

Husbandry guidelines for **Major Skink**



Bellatorias frerei

Reptilia:Scincidae

Madeline Stokes

14/06/2020

Open Colleges, ACM30317 Certificate III in Captive Animals

Trainer: Chris Hosking

Author contact details

Madeline Stokes

madeline.m.stokes@gmail.com

Disclaimer

Please note that these husbandry guidelines are student material, created as part of student assessment for Open Colleges ACM30317 Certificate III in Captive Animals. While care has been taken by students to compile accurate and complete material at the time of creation, all information contained should be interpreted with care. No responsibility is assumed for any loss or damage resulting from using these guidelines. Husbandry guidelines are evolving documents that need to be updated regularly as more information becomes available and industry knowledge about animal welfare and care is extended.

Workplace Health and Safety risks warning

The Major Skink (*Bellatorias frerei*) is generally a very skittish animal, generally not an a pet to handle but more as one to watch, this being said they can still bite if handled, they have very strong jaws and sharp teeth. This species of skink does have claws, these can be sharp and cause scratches to the handler. Being skinks, they also may drop their tail if handled too much or grabbed incorrectly, please see Section 7.3 for further handling techniques.

As with working with any animal, lizards and skinks can pose a zoonotic risk. A Zoonotic infection can be transmitted to people by contact with excrement, urine, uneaten food and sloughed skin. You should always have good hygiene practices in place to ensure as little risk as possible such as hand washing and gloves.

Some other risks when keeping this species can include burns from heat bulbs, and injuries from bending or reaching into enclosures.

Contents

Author contact details.....	2
Disclaimer.....	2
Workplace Health and Safety risks warning	3
1. Introduction.....	8
2. Taxonomy.....	9
2.1 Nomenclature.....	9
2.2 Subspecies.....	9
2.3 Recent synonyms.....	9
2.4 Other common names.....	9
3. Natural history.....	10
3.1 Morphometrics.....	10
3.1.1 Mass and basic body measurements	10
3.1.2 Sexual dimorphism	10
3.1.3 Distinguishing features	10
3.2 Distribution and habitat	11
3.3 Conservation status.....	11
3.4 Longevity	11
3.4.1 In the wild	11
3.4.2 In captivity	11
3.4.3 Techniques used to determine age in adults.....	11
4. Housing requirements.....	12
4.1 Exhibit/enclosure design	12
4.2 Holding area design	12
4.3 Spatial requirements	12
4.4 Position of enclosures	13
4.5 Weather protection.....	13
4.6 Filtration and aeration requirements.....	13
4.7 Temperature requirements.....	13
4.8 Substrate	14
4.9 Nestboxes and/or bedding materials	14

Husbandry guidelines for Major Skink (*Bellatorias frerei*)

4.10 Enclosure furnishings	14
5. General husbandry	15
5.1 Hygiene and cleaning	15
5.2 Record keeping.....	15
5.3 Methods of identification.....	15
5.4 Routine data collection.....	16
6. Feeding requirements	17
6.1 Diet in the wild	17
6.2 Captive diet	17
6.3 Supplements.....	18
6.4 Presentation of food.....	18
7. Handling and transport.....	19
7.1 Timing of capture and handling.....	19
7.2 Catching bags	19
7.3 Capture and restraint techniques.....	19
7.4 Weighing and examination.....	20
7.5 Release	20
7.6 Transport requirements	20
7.6.1 Box design	20
7.6.2 Furnishings	21
7.6.3 Water and food	21
7.6.4 Animals per box	21
7.6.5 Timing of transportation.....	21
7.6.6 Release from box	21
8. Health requirements	22
8.1 Daily health checks.....	22
8.2 Detailed physical examination.....	22
8.2.1 Chemical restraint	22
8.2.2 Physical examination	22
8.3 Routine treatments	23
8.4 Known health problems	23
8.5 Quarantine requirements.....	24
9. Behaviour	25

Husbandry guidelines for Major Skink (*Bellatorias frerei*)

9.1 Activity.....	25
9.2 Social behaviour	25
9.3 Reproductive behaviour	25
9.4 Bathing	25
9.5 Behavioural problems.....	25
9.6 Signs of stress	26
9.7 Behavioural enrichment	26
9.8 Introductions and removals.....	26
9.9 Intraspecific compatibility	26
9.10 Interspecific compatibility	26
9.11 Suitability to captivity	26
10. Breeding	27
10.1 Mating system.....	27
10.2 Ease of breeding.....	27
10.3 Reproductive condition	27
10.3.1 Females	27
10.3.2 Males.....	27
10.4 Techniques used to control breeding.....	27
10.5 Occurrence of hybrids	27
10.6 Timing of breeding	27
10.7 Age at first breeding and last breeding	28
10.8 Ability to breed every year	28
10.9 Ability to breed more than once per year	28
10.10 Nesting, hollow or other requirements.....	28
10.11 Breeding diet	28
10.12 Oestrous cycle and gestation period	28
10.13 Clutch size	28
10.14 Age at weaning.....	28
10.15 Age of removal from parents	28
10.16 Growth and development	29
11. Artificial rearing	30
11.1 Incubator type	30
11.2 Incubator temperature and humidity.....	30

