or to another park close by, early morning is ideal. If it is over a long distance then it may be better to capture the birds up in the morning and leave them in quarantine or a holding area then catch them in the afternoon and transport them overnight so they arrive in the morning at their destination. But early morning transportation is the most ideal.

7.6.6 Release from Box

The best way to release a Rainbow bee-eater from a box is to leave the box on the ground with the door open. The box door should be facing an open area though, not blocked by any objects. And there should also be easily accessible perches in the direction that the open door is facing. The release from the box should also be done early morning so that it can be checked on throughout the day and has the full day to familiarise with its surroundings. Once the Rainbow bee-eater has left the box and seems comfortable in its new environment the box can be taken away.

References: Chad Staples Featherdale Wildlife Park. Michael Randy Featherdale Wildlife Park

8 Health Requirements

8.1 Daily Health Checks

The Rainbow bee-eaters *Merops ornatus* should be fed twice a day. When in the aviary and feeding it is important to visually examine each bird. When I feed them, I throw meal worms in the air for them to catch as it is natural behaviour to catch their food whilst flying.

The most commonly encountered health problems that Rainbow bee-eaters encounter is during winter and colder months, especially when there is large amounts of rain or continuous days of rain. Bee-eaters are migratory birds and migrate away from cold weather. So when it becomes winter time some birds can start to be affected by the cold. When it is very cold and they cannot become warm they will most commonly be sitting on the ground or a low perch hunched over, wings drooping. If this is seen the bird should be taken to the vet block area and placed in an aviary near a heat light so they can stay warm and bring their core body temperature back to normal, av. 36.7 degrees celcius

When feeding Rainbow bee-eaters you should make sure that each bird is eating well. If the birds usually catch food whilst flying but start not to, then check if they are eating from feeding station. This should be done from a distance, like outside the aviary, as the birds may not feed whilst you are in the aviary. When waiting for the birds to feed they may not eat straight away. Observe them as you leave the aviary and then if possible five to ten minutes later. This was you have more chance to see whether the birds are eating or not. If you do not think they are eating closer observation should be made.

If the birds do not fly for the food during the first feed or the second feed then a note should be made. If the Rainbow bee-eater/s do not eat the next day in the morning feed then they should be caught up and physically examined

8.2 Detailed Physical Examination

Limbs

When preparing to enter the aviary for the morning feed each bird should be identified first. You should be able to see where they are, and how they are perched. If they are not using both legs when perching they may have an injury and may need to be caught up and examined. Before this is done though the bird should try to be made to fly and land again. Do this by walking towards the bird and if needed slowly move your hand towards the bird to make it fly away. This needs to be done because the bird may just be resting or just may have been seen on a bad angle. When feeding by throwing meal worms into the air the wings can be checked. The bird should be able to fly and manoeuvre through the aviary relatively easy. Rainbow bee-eaters *Merops ornatus* are fast and agile fliers. If they appear to struggle to turn quickly or fly fast then their wings may need to be checked. Do this by capturing the bird and restraining. Firmly hold the elbow and gently

pull away from the body, this will allow you to examine the wing carefully. Make note of anything that appears abnormal.

This is a good way to examine topside of wing, back, tail, head, beak and eyes. Note how it is restrained by the feet. If bird becomes stressed and tries to fly away, your other hand can be used to hold wings in against the body.

General appearance

Rainbow bee-eaters *Merops ornatus* are brightly coloured birds. They are also very alert birds, usually looking around the aviary. If their feathers appear dull they may not be getting the proper diet. Their beaks should be glossy black. When flying they should be able to change direction quickly and should be fast moving. Tail feathers should be rounded on the edges with central tail feathers easily seen. If any of these appearances do not seem normal a note should be made as the diet may need to be changed or the bird may need to be examined by a vet.

Note the colours; these are the colours of a healthy bird.

Changes in behaviour
Rainbow bee-eaters *Merops ornatus* are very vocal. I have found that as you enter the aviary for morning and afternoon feeds each bird vocalises to other birds in the aviary. Also they fly around the aviary when you are about to enter. If they usually do this but stop doing it a note should be made so that they can be checked later. If later on in the day or the next day the birds are still not behaving as they usually do they may need to be examined. Birds in general are very good at hiding their illness's so it may be hard to notice if they are ill, noticing changes in their natural behaviour are usually the first signs that are noticed by us as keepers.

