The Natural History and Captive Care of the Royal or Ball python (*Python regius*) SHAW, 1802

By Zack Tippie (ztippie@gmail.com)

1.) Introduction

Royals are one of the most popular snakes in the hobby today [18]. They can be found in just about any pet shop, they dominate reptile expos, and they are the focal point of a massive morph breeding industry. As captives they are hardy, typically tolerant of handling [9], and forgiving of poor husbandry; indeed, they propagate and survive for many years in very minimal care. I have personally kept regius for about 8 years now and have pushed myself towards higher quality enriched husbandry, and I have seen my animals respond in very positive ways. This care account will be aimed at best care, not basic care.

2.) Distribution, habitat and wild ecology

P. regius inhabits a 5000 km wide swathe of sub-Saharan Africa extending from the coast of Senegal to the northern border of the Democratic Republic of the Congo. Their range is rather narrow north to the south however, in most areas only 800 km to 1200 km [19] (this is likely due to the fact they cannot perform thermogenesis while brooding, like some larger pythons can [5]). In this sub-tropical region royals can be found in grasslands, rainforests, savannah, and developed farmland [6]. Temperature and humidity is rather stable in the region, but there is a distinct wet season and dry season. The dry season extends from November to April with mean monthly day temperatures of 30-34°C (86-93°F), mean monthly night temperatures of 21-24°C (70-75°F), and a day/night humidity range of 60/80%. The wet season is from May to October with mean monthly day temperatures of 28-31°C (82-88°F), mean monthly night temperatures of 20-22°C (68-72°F), and a day/night humidity range of 70/90%.

This species is nocturnal and terrestrial [10]; during the heat of the day (especially in the dry season) they will typically be hidden in a burrow constructed by another animal [6]. However, it must be stressed that these designations are merely tendencies; royals do indeed climb trees and hunt or bask during the day (more so in the wet season) [1][10][12][17].

Royals are obligate carnivores and prey exclusively on birds and mammals. There is significant sexual dimorphism wherein males eat mostly birds and females eat mostly mammals. Multimammates and songbirds make up a large portion of their wild diet, but they have been documented eating all sorts of other rodents, mustelids, woodpeckers, parrots, and even bats [11][12]. While there is no data to suggest that in the wild they consume any reptiles, fish, or invertebrates, there are pictures floating around of captive hatchlings who died trying to cannibalise one another. It should be mentioned that those events happened under extreme stress and are not reason to consider this species cannibalistic.

3.) Appearance

Royals are small pythons averaging 1m to 1.5m in length and 1-1.7kg in mass as adults [1][6]. Extreme cases of 2m and 2kg+ females have been reported (typically in an overfed captive setting) but are very rare. Females are typically larger than males as adults [1][6] but probing or popping are more reliable methods of sexing. They are relatively heavy bodied

snakes, but in cross section they should not be fully round. With a healthy body tone, they will have a very soft triangle shape; fat is naturally stored ventrally and, on the sides, not up towards the spine. Juveniles will be slightly sharper in this triangle shape, and their heads will start out nearly as wide as their bodies. As adults, their bodies will be two to three times as wide as the head.



Fig.1 – An example of the "soft triangle" body shape.

Their natural coloration features a beautiful pattern of a very dark brown or black dorsal color broken by dorsal islands and lateral peninsulas of lighter browns or even yellows (some of those with darker islands within them), with pale tan or white bellies. Individuals may get darker or lighter with age (some anecdotal evidence suggests UV has a part to play in this color shift) but otherwise there are no real ontogenetic color changes.

Beyond the wild type, there are thousands of color morphs available in the hobby today. Barring greens and blues, just about every other color and pattern can be found (though even greens and blues can be found in the eyes). These are genetic mutations and as such, many carry deleterious effects which should be considered before purchase [7].

4.) Acquiring and acclimatising

Anyone hoping to keep this species can purchase captive bred and born individuals of many generations in captivity nearly anywhere. They can even be readily acquired as rescues from shelters or fellow keepers looking to rehome them. Wild caught royals can be acquired but this is rarely necessary.

New acquisitions should all be quarantined to avoid spreading any diseases or parasites to the main collection. 90 days is a typical quarantine period, and, in that time, you should be checking for mites, observing for any motor function issues (keep in mind any known genetic issues that may present this way, like the "spider wobble" [7]), and getting a fecal test done. Internal parasites are rare, provided the animal came from a reputable breeder, but ectoparasites like mites are more common. There are many ways to treat mites, luckily royals are quite hardy and respond well to various methods.

Beyond quarantine, royals can be shy when first moved to a new home or even after a cage rearrangement. It is suggested to wait a week or two after such changes before attempting to feed.

5.) Enclosure and design

1. Enclosures measuring a minimum of 120cm x 60cm x 60cm (4'x2'x2') are recommended for singly kept adult royals. This allows the animal to fully stretch out (so especially large individuals may require larger housing), provides room for lighting/heating equipment with appropriate clearance below them, climbing branches, hides throughout, and deep substrate. Larger is of course better; I personally have a ~1m male in a 180cm x 60cm x 90cm vivarium, and he uses all of it. Juveniles can be kept in smaller caging, but they can also be moved into their permanent enclosure immediately following quarantine. Simply ensure the

hides are appropriately sized as the snake grows.