Husbandry guidelines for Major Skink (*Bellatorias frerei*)

11.3 Desired % egg mass loss	30
11.4 Hatchling temperature and humidity	30
11.5 Normal pip to hatch interval	30
11.6 Diet and feeding routine	30
11.7 Specific requirements.....	30
11.8 Data recording.....	30
11.9 Identification methods	31
11.10 Hygiene	31
11.11 Behavioural considerations	31
12. Acknowledgements	32
13. References.....	33
14. Bibliography.....	34
15. Glossary	35
16. Appendix	36

1. Introduction

The Major Skink (*Bellatorias frerei*) is a species of skink first described in 1897 by Albert Karl Ludwig Gotthilf Günther, a well-known herpetologist and taxonomist who described over 340 reptile species. The Latin name *Bellatorias* means 'war-like', with *frerei* is after Mount Bartle-Frere, a mountain in North Queensland which is within the Major Skinks natural range. These skinks range between the top end of New South Wales and along the east coast and up to the top of Queensland, this species is also the only one in their genus to be found outside of Australia with ranges up to New Guinea.

This species is one of three in the genus *Bellatorias* along with the Land Mullet (*bellatorias major*) and the Arnhem Land Gorges skink (*bellatorias obiri*), this species is closely related to the genus *Egernia*. This species is a terrestrial species, not very comfortable climbing and are more likely to burrow into the ground. They can be found in inland cliffs, desert, rainforests and woodlands, they can usually be spotted out basking on big rocks.

This species is not very common in zoos nor in the reptile hobby compared to its relatives, but are still kept comfortably to those who are passionate about this species. Major Skinks are kept as display pets, little handling is recommended as this species can be very skittish and flighty but in some cases individuals can tame down.

2. Taxonomy

2.1 Nomenclature

Kingdom: Animalia

Phylum: Chordata

Class: Reptilia

Order: Squamata

Family: Scincidae

Genus: *Bellatorias*

Species: *B. frerei*

2.2 Subspecies

Not Applicable

2.3 Recent synonyms

Egernia frerei.

2.4 Other common names

No known common names

3. Natural history

Major Skinks are native to Australia and New Guinea, they are found up the east coast of Australia. This species is robust and lengthy, with brown and black stripes down their backs with spots down their sides.

3.1 Morphometrics

3.1.1 Mass and basic body measurements

The mass and body measurements are based on full length from snout to tail, height and weight, and snout to vent.

The average measurements for Major skinks are:

Snout to vent: 180mm

Height: 20-30mm

Weight: Not enough information available

3.1.2 Sexual dimorphism

With Major Skinks, there isn't any completely correct sexual dimorphism. The general rule is that female major skinks have a wider head while males have a longer head, but this is not reliable as individuals are highly variable. There are no colouration differences. Some breeders will just wait to see if a lizard becomes gravid.

Another way to sex these skinks is that you can shine a torch from behind the base of the tail from behind the vent, for males there will be two shadows for the hemipenes, and for females there will be nothing there. Vets can also do ultrasounds on the ventral area to sex. Some professionals are able to extend the hemipenes out from the vent but this can be extremely stressful for the lizard and can cause the tails to drop.

3.1.3 Distinguishing features

Major skinks can be distinguished from other similar sized skinks by head shape, stockiness and size, this is one of the larger skinks in Australia. Their colouration is typically shades of brown with thin black stripes 'forming fine longitudinal lines' (Wilson and Swan 2017) down the back.



Figure 1.2

Showing the thin back stripes

(Photo by Kirrily Douglas)

3.2 Distribution and habitat

This species is found in a variety of different habitats up the coast of Australia, from rainforest, heathlands, vine thickets to open woodlands and rocky outcrops (Wilson and Swan 2017), they are commonly found basking in the sun or hunting insects near thick ground cover. These species are not commonly found in suburban areas but have been found living amongst people.

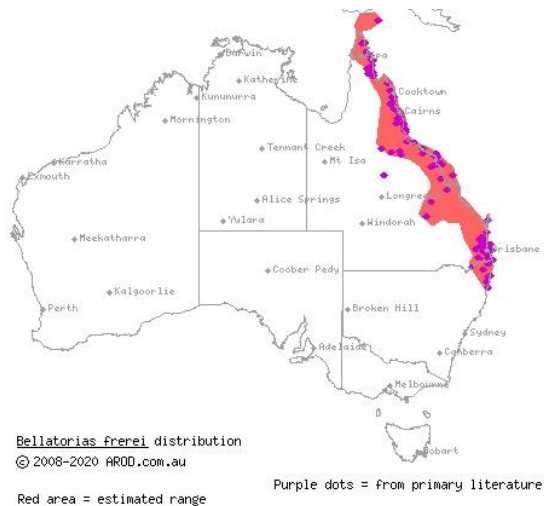


Figure 1.3

Distribution of Major Skinks

(Distribution map by AROD.com)

3.3 Conservation status

Least Concern (IUCN red list)

3.4 Longevity

3.4.1 In the wild

Their wild life span is not documented but similar species such as Land Mulletts (*Bellatorias major*) and Cunningham's Skink (*Egernia cunninghami*) have a life span of 10-20 years old.