8.2.1 Chemical Restraint

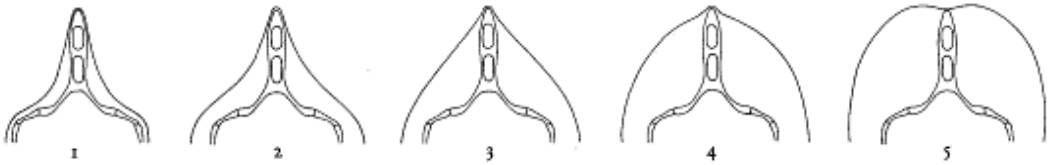
There are no known chemical restraints that are easily applied in most captive situations. Veterinary hospitals will be able to use chemical restraints if necessary.

8.2.2 Physical Examination

To physically examine a Rainbow bee-eater it must be caught with a net and restrained using your hands.

Things that should be checked when physically examining Rainbow bee-eaters *Merops ornatus.*

1. **The keel bone.** The keel bone is the chest bone in a bird. The keel bone is a good indication to tell if a bird is underweight or overweight. If the bone is easily visible and very easy to feel the bird is underweight. If the keel bone is hard to find and there is a lot of flesh where the keel bone should be the bird is overweight. Ideal weight is to be able to feel the keel bone with a small amount of flesh on either side of the bone. A bird that is a number 1 is extremely underweight where a 5 is overweight. Ideal weight for a Rainbow bee-eater *Merops ornatus* would be between 3 and 4 but more closely to a 3.



2. **Facial area.** The facial area can then be checked for any discharges from eyes or nostrils or any damage to the eyes or beak. The beak should be a glossy black colour. If possible try and open the beak and check inside for any abnormalities. Also check eyes and areas around the eyes

Photo of a healthy adult Rainbow bee-eater *Merops ornatus*.

3. Wings. To check the wings the elbow joint of the wing should be firmly held and then the wing pulled away from the body. Check for any damage to feathers. Also check for any mites that may be present in the feathers. The top side and bottom side of the wing should be examined and the part of the body that is usually hidden by the wing should also be examined. If the bird becomes distressed or starts becoming more vocal or violent towards restrainer there may be some pain in the wing and will need to be checked by a vet.

4. Body. The rest of the body should be examined. The body, including the feet, should be checked for any abnormalities, wounds or mites or lice. If any of these are found the appropriate medical procedures should be taken. Feathers should be brightly coloured and neatly rounded on the ends. When checking during breeding season this may not be the case as they are constantly entering and exiting the nesting burrows making them very dirty and split and tattered in appearance.

Note: Feathers all in good condition, brightly colored. Tail feathers neatly rounded and overlapping. This is a female bird, identified by short central tail feathers.

Entrance to nest burrow in dirt, the birds will be entering and exiting holes similar to this, so it easy to see that they can become quite dirty.

Chemical. There are no known chemical examinations that can be done on Rainbow bee-eaters *Merops ornatus*. If you are able to collect fresh faeces you may be able to use them in a chemical examination. This will allow you to see if the bird is properly hydrated and if there are any other issues.

8.3 Routine Treatments

Worming- Rainbow bee-eaters *Merops ornatus* are very hardy birds. All the Rainbow bee-eaters *Merops ornatus* I have taken care of have never been wormed or needed to be wormed and no birds have ever died due to worms. Worming can be done to be safe but is not necessary.

Vaccinations- Rainbow bee-eaters *Merops ornatus* do not need any vaccinations as they are not susceptible to any diseases.
Because Rainbow bee-eaters *Merops ornatus* do not need to be vaccinated or wormed there are no routine treatments.
Faeces should be collected and tested bi-annually.

8.4 Known Health Problems

There are not many known health problems that affect Rainbow bee-eaters *Merops ornatus*. They are not susceptible to any known diseases, worms or viruses. There is one common problem that Rainbow bee-eaters *Merops ornatus* can encounter. When hand raising young birds they can have feather problems. Their feathers can grow too fast and this causes them to have trouble flying. And if they cannot fly properly it will make it hard for them to fly, eat or breed.