Fig.2 – An example of a large naturalistic cage.

3. Furnishings should first and foremost provide for their nocturnal and terrestrial nature. Royals are also positively thigmotactic, so hides should be plentiful, snug fitting, and sturdy. Cork rounds and flats are favorites of mine, especially when mostly buried in the substrate. Stacked rocks also make fantastic “hot hides” when placed under heat lamps. Commercial hides tend to be lofty on the inside and easily shifted, but that can be fixed by mostly filling and covering them with substrate. Beyond that, multiple sturdy branches should be provided for exercise, enrichment, and basking opportunities. Branches should be mostly horizontal and near the same thickness as the snake.



Fig.3 – Subterranean hides, prior to addition of substrate.



Fig.4 – Branches and basking stones.

Plant cover (live or fake) is beneficial when used to cover hide entrances, open patches of ground, and even over branches to create cryptic basking sites. *Epipremnum sp.* (Pothos varieties) are probably the best choice for a first foray into live planting a royal enclosure, though even those may be uprooted depending on the snake’s personality. Most “house plants” that form vines will do well, ferns and dracaena are also good options.

4. Fresh water should always be available. While royals are not known to spend much time in the water [6], they may choose to soak themselves for a variety of reasons, so the water bowl should be sized appropriately. Filtered water features are also an option, mine is heated to 25-26°C and takes up roughly 15% of the floorspace. Royals will drink from their water bowls, typically without any intervention from the keeper. Misting should be done as needed to maintain humidity levels. The ground should not remain wet, as this species is susceptible to scale rot. Proper substrates (like those listed above) should have good drainage to prevent this. Note: if you are having humidity issues, more substrate is likely a better solution than more misting.

6.) Environmental conditions

Note: Climate data is taken from weather stations (usually in towns) and gives us above ground ambient readings. This is not necessarily representative of the microclimates the snakes actually encounter, but by looking at the thermodynamics of burrows and other natural features they are known to interact with (how rocks are warmed by the sun, etc), we can infer upon the microclimates we should replicate in captivity. The above climate data (Section 2.) was taken from

the southern and central portion of their native range; chiefly Ghana, Togo, and Benin. This is where most of the study, wild collection, and farming, has taken place with royal pythons [18]. There are no known physiological locality differences among this species so specimens in the northern and more extreme areas would cope via behavioral differences (likely spending even more time in burrows). It would be acceptable to establish hotter and dryer parameters in captivity so long as they are extremes in the gradation offered, and the stability they would find in any burrow in the wild is always available in the cage.

As with most reptiles, royals should be provided with gradation in most of their climate parameters. However, the entire cage should not fluctuate. Burrows in the wild are in fact extremely stable in both temperature and humidity [4][8], and we know royals spend a lot of time in burrows, so they should always have access to a cool, humid, and stable burrow.

Burrow (or “cool side”) parameters should remain near 26°C and 70-90% humidity always, and the full cage can return to these levels at night. During the day however, the rest of the cage should exhibit ambient temperatures of 28-32°C with basking surface temperatures of 35-40°C [3]. Humidity may drop as low as 50% in the hottest areas of the cage. Keep in mind hides should be provisioned all over these gradients to simulate holes in trees and rock crevices that will be secure but not as climate controlled as a burrow. This ensures the snake does not have to choose between proper heat/humidity and security.

Royals do not exhibit any brumation behavior, but there are other behavioral changes (particularly breeding behavior) influenced by the dry or wet season. If you wish to enact seasonal changes, simply shift all those temperatures down a couple degrees during the “wet season” (May – October).



Fig.5 – Example of a suspended hide being used for cryptic basking.

Heating equipment for royals should all be above the animal (heat mats are not advised, burrows should be cooler than the outside world). Ceramic heat emitters and radiant heat panels are both great for night heating and background heating during the day, but they are not sufficient alone during the day as they only provide far infrared light. This is not as biologically available as near infrared, which is emitted by incandescent bulbs [14].

Full spectrum lighting should be provided during the day (12/12 light cycle, year-round), including UVB/A. Royals are able to see in the UVA spectrum and it has some behavioral implications [15]. UV light also has antimicrobial properties, I’ve personally seen it positively influence daytime activity and coloration, and it is known to regulate vitamin D3. UV indexes of 0.7-1.0 should exist at the prime basking locations, with peaks of 3.0 being acceptable in some spots. T5HO fluorescents are typically best suited for royals, the Arcadia 6% D3 being best with the ZooMed Reptisun 5.0 coming close behind (the Arcadia has slightly higher UVB output and typically lasts longer, while the ZooMed is more readily available

in the United States; if using the ZooMed, shorten the basking site distances by 5-10 cm). With these bulbs, basking sites should be 20-40 cm away from the bulb, with no reflector [3].