3.4.2 In captivity

It is largely unknown, but more than likely up to 20 years like other bellatorias and egernia.

3.4.3 Techniques used to determine age in adults

These skinks sexually mature around their second year, generally size (Snout to Vent) are the indicator for determining age in these skinks so long as they are fed regularly and on a healthy diet with correct spatial requirements.

4. Housing requirements

4.1 Exhibit/enclosure design

This species can be kept in large lizard pits, tubs or aviary type enclosures. When designing these enclosures some factors to consider are how secure the surrounds are, hiding spots/burrows, heat sources, a shaded area, protection from the elements/predators, water source/s and feeding platforms.

It would be ideal to mimic as close to the natural environment as you can to allow natural behaviours. This species in the wild generally are terrestrial and will require more ground space rather than height in their enclosures. (See 4.3 Spatial requirements for more specifics). As burrowers, it will be essential that the enclosure have a secure bottom such as aviary mesh or concrete to stop them from digging out of their enclosure.

4.2 Holding area design

For quarantine, holding while main enclosure is being cleaned/renovated, health checks and vet trips, a holding space will be required. For these species, a 50-200L tub (depending on how many skinks you have and their size), while their usual substrate can be used, it would be safest to use newspaper substrate with some shredded paper for them to hide in for comfort, this way it is easier to monitor any faeces, food intake and remove soiled paper rather than scooping out substrate.



Figure 1.4

Example of an appropriate quarantine/holding tub. Newspaper to line, with shredding paper to burrow in, and holes drilled into the sides for ventilation.

(Photo by Madeline Stokes)

4.3 Spatial requirements

Being long skinks, they need decent space. According to “Keeping and Breeding Australian Lizards” by Mike Swan, the height should be no less than 500mm. For an adult pair, 1200mm x 600mm is minimum. But for a colony of adults, 2400mm x 1200mm is preferred as a minimal requirement.

4.4 Position of enclosures

The position of permanent enclosure should take into account the weather, temperature and whether there is a flood risk. Major Skinks love to bask, so a sunny spot would be ideal but not too sunny that they would overheat on a hot day, ensure there is adequate shade whether that is natural cover such as plants or trees around the enclosure or a shade cloth over one quarter/one half of the enclosure for when temperatures soar.

As for colder weather, animals can either be moved inside to a room where they can be heated artificially. Or animals can be left out to naturally brumate over the winter so long as the substrate is deep enough and the enclosure is safe enough.

4.5 Weather protection

Enclosures can be protected in many ways to keep the animals safe, a shade cloth (as mentioned in section 4.4) can be used to protect them from the sun, the use of a tarp can be used to protect the enclosure from heavy rains/hail. The use of corrugated iron as an enclosure wall is also very popular when housing outdoor lizards.



Figure 1.5 - A lizard pit housing Cunningham's Skinks (*Egernia cunninghami*) at Snakes Downunder Reptile Park & Zoo

(Pictures by Jaimi Raveneau)

4.6 Filtration and aeration requirements

Major Skinks are not water dwellers, so an inbuilt filtered pond is not a requirement. A removable water bowl will suffice for the water requirements.

4.7 Temperature requirements

This species love to bask, with a preferred body temperature is 32-36°C. If using artificial heating, aim for a basking spot of about 40°C by using a 75-100 watt bulb depending on the enclosure size and how high the bulb will be from the basking spot.

4.8 Substrate

This species tend to burrow and dig themselves into the ground to protect themselves from the weather or predators. Substrate such as sand, eucy mulch, coconut peat, and coir peat or reptile safe litter from a pet store can be used to mimic the forest floor. The substrate should be at least 15-20cm deep to allow for burrowing.

4.9 Nest boxes and/or bedding materials

This species is a live bearing so does not need a nest box nor requires bedding materials for burrows or hides.

4.10 Enclosure furnishings

This species doesn't require many big furnishings like some other lizards, they require a basking spot whether it be a large rock, tile or log to lay on. They should have plenty of natural cover such as pieces of bark, small shrubs/plants, or manmade hides from pet stores. Ideally these species are given an artificial burrowing system which can be as easy as a box with a little entrance. But given correct substrate depth, they can make their own burrows.