8.5 Quarantine Requirements

Specific tests:
There are no real specific tests that can be done for Rainbow bee-eaters. If you have them in a quarantine area or housed by themselves, faecal samples can be done. Another way to test is by physical examination. This is the easiest way to see mites or lice, and to see what conditions the feathers are in.

Duration in quarantine:
The duration of quarantine time varies. If in quarantine because feathers have grown too fast due to too much protein than the bird will need to remain in quarantine until a full moult has occurred and new feathers grow through. If being treated for mites or lice than the bird shall remain in quarantine until treatment has finished no signs of mites or lice are present.

Disease considerations/incubation periods:
Rainbow bee-eaters *Merops ornatus* do not have any known disease considerations. So there are no incubation periods for any diseases for Rainbow bee-eaters *Merops ornatus*.

Transportation of Rainbow bee-eaters to quarantine area or off site to a veterinarian is easy. They can be placed in any bird transport box, that is around 60 cm long, 30 cm high and 30cm wide (just average lengths does not have to be these exact sizes just close to). The box needs to have a small perch in the box for the bird to perch on. It is also a good idea to have a door on each end of the box, one just a door and the other side a door with rubber flaps on the inside so bird can be caught by keeper or vet from this side easily.

References:

Readers digest Complete Book of Australian Birds pg 356

Cuckoos, Nightbirds & Kingfishers of Australia. Edited Ronald Strahan, The national Photographic index of Australian Wildlife.

Richard Webb Featherdale Wildlife Park

Chad Staples Featherdale Wildlife Park

9 Behaviour

9.1 Activity

Rainbow bee-eaters *Merops ornatus* spend the majority of the day perching on exposed dead horizontal branches, flying off to catch flying insects, usually wasps or bees, to feed on. When insects are caught they are taken back to the perch and the stinger is squeezed out with the beak. During winter they migrate to the north of Australia to escape the cold.

9.2 Social Behaviour

Rainbow bee-eaters are social birds and can usually be seen within loose groups of 20 to 30 when migrating and in groups of up to 40 when breeding. They constantly call to each other. During breeding season they spend much more time in pairs during the day when feeding, themselves and young. At late afternoon the group roosts in small shrubby trees for the night

9.3 Reproductive Behaviour

Rainbow bee-eaters *Merops ornatus* are usually found in large groups of up to 40 in breeding sites. They nest in burrows that are dug into the ground. The male and female dig the burrow, incubate the egg and feed the young. Up to eight different birds have been seen feeding young birds in the same nesting burrow. These are most likely young males that did not find a mate as males usually outnumber females 3 to 2.

9.4 Bathing

Rainbow bee-eaters *Merops ornatus* are not usually seen bathing. And when raining they tend to seek shelter or just sit in the rain unlike some birds that bath and play in the rain.

9.5 Behavioural Problems

Rainbow bee-eaters *Merops ornatus* don’t usually have behavioral problems. They don’t become aggressive towards keepers or other birds. Getting them to feed from bowls is the only main problem as they are used to catching prey on the wing. This can be overcome by throwing some foods in the air and slowly reducing the amount thrown. Enrichment feeding will also help.

9.6 Signs of Stress

Rainbow bee-eaters *Merops ornatus* don't usually become stressed in captivity. Some signs that they may be becoming stressed would be excessive preening and flying around the aviary a lot. Rainbow bee-eaters *Merops ornatus* usually do fly around the aviary but they are usually moving from perch to perch or catching food. If flying a lot from one side of enclosure to the other or flying a lot any time a keeper or member of the public comes close to the enclosure could be a sign of stress. Excessive movement on the perch could also be a sign of stress as they usually just perch and not move much when looking for food.

9.7 Behavioural Enrichment

There are many ways that you can enrich Rainbow bee-eaters *Merops ornatus*. Using food is the best way. Rainbow bee-eaters *Merops ornatus* like to catch food in flight so attracting flying insects into the aviary is very good. An easy way to do this is to place old fruit in the aviary to attract fruit flies. The fruit can be placed under some mesh or in a bucket with a lid on it that has holes. This is so that other animals do not try and eat the food but will still allow the fruit flies to come to the fruit. The Rainbow bee-eaters *Merops ornatus* will eat the fruit flies as they fly in. Enrichment is to have a small piece of PVC pipe attached to the roof with a screw off cap with small holes drilled into it. If meal worms are placed in here they make their way out of the holes and fall from the roof. The Rainbow bee-eaters *Merops ornatus* will see the meal worms falling and start catching them as they fall and eating them.
Behavioral enrichment is easy for Rainbow bee-eaters *Merops ornatus*. Any ways that flying insect can be attracted into the aviary or can be placed into the aviary will enrich them a lot.

9.8 Introductions and Removals

Rainbow bee-eaters *Merops ornatus* can be introduced into an aviary with other Rainbow bee-eaters *Merops ornatus* relatively easy. They will not become aggressive to the other bee-eater.
Removals of one bird from a pair will cause a lot of stress to both birds. Each bird will continually call, trying to communicate with the other bird. When housed it is ideal for there to be a pair in each enclosure.

9.9 Intraspecific Compatibility

Rainbow bee-eaters *Merops ornatus* are social birds and can be housed with other Rainbow bee-eaters *Merops ornatus* as long as there are suitable housing requirements such as perching areas and enough space for all the birds to be able to fly.

9.10 Interspecific Compatibility

Rainbow bee-eaters *Merops ornatus* have been successfully housed with several other animals such as:
Long tailed finches, pied honeyeaters, spinifex pigeons and diamond firetail finches

9.11 Suitability to Captivity

Rainbow bee-eaters *Merops ornatus* are suitable to captivity. They are relatively low maintenance. The main difficulties with keeping them in captivity is during winter. They are not very tolerable to colder areas as they migrate north in the summer. This is overcome by keeping making sure there are sheltered areas and non sheltered areas so the birds can perch in the sun for warmth but also hide under the shelter from the rain.

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Richard Webb and Michael Randy Featherdale Wildlife Park.

10 Breeding

10.1 Mating System

Males attract the females by presenting them with insects and continuous calling. Once the female has accepted the male mating occurs. After mating both birds build the nesting burrow. Once the eggs are laid both birds incubate the eggs along with helper birds. When the eggs hatch both parents feed the young along with the helper birds. Helper birds are young birds, usually last year's offspring that are too young to breed so they help in the feeding of hatchlings. Helper birds can also be made up of sexually mature adult birds that did not find a mate for the breeding season. Helper birds do not help incubate the eggs.

10.2 Ease of Breeding

If raising of young is left to the adult birds it can be hard to get the young to adulthood. There are many contributing factors that can make it hard for the young to reach adulthood. Burrows can cave in on young birds or eggs while they are in the burrow, when young are fledging they can be attacked by other birds in the aviary and when fledging they can fly into the sides and roof of the enclosure causing injury or even death. To stop these things from happening young birds should be pulled from the nest and hand raised. When both adult birds are seen entering the nesting burrow the nest should be carefully excavated and the young should be pulled from the nest.

10.3 Reproductive Condition

10.3.1 Females

Females appear the same during breeding season as they do all year round. They do not gain breeding plumage. They become very dirty though as they are constantly entering and exiting their nesting burrow

10.3.2 Males

10.3.3 Males also do not develop breeding plumage during the breeding season; they are same in appearance all year round. They also do become very dirty as well due to constantly entering and exiting the nesting burrow

10.4 Techniques Used to Control Breeding

The most effective technique used to control breeding is to separate the male from the female. If trying to breed large amounts of Rainbow bee-eaters *Merops ornatus* the first clutch of eggs can be removed from the nesting chamber and incubated. This will allow the female to possibly go back to nest and lay more eggs to be raised by them.

If a new bird is gained to the collection they should not be housed with other birds. They should be quarantined then introduced to a non related mate. Even if new birds are acquired from a different zoo or wildlife park they can still be related if in the past you have sent birds to other zoos or wildlife parks. Make sure you know the pasts of newly acquired birds.

10.5 Occurrence of Hybrids

There are 26 species of bee-eaters found throughout the world. Most of them occur in Africa. Australia only has the Rainbow bee-eater *Merops ornatus*. There are no known occurrence of hybrids anywhere in the world, in both zoos and the wild.