Water dishes should also be implemented whether it be a natural looking dish from a pet store or a regular pet bowl. It should be removable and easily cleaned.



Figure 1.6 - An example of an outdoor enclosure for a trio of juvenile Major Skinks (*Bellatorias frerei*) it is meshed on the bottom with a sand substrate about 3cm deep. Note the furniture lots of big basking spots but plenty of spots to hide and burrow under.

Dimensions: 1200mm x 760mm x 450mm

(Photos by Madeline Stokes)

5. General husbandry

5.1 Hygiene and cleaning

This species is generally pretty tidy, it is assumed that like other bellatorias and egeria that this species has one communal toilet. This should make cleaning up after them fairly easy going. The substrate of the enclosure should be cleaned out either half yearly or yearly depending on how soiled it is. Water dishes and food dishes/platforms should be cleaned daily as well to avoid rot in the food or algae in the water. Uneaten food should be removed at the end of every day. Any glass or Perspex should also be cleaned as needed.

If in quarantine, the enclosure they are in should be cleaned as it is soiled and the container disinfected with animal safe cleaners such as f10 veterinary disinfectant, or the old fashioned vinegar with water (2:1 ratio of vinegar to water.) are animal safe options for cleaning out enclosures.

If using UV/heat bulbs, these should be replaced half yearly if not blown before then. Make sure to inspect locks, any seals and possible gaps daily to ensure no escaping and safety for the animals.

5.2 Record keeping

Records should be kept of every species, and even each individual. Some important records to keep are:

- | | |
|-------------------|-------------------------|
| + Medical records | + Changes in behaviour |
| + Breeding habits | + Births / Deaths |
| + Changes in diet | + ID of individuals |
| + Acquisitions | + Enclosure maintenance |

Records are incredibly important to an institution or hobbyist as they help keep track of breeding, health of the colony, general maintenance and any other notes. This keeps keepers or hobbyists on the same general page and know what is happening with their colony.

5.3 Methods of identification

Major skinks can be hard to tell apart, identifying them can be hard as they have pretty similar patterning. Head shape, length, subtle pattern variations, and behaviour/personality are all good key ID factors. A keeper/hobbyist that works with the colony of major skinks often will be able to notice these differences. There should be enclosure sheets with written/photographic differences to help ID the individual animals.



Figure 1.7 - Two individuals. Take note of amount of spots, darkness of the sides, head shape, and stripes on mouth



Figure 1.8 - Two individual head shapes, take note of the different patterning down the back of the neck, the pointedness of the snouts and the width of the heads.

5.4 Routine data collection

With this species, to ensure correct growth rate then information like snout to vent length and weight should be collected over time. Other data to keep track of would be any clutch sizes (this species is live-bearing), breeding, food intake/waste, favourite spots in enclosures, behavioural shifts/changes and any other notes of interest should all be taken into account.

6. Feeding requirements

This species is omnivorous, meaning they eat vegetation and prey items. There is not much information on their wild diets nor on their captive diets, with most hobbyists keeping them in the same way as large egernia species like Cunningham’s Skinks (*Egernia cunninghami*) and Land Mullets (*Bellatorias major*). This species is an active forager so the food should be displayed in a way that is enriching and similar to the natural diet.

6.1 Diet in the wild

There is next to no information on the wild diet of this species, in “Reptiles of Australia” by P. Rowland and C. Farrell. (2017), it is noted that they “[...] forage for invertebrates, mice, other lizards and vegetable manner.”

6.2 Captive diet

In captivity there is some more information on their captive diet from breeders/hobbyists who keep them. Major skinks should be fed on mostly invertebrates and vegetables. But can be fed in similar fashion to Blue tongue skinks (According to hobbyists), along with veg and insects, they can be fed wet dog/cat food (“rarely supplemented” according to M. Swan in Keeping and Breeding Australian lizards) and on occasion given mouse/rat pinkies.

A good general ratio would be 40% insect, 40% vegetable and 10% fruits and 10% meat.

Safe insects to feed are LIVE OR DEAD crickets, super worms, mealworms, dubiaroaches and snails.

Safe vegetables to feed would be peas, corn, mustard greens, rocket, broccoli, carrot, beans, sprouts, capsicum and zucchini.

Safe fruits to feed would be apple, berries, grapes, mango, banana, papaya, pawpaw, pear and melons.

Other extras could be flower petals (pesticide free - hibiscus, rose, dandelions) and mushrooms fed ONCE a week.

Juveniles should be fed on 70-80% insects.

In the hotter months, they can be fed every second day, the diet varying. While in cooler months the food should be slowed to maybe 2-3 times a week as the species begins to slow down naturally, especially if this species is outside. See below for an example weekly feeding schedule.

	SUN	MON	TUE	WED	THU	FRI	SAT
Warmer	Insects	Vegetable		Insects+vegetable		Vegetable W/FruitORmeat	
Cooler		Insects		Insects+vegetable		Vegetable W/FruitORmeat	

6.3 Supplements

With reptiles, if there is no UV they need to be supplemented to avoid skeletal issues, such as metabolic bone disease caused by lack of calcium or phosphorus in their diets. While this species does not need UV specifically, they still require calcium. Supplementing their diet with calcium or vitamin powders added to the food is a safe alternative to UVB or having outdoor enclosures. Insects (live or dead) can be dusted in calcium powder and can be added to vegetables. Only a pinch of this powder is required and only needs to be supplemented once a week.



Figure 1.9

Two safe options for supplemental calcium and D3

(Pictures from the internet)

6.4 Presentation of food

This species is seen in the wild foraging, so scatter feeding insects would be recommended and any plant/meat spread out on different feeding platforms around the enclosure to avoid dominant animals hoarding all the food. The vegetables/meat should be cut into small bite sized pieces. If using food dishes, the dish should be shallow and the food spread out and not piled. Food dishes should be removed when empty/at the end of the day, and platforms should be scrubbed down the same.

With dead insects, they can be scatter fed around the enclosure to promote natural foraging behaviour. With live, try to target feed with a pair of feeding tongs/tweezers to ensure insects don't escape/wasted and be able to control the amount each animal gets.

7. Handling and transport

7.1 Timing of capture and handling

Being cold-blooded, these reptiles become less active when they are in a cooler environment. Plan in advance to switch off heating a few hours in advance to have the animals cool down and become less active. This species is skittish at the best of times to having them cooled down would be the safest method.

7.2 Catching bags

Cotton reptile-specific catching bags or cotton pillowcases can be used to put the animals in. The size should be comfortable for the animal not to be in a squished/pretsel like position that could be uncomfortable. To secure a bag they should be twisted and tied together or using a cable clamp to secure the bag closed.

Figure 2.0 Pictures below show a cotton pillowcase, it was twisted at the top and folded over before a clamp was secured around it. Instead of a clamp, you can also use a rubber band, zip tie or duct tape.



(Photos by Madeline Stokes)

7.3 Capture and restraint techniques

The capture and restraint of these animals can be tricky, being so skittish and highly strung. Come to their enclosure when it is cooler, lift up furniture to find them and when you find them, quickly reach down and with your whole hand grab around the shoulders/midregion of these animals, (see figure 2.1 and 2.2 for restraint handling) and hold their body with your whole hand. If they are extra squirmy, use a second hand to restrain. Put absolutely NO pressure or grab the tail, they will drop their tails.

Head first, place the animal into the capture bag/box and release and quickly close the bag or box.



Figure 2.1 Displaying a one hand hold on a Major Skink (*Bellatorias frerei*) and displaying a two hand hold the same animal.

(Pictures by Madeline Stokes)

7.4 Weighing and examination

To weigh these animals, place them in a restraint bag and retrieve a set of scales, a bowl would be recommended to make sure the animals don't wiggle off the scales. Take the weight of the animal and then take the weight of the bag and weight of the bowl off the weight.

These skinks can be examined from afar and would be safest to do it this way. If there are any suspected injuries or illness, restrain the animal in your hands and examine the injuries/sickness (such as weepy eyes, swollen jaw etc) and take note.

7.5 Release

To release the animal from the restraint bag or the box, simply undo the lid/top of the bag and place into the enclosure (preferably near a hide), gently tilt the bag or box to encourage the animal to go out on its own accord.

7.6 Transport requirements

7.6.1 Box design

For transport, you can use a similar box to figure 1.5 in section 4.2. For freighting transport, you can use a renovated esky (see figure 2.2) secured with tape – the animals inside should be secured in restraint bags. All transport should have holes for ventilation, some tubs have them inbuilt into the roof (See figure 2.3)

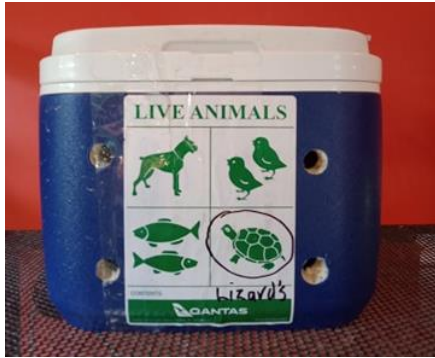


Figure 2.2

Esky with air holes drilled into it



Figure 2.3

Commercial animal containers with ventilation

(Photos by Madeline Stokes)

7.6.2 Furnishings

These transport enclosures shouldn't have any large pieces of furniture in the enclosure as they can roll around and possibly crush the skinks. Instead, like with quarantine, they should have shredded paper to hide in for the duration of the transportation process.

7.6.3 Water and food

They should not be fed the day of transport but may be fed the day before. Water shouldn't be left in the enclosure as its most likely to spill and soil the paper. They are most likely not to drink before or after the transport.