10.6 Timing of Breeding

The timing of breeding for Rainbow bee-eaters *Merops ornatus* is determined by which part of Australia they live in. Pairs in the north of Australia breed just before and after extended wet seasons. These usually occur between September - October and May - July. In the more southern parts of Australia they breed between November and January. They breed at these times because this is more likely when there is a large number of flying insects available for feeding

10.7 Age at First Breeding and Last Breeding

Rainbow bee-eaters *Merops ornatus* are capable of breeding at 1 year of age but are more successful at breeding when they are two years of age. This may be because in the wild young birds assist in incubating and raising young with adult pairs. In captivity this may be because they do not gain the experience that they would in the wild, new surroundings or other environmental issues. Last breeding age is unknown in Rainbow bee-eaters *Merops ornatus* because their lifespan is unknown. Because they are a small migratory that has to travel long distances each year, it is thought that they would only live to an estimated age of 10 years. Rainbow bee-eaters *Merops ornatus* should be able to breed until they die so they can breed for an estimated time of 8 – 9 years

10.8 Ability to Breed Every Year

Rainbow bee-eaters *Merops ornatus* have the ability to breed all year round. Environmental factors may not allow breeding every year though. If there are not a sufficient number of flying insects in the area they will not be able to breed. Large monsoonal rains may also prevent them from breeding by flooding out nesting burrows.

10.9 Ability to Breed More than Once Per Year

Rainbow bee-eaters *Merops ornatus* have the ability to breed twice a year in the northern parts of Australia but only once in the more southern parts of Australia. Southern populations breed only once a year. This is so that they can raise their young and be able to migrate back to the north of Australia when insect populations reduce in southern parts of Australia. They can also go back to nest if their young or eggs are lost due to predation by snakes or monitors or by flooding from excessive rains. Bee-eaters that live in the

northern parts of Australia are able to breed twice a year due to the weather never getting to cold and slowing down the population of insects.

10.10 Nesting, Hollow or Other Requirements

Rainbow bee-eaters *Merops ornatus* require a mound of dirt or sand to nest in. The mound needs to be of dirt or sand that will not collapse in when the birds are building the nest site. Rainbow bee-eaters *Merops ornatus* build their nests in these mounds. They are on average 1 meter in length with a chamber at the end where the eggs are laid. The mound needs to be wide enough and high enough so that when they are building the nest chamber they do not burrow all the way through.

10.11 Breeding Diet

In the wild Rainbow bee-eaters *Merops ornatus* breed when there are much more insects around. This ensures that there is enough food for both hem and their young. In captivity it is important that during breeding season that the amount of food placed in the exhibit is increased. Meal worms are a staple diet for Rainbow bee-eaters *Merops ornatus* in captivity and are a good food to help in the development of young birds. Before being fed out though an insectivore mix, should be mixed in with the mealworms to provide proper nutrients to the birds. Feeding natural foods like flies, fruit flies and if possible bees would also help with the breeding diet.

10.12 Incubation Period

Rainbow bee-eaters *Merops ornatus* incubate their eggs for 21 – 28 days. The incubation is done by the parental pair and helpers. The helpers are birds that did not mate that year, usually young males, so they assist with the raising and incubation of paired birds clutches.

10.13 Clutch Size

Rainbow bee-eaters *Merops ornatus* can have between 3 and 7 eggs in a clutch. The average number though is four to five and are laid every second day. The eggs are rounded and a glossy translucent white colour.

10.14 Age at Fledging

Rainbow bee-eater *Merops ornatus* babies start to develop pin feathers at a week old. They begin to fledge from the nest at four weeks old. At this stage they are still fed by the adult birds.

Adult female Rainbow bee-eater *Merops ornatus* returning to burrow entrance with food for young.

10.15 Age of Removal from Parents

Age of removal from parents for hand raising can be done from when they are eggs to when they start to fledge. The ideal age for this though is about a week old. This makes hand raising much easier. If left for parents to raise, the young should be removed from the parents before the next breeding season. This will allow them to be paired with other non related bee-eaters to breed with.