7.6.4 Animals per box

How many animals per transport container will depend on the size of the skinks and the size of the container. They should have enough space to wiggle around but not be uncomfortable shoved into a box. A good size for a trio of adult skinks would be 40cm x 30cm sized container. For a group of juveniles then a smaller container like the containers in figure 2.3 in section 7.6.1 will suffice.

7.6.5 Timing of transportation

Reptiles shouldn't be transported during heavy weather, extreme heat or extreme low temperature. They also shouldn't be transported if there are delays, the transport time should be kept to a minimum.

7.6.6 Release from box

Before they are released from the transport container, their enclosure should be set up and ready for their arrival, then refer to section 7.5 for release into their enclosure.

8. Health requirements

8.1 Daily health checks

Some daily health checks that should be taken during daily husbandry are:

- General alertness, activity
- Damage to body/toes/tails
- Eyes clear, undamaged
- General appearance to the scales/body
- Wounds/signs of illness
- Shedding problems
- Faecal/urate consistency or condition

Any sort of problems should be noted immediately and written down with the date and as much detail as possible.

8.2 Detailed physical examination

8.2.1 Chemical restraint

Chemical restraint is not recommended for this species.

8.2.2 Physical examination

For a physical examination, refer to section 7.3 for physical restraint. What to check for a physical examination would be:

- All scales are not lifted or in a wrong position
- Correct movement of all limbs
- No foam in mouth, inflamed gums, injured mouth
- No injuries/lesions/open wounds
- Check for stuck shed on toes
- Check for mites under the scales

To check inside the mouth, it isn't recommended that you 'pry' a mouth open, like other lizards, you can generally tap on the nose/on the forehead, and it will open its mouth in a threatening position.



Figure 2.4 - A major skink displaying a healthy pink mouth, healthy shiny scales and healthy underbelly and vent area.

(Photos by Madeline Stokes)

8.3 Routine treatments

General husbandry and proper nutrition will ensure your skink avoids illness and parasites.

8.4 Known health problems

With reptiles, some common diseases or disorders are mites, metabolic bone disease and scale rot.

Mites

Mites are parasites that are caused by ineffective quarantine or husbandry, they can spread amongst a reptile collection. Raised scales, seeing the mites physically or white specs on the scales are all indicators that your animal has mites. They can be treated with specific mite treatments from pet stores. Always quarantine newly acquired animals.

Metabolic Bone Disease (MBD)

MBD is a very common disease in reptiles that is generally caused by poor husbandry in nutritional imbalances related to diet and UV needs. Some signs of MBD are skeletal deformities, lameness, spinal curving and muscle spasms. If it becomes so serious for skeletal deformities a vet should be contacted and follow their directions. Otherwise supplement diet with calcium and vitamin d3 (refer to section 6.3 for brands) every week or fortnight.

Scale Rot

Scale rot is a bacterial infection, it is caused by wet bedding and contamination of wound. Its symptoms include blistering, lesions, scale loss and unnaturally brown scales. This is serious and animals should be taken to a reptile vet.

8.5 Quarantine requirements

All new acquisitions should be quarantined, refer to section 4.3 for a suggested quarantine container. New animals should be kept in a temporary enclosure of a minimum for 90 days, but it's more recommended to quarantine for at least 6 months as some diseases or viral infections can have a long incubation period.

The animals should be kept away from the current collection, in a separate airspace if possible. They should not be in a high traffic area, and a higher standard of hygiene. Disinfecting hands, items and door handles related to the quarantine space are essential. There should be a whole set of cleaning items for the quarantine room.

9. Behaviour

9.1 Activity

This species is diurnal, meaning active during the day. They are “often seek basking at the edge of open forest or rainforest.” (P. Rowland, C. Farrell (2017)) this species become active during foraging behaviours, rushing after insects or small vertebrates. They generally are observed in captivity basking in the hottest parts of the day, but scattering when there is a sign of danger such as a person walking past or a bird of prey flying over their enclosure (if they’re outside)

When the weather gets cooler, reptiles go into a state of brumation. A state similar to hibernation. This species is now different. They become lethargic and will remain hidden for the entire cool period. This species will hide away deep in its burrows or in logs for the winter and emerge once the days start getting warmer.

9.2 Social behaviour

Major skinks live in family groups, while there isn’t much information on any social structure, it is assumed they have similar structures to tree skinks (*egernia striolata*) and yakka skinks (*egernia rugosa*), Male Major skinks will engage in combat with each other, so when owning a colony of Major Skinks, only one male should be per colony.

Captive colonies have been seen piling into one small space and sleeping in that area, it is also assumed this species have a communal ‘toilet’ area. Other *egernia* species will defecate in one spot of their territory away from burrow entrances as to not let predators know where their burrow systems are.

9.3 Reproductive behaviour

When breeding season comes around, the males of this species will become very aggressive towards one another and will begin fights. Some hobbyists will use these behaviours to sex their colony of major skinks. This species breeds once a year around September, the behaviours beginning in early spring just out of winter. This species is viviparous, meaning live-bearing, females will give birth to litters between 1-7 young.