10.16 Growth and Development

Young are born between 21 and 28 days of incubation. They develop pin feathers after a week of being born. After 4 weeks they fledge from the nest but are still reliant on parent and helper birds to feed them. After one or two weeks of fledging they begin to catch their own food. In the southern parts of Australia the young birds migrate north with the

adult birds in the colony, they migrate to north Australia to avoid the winter in southern parts of Australia. At this stage of development the young birds have full adult plumage bar the central tail feathers. These develop the next year when the young birds reach sexual maturity. Birds that are being hand raised may develop growth problems due to high levels of protein in their diet. If young are fed on cut up pinkies when being raised they can grow too quickly due to the high amount of protein. To stop this from happening meal worms are used as a supplementary diet. Meal worms should be powdered with an insectivore mix to make sure all appropriate nutrients are gained.

References for section 10.

Readers digest Complete Book of Australian Birds pg 356

Cuckoos, Nightbirds & Kingfishers of Australia. Edited Ronald Strahan, The national Photographic index of Australian Wildlife.

http://www.jstor.org/pss/4090318 Breeding biology of Rainbow bee-eaters *Merops ornatus*. A migratory, colonial, cooperative bird. C.R.J Boland

Rick Webb, Michael Randy, Chad Staples- Featherdale Wildlife Park.

11 Artificial Rearing

11.1 Incubator Type

The best incubators to use are bird egg incubators that can rotate the egg. This is important for all bird species as it stops the air sack and fetus getting stuck to the side of the egg wall and dying. In my experiences Brinseas egg incubators have worked very well

11.2 Incubation Temperatures and Humidity

The incubation temperature should be set on 36 degrees celcius with a humidity of 60%. This replicates the temperature and humidity of the nesting chamber where eggs are laid.

11.3 Desired % Egg Mass Loss

The desired egg mass loss for Rainbow bee-eaters *Merops ornatus* is between 10 and 15 percent

11.4 Hatching Temperature and Humidity

The hatching temperature and humidity is the same as the incubation temperatures and humidity. 36 degrees celcius with a humidity of 60%

11.5 Normal Pip to Hatch Interval

The average pip to hatch interval for Rainbow bee-eaters *Merops ornatus* is between 6 and 8 hours. The maximum interval would be 12 hours.

11.6 Brooder Types/Design

The best design I have found is a hot box. In the hot box you have a small bucket with sawdust in it which is where the hatchlings sit. The hot box should have 2 heat lights, in case one break there is still a second one going, a thermostat and a thermometer. The thermometer should be able to take temperatures of inside the hotbox and inside the bucket where the hatchlings are.

11.7 Brooder Temperatures

The brooder temperature should be set at 36 degrees celcius when the hatchling is placed in. Once the hatchling starts to develop pin feathers the temperature should be dropped half a degree each day until the temperature reaches 27 degrees celcius. No less. When dropping temperature the hatchling and temperature should be monitored closely.

11.8 Diet and Feeding Routine

In my experiences with artificial rearing of Rainbow bee-eaters *Merops ornatus* they should not be raised pinkie pieces. Pinkies are high in protein and can cause the young to grow too fast and cause deformation. They should be fed on a diet of meal worms with an insectivore mix on them. Pinkies can be fed on occasion but meal worms should be the main diet.

They should be fed 4 times daily. Once they have grown their feathers they should start to be weaned from being hand fed with tweasers to eating on their own. Do this by placing whole mealworms in a bowl. The mealworms heads should be squeezed so they are easier for the young to eat and they will not crawl away.

11.9 Specific Requirements

When Rainbow bee-eaters *Merops ornatus* begin fledging they need an aviary large enough for them to fly around in but has to still be indoors to keep the fledgling out of the weather. The aviary, for the fledgling, should have low perches and high perches and astro-turf on the base of the aviary. As the young bird becomes better at flying and is not dependant on you it can be moved to a bigger aviary and the perches placed just at high points in the aviary. I have found that the aviary with the astro-turf on the bottom of the aviary is best kept in a warm area such as a vet block area where heat sources can be used if necessary. The second aviary used can be in an area like a bird room but should still be kept out of the full weather. Once the bird is confident in flying, eating well and is considered an adult bird it can be moved into an outdoors aviary. All this will ensure that the bird has the best chance of reaching sexual maturity

11.10 Pinioning Requirements

Rainbow bee-eaters *Merops ornatus* should not be pinioned. They rely on being able to fly to catch prey. They are not ground dwelling birds so they will not be able to survive by living on the ground. And unlike parrots they cannot use their beak to help them climb the side of an aviary onto a perch. For these reasons pinioning is not recommended

11.11 Data Recording

In my experience it is good to keep data from as early as possible. Take note of days that you see the adult pair mating if possible. Then record the date the nesting burrow starts to be excavated. Record the date that you think the eggs have been layed. Even if it is only an estimate it will still help in days of incubation.