Little else is known about reproductive behaviour/courting.

9.4 Bathing

This species is rarely seen in the water, not actively seeking it out to swim in or soak in.

9.5 Behavioural problems

Major Skinks, both male and female, can become very aggressive towards one another if the spatial requirements aren’t met (such as too small of a space). This species is skittish and paranoid when it comes to people and are more likely to scatter and hide when approached, but with time and patience they can settle with humans quietly walking near their enclosure.

9.6 Signs of stress

Some signs of stress are decreased/increased activity, increase/loss of appetite and repetitive behaviour, foaming from mouth, excessive thrashing, and tail dropping.

9.7 Behavioural enrichment

Section 6.4 covers some food enrichment which will allow natural behaviours such as foraging and chasing, and in Section 4.10 figure 1.6 the enclosure shows lots of items to hide under which double as basking spots.

9.8 Introductions and removals

It isn't recommend to introduce new animals to an existing colony, as it is more than likely a new animal will be attacked by members of the colony and in extreme circumstances could be killed. It's recommended to purchase a breeding pair or a colony already. Young can remain with the colony. There isn't any information on removing live animals.

9.9 Intraspecific compatibility

This species is a colony animal, and shouldn't be kept by themselves. There should be one male per group (excluding the young) to avoid fights amongst the colony.

9.10 Interspecific compatibility

Bigger individuals can be kept with other species of lizards, such as *Tiliqua* sp. (blue tongued skinks), Frill-necked lizards (*Chlamydosaurus kingi*) and other larger egernia species like Land mullets (*Bellatorias major*).

It isn't recommended to leave gravid females in a co-hab situation as larger lizards such as blue tongues will eat the young of the major skink.

9.11 Suitability to captivity

This species can thrive in captivity, they are a hardy species that can adjust well to living in enclosures provided they have enough space and furnishings. There isn't any zoos/wildlife parks that kept Major skinks, but do keep other members of the egernia family. But the major skinks are kept among hobbyists and private institutions.

10. Breeding

10.1 Mating system

The Major skink naturally lives in a harem system with one male and multiple females, it is assumed that outside males will fight other males for females.

10.2 Ease of breeding

There isn't much information on ease of breeding, but this species can breed each season for hobbyists. These species do rely on the seasonal changes to breed, this can be hard to mimic in captivity. It is recommended in "Keeping and Breeding Australian Lizards" that the basking spot should be a reduced temperature for the entire winter period and allow brumation, before raising the temperature back to its usual basking temperature as spring begins and the weather warms up.

"Do not expect to breed specimens than have been kept warm and active over the winter period."
(M. Swan, *Keeping and Breeding Australian Lizards*)

10.3 Reproductive condition

10.3.1 Females

Like with other lizards prepping for breeding, the feeding should be increased to aid the development of baby lizards. Growing babies requires large fat storage on the females.

There is no more information on this species specifically.

10.3.2 Males

There is no information on this species specifically, but like similar species males should have their food increased as well to aid in copulation.

10.4 Techniques used to control breeding

There aren't many ways to control breeding other than not allowing a male in a colony, or keeping the colony warm and active over the winter period (as specified in section 10.2)

10.5 Occurrence of hybrids

There are no records of hybrids.

10.6 Timing of breeding

This species is a seasonal breeder and is bred after a brumation period. (See section 10.2)

10.7 Age at first breeding and last breeding

This species reaches sexual maturity at 2 years old, and can breed from then. There is no specified last breeding age for this species.

10.8 Ability to breed every year

The ability to breed every year is possible, especially if in an outside enclosure and living with the natural seasons. If their needs are also met such as feed requirements and environmental cues, there shouldn't be an issue breeding each year.

10.9 Ability to breed more than once per year

It is unlikely that they will breed more than once a year, but there is no information on it.

10.10 Nesting, hollow or other requirements

There are no known nesting requirements.

10.11 Breeding diet

The accessibility of food will heighten the possibility of Major Skinks reproducing, increasing the amount of food they have before and during the breeding period will help aid in reproduction.

10.12 Oestrous cycle and gestation period

The female is gravid for 100-120 days.

10.13 Clutch size

The general clutch size is between 1-7 young. (M. Swan)

10.14 Age at weaning

Not Applicable.

10.15 Age of removal from parents

Not Applicable.

10.16 Growth and development

There isn't any information on the general growth rate for major skinks. Like all lizards, they will grow as well as they're conditioned.

11. Artificial rearing

11.1 Incubator type

Not Applicable

11.2 Incubator temperature and humidity

Not Applicable

11.3 Desired % egg mass loss

Not Applicable

11.4 Hatchling temperature and humidity

Not Applicable

11.5 Normal pip to hatch interval

Not Applicable

11.6 Diet and feeding routine

Newborn major skinks should be fed on almost solely insects, introducing more foods as they develop and move towards a juvenile state. They should be fed 3-4 times a week.

11.7 Specific requirements

Not applicable.

11.8 Data recording

Record their snout to vent length, weight, deaths, illness, diet changes, behaviour changes, and identifying patterns between the clutch.

11.9 Identification methods

These skinks look very similar as juveniles and this can make it very hard to tell them apart, as they develop they will start to develop distinct patterning for each individual, Refer back to section 5.3 for identification.

11.10 Hygiene

This applies if the young are removed from the colony to be moved on, if not being removed then maintain same hygiene practices for the adult skinks. It is important for juveniles to be in a clean environment and slowly build up their immune systems with substrate and furniture.

11.11 Behavioural considerations

Ensure if the enclosure is outside that there aren't any tiny gaps or spots in the bottom where juveniles could dig, jump or squeeze out. When inside, make sure the substrate is deep enough for them to be able to burrow down under furniture.

12. Acknowledgements

I would like to thank my assessor Chris Hosking for his patience with me while I asked him questions. I would also like to thank Mckenzie Higgins for being my biggest supporter while I created this manual and for allowing access to Major Skinks and their husbandry, I would like to acknowledge several breeders I have made contact with to help me put this manual together.

13. References

References

Brisbane Bird and Exotics, 2012. *Quarantine Practices for Reptile Collections*. [Online]
Available at: <https://bbevs.com.au/wp-content/uploads/2017/11/Reptile-Quarantine-put-in-all-reptile-folders.pdf>

Chapple, D. G., 2003. *ECOLOGY, LIFE-HISTORY, AND BEHAVIOR IN THE AUSTRALIAN SCINCID GENUS EGERNIA, WITH COMMENTS ON THE EVOLUTION OF COMPLEX SOCIALITY IN LIZARDS*. ACT: Herpetological Monograph.

Swan, M., 2008. *Keeping and Breeding Australia Lizards*. s.l.:Mike Swan Herp Books.

Uetz, P. & Hallermann, J., 2008. *Bellatorias frerei* (GÜNTHER, 1897). [Online]
Available at: <http://reptile-database.reptarium.cz/species?genus=Bellatorias&species=frerei>

Wilson, S. & Swanson, G., 2017. *The complete guide to reptiles of Australia*. s.l.:New Holland Publishers.

14. Bibliography

Bibliography

The Center For Avian & Exotic Medicine, 2020. *Metabolic Bone Disease In Reptiles*. [Online]
Available at: <https://avianandexoticvets.com/metabolic-bone-disease-in-reptiles>

Brisbane Bird and Exotics, 2012. *Quarantine Practices for Reptile Collections*. [Online]
Available at: <https://bbevs.com.au/wp-content/uploads/2017/11/Reptile-Quarantine-put-in-all-reptile-folders.pdf>

Chapple, D. G., 2003. *ECOLOGY, LIFE-HISTORY, AND BEHAVIOR IN THE AUSTRALIAN SCINCID GENUS EGERNIA, WITH COMMENTS ON THE EVOLUTION OF COMPLEX SOCIALITY IN LIZARDS*. ACT: Herpetological Monograph.

Healey, M., 2020. *Scale Rot*. [Online]
Available at: <https://reptifiles.com/blue-tongue-skink-care-sheet/blue-tongue-skink-illnesses/scale-rot/>

McDonald, S., 2020. *Major skink, Bellatorias frerei*. [Online]
Available at: <http://www.arod.com.au/arod/reptilia/Squamata/Scincidae/Bellatorias/frerei>

Shea, G. et al., 2018. *Bellatorias frerei*. *The IUCN Red List of Threatened Species*. [Online]
Available at: <https://www.iucnredlist.org/species/42483725/42483732>

Swan, M., 2008. *Keeping and Breeding Australia Lizards*. s.l.:Mike Swan Herp Books.

Uetz, P. & Hallermann, J., 2008. *Bellatorias frerei* (GÜNTHER, 1897). [Online]
Available at: <http://reptile-database.reptarium.cz/species?genus=Bellatorias&species=frerei>

Wilson, S. & Swanson, G., 2017. *The complete guide to reptiles of Australia*. s.l.:New Holland Publishers.

15. Glossary

Brumation – A phase in the life cycle similar to hibernation where an animal becomes inactive, stops feeding and sleeps/hides.

Interspecific – meaning of the same species.

Intraspecific – meaning being two separate species.

Hemipenes - Hemipenes are usually held inverted, within the body, and are everted for reproduction via erectile tissue like that in the human penis.

Quarantine – A state of isolation intended to stop the spread of parasites and pathogens in the captive environment.

Zoonosis – An infection caused by contact with organisms such as viruses, bacteria, protozoa, fungi as well as internal and external invertebrate parasites.

16. Appendix