Weights are also very important to record. Weights of the eggs and the young should be recorded. These should be recorded every third day.

Feeding times and amount of food eaten should be recorded

11.12 Identification Methods

Hatchling birds are not sexually dimorphic so identification of young is difficult. They do not become sexually dimorphic until they reach sexual maturity and the male develops the long central tail feathers.

11.13 Hygiene

Hygiene is very important for young birds as they are much more susceptible to disease. After tweasers are used for feeding they should be washed in boiling water. Substrate, whether it is sawdust or cat litter, should be changed at least every third day.

11.14 Behavioural Considerations

Rainbow bee-eaters *Merops ornatus* do not have behavioural considerations as young birds.

11.15 Use of Foster Species

Some species that can be used as foster species are woodswallows. Woodswallow adults will be able to teach the young birds how to feed from a bowl. Most insectivorous birds could be used as foster species but my suggestion would be woodswallows species such as white browed woodswallows *Artamus superciliosus* or white breasted woodswallows *Artamus leucorynchus*

11.16 Weaning

Weaning of young rainbow bee-eaters *Merops ornatus* can be difficult and time consuming. When the birds are first hatched feeding is done with tweasers. Trying to get fledgling birds to change from eating from tweasers to eating from a bowl is difficult as they are used to being fed instead of feeding themselves. To encourage them to eat by themselves small meal worms or maggots should be placed in the feeding bowl. This is so the food item is easy to pick up and eat but still moves around to get the attention of the young bird. During the midday feed they should not be fed until the birds are full. This will encourage them to look for food. In my experiences not giving them a full feed at midday is the best time. The morning feed is important as they havn't eaten all night and the night feed is what keeps them full throughout the night.

11.17 Rehabilitation Procedures

If Rainbow bee-eaters *Merops ornatus* become injured are donated injured they are very hard to rehabilitate. They rely on being able to see insects, fly and catch insects and are able to perch to eat the insects so if the feet, wings or eyes are damaged they are very hard to rehabilitate.

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Richard Webb and Michael Randy Featherdale Wildlife Park.

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13 Glossary

Distinctive- Something noticable

Auxiliary- substitute or reserve

Wingspan- Length of wing from one wing tip to the other wing tip

Elongated- long or increased in length

Acquired- Received from somewhere

Restrain- to hold with control

Keel bone- Chest bone of a bird

Bi annually- Twice a year

Appendix

Insectivore mix ingredients and analysis.

Min Crude Protein	52%	Whey protein, soy protein, meat meal, fish meal, blood meal, cereal bran, lysine, methionine, vegetable oils, omega-3 and omega-6 fatty acids, vitamins A, B_1, B_2, B_6, B_{12}, C, D_3, E, K, nicotinamide, pantothenic acid, biotin, folic acid, choline, inositol, calcium, phosphorus, potassium, sodium, magnesium, zinc, iron, manganese, copper, iodine, selenium.
Min Crude Fat	12%	
Max Fibre	5%	
Max Salt	0.8%	

Finch soft food mix ingredients and analysis.

Min Crude Protein	30%	Ground wheat, barley and oats. Bread crumbs, whey and soy proteins, lysine, methionine, vegetable oils, omega-3 and omega-6 fatty acids, vitamins A, B_1, B_2, B_6, B_{12}, C, D_3, E, K, nicotinamide, pantothenic acid, folic acid, choline, inositol, calcium, phosphorus, potassium, sodium, magnesium, zinc, iron, manganese, copper, iodine, selenium.
Min Crude Fat	12%	
Max Fibre	7%	
Max Salt	1%	

Diet used at Featherdale Wildlife Park to feed pair of Rainbow bee-eaters *Merops ornatus* in mixed species aviary.

-250mL of semi lean mince
- 200mL of dog dust
-50mL meal worms
- insectivore mix sprinkled on meal worms. Just enough to coat meal worms
- Finch soft food mix. Just enough to coat meal worms