Daytime basking site heating is best done with small incandescent flood lights that provide near infrared, such as 50W halogen bulbs [14]. Look for bulbs with low Kelvin color temperatures (2500k-3000k) and low lumens/watt efficiency (9 - 20lm/w is typical), this means more of that energy goes directly to near infrared. These bulbs should be controlled with dimmers, or ideally dimming thermostats. Dimming thermostats with steel tipped probes (like the Herpstat EZ series) can be used to directly control surface temperatures.



Fig.6 – Halogen basking bulbs being dimmed individually via dimming thermostats, maintaining the same basking surface temperature at different distances.

7.) Feeding

As aforementioned, royals feed exclusively on mammals and birds. Rats (*Rattus norvegicus)*, mice (*Mus musculus*), juvenile chicks (*Gallus gallus domesticus*), and quail (*Coturnix japonica*), are suitable staples [2]. It is recommended to follow a rough 30/70 mammal/bird ratio for males, and 70/30 for females. There is no reason to adhere to these feeder types of course, just about any mammal or bird available in the hobby as feeders of appropriate size are fair game.

A full-size meal should be roughly as thick around as the snake's widest part, though they can handle bigger or smaller for variety. In the interest of enrichment, this volume can be made up of several smaller feeders (simulating a nest raid).

Overfeeding and obesity are serious problems in the hobby today. Many captive snakes attain massive sizes of over 2kg, however in the wild males and females tend to stay well under 2kg [1][6]. Royals (like many snakes) undergo major physiological changes during digestion, and it takes on average 2 weeks for their bodies to return to a resting state post feeding [16]. In captivity, adults should be fed on average every 6 weeks, plus or minus 2 weeks for the sake of variation and enrichment. Hatchlings may be started on weekly feedings, and durations will stretch with age. Care must be taken to monitor body tone, and your feeding schedule should be tailored maintain a healthy shape.



Fig.7 – An example of a physically fit royal, image and snake owned by Trinity Kotyluk

Live feeding may help entice a trouble feeder to respond, but they usually accept frozen/thawed or pre-killed prey readily. Pre-killed is my preferred method, and individuals with issues like the "spider wobble" should not be fed live depending on their efficacy in striking. Typically,

royals will refuse food when something is incorrect in their husbandry.

Following a refused meal, the first things to check would be access to secure hides, proper heat, and proper humidity. Once those are fixed, wait at least one week before trying again. Seasonal cues may also put them off food. In breeding season, males especially may refuse food as they will be focused on searching for a mate [13]; food in the belly would slow them down. This yearly fasting is normal and even considered beneficial. Adults can fast for several months with no ill effects whatsoever, refused meals are rarely reason to panic with this species.

8.) Conclusion

Royal keeping is inundated with controversy over what is “needed” and what is merely “beneficial”. They really are victims of their own hardiness; the fact they live for many years and breed in abhorrent conditions is illogically interpreted as reason to stop all progress in husbandry quality. The ceiling on husbandry quality is so much higher than the requirements under which they breed. As a keeper, I see things the animal can *benefit* from as things I *need* to provide, or at least push towards. I can assure you, they’re not just pet rocks.

9.) Figures – All images owned by Zack Tippie unless otherwise stated.

10.) Acknowledgements

I’ve learned from too many keepers to count or even recall at this point. In particular, and more recently, I’d like to thank the following for really opening my eyes to the herpetological side of herpetoculture, and the wonderful world of artificial light: Dr. Fran Baines, Francis Cosquieri, Darrell Raw, and Roman Muryn.

To meet them, check out the groups Advancing Herpetological Husbandry, Reptile Lighting, and Not Just a Pet Rock (Python regius) on facebook!

11.) Reference list / Suggested reading

[1] Aubret, F., Bonnet, X., Harris, M., Maumelat, S. (2005) Sex Differences in Body Size and Ectoparasite Load in the Ball Python, Python regius. Journal of Herpetology 39(2): 312-315.

[2] Arbuckle, K. (2010) Suitability of day-old chicks as food for captive snakes. Journal of Animal Physiology and Animal Nutrition 94: e296 – e307.

[3] Baines, F., Chattell, J., Dale, J., Garrick, D., Gill, I., Goetz, M., Skelton, T., Swatman, M. (2016) How much UV-B does my reptile need? The UV-Tool, a guide to the selection of UV lighting for reptiles and amphibians in captivity. Journal of Zoo and Aquarium Research 4(1): 42 - 63.

[4] Bennett, N., Jarvis, J., Davies, K. (1988) Daily and seasonal temperatures in the burrows of African rodent moles. South African Journal of Zoology 23(3): 189 – 195.

[5] Ellis, T., Chappel, M. (1986) Metabolism, temperature relations, maternal behavior, and reproductive energetics in the ball python (Python regius). Journal of Comparative Physiology B 157: 393 – 402

[6] Gorzula, S., Nsiah, W., Oduro, W. (1997) Survey of the Status and Management of the Royal Python (Python regius) in Ghana.

[7] Huck, M. (2017) Morph Issues. Retrieved from http://www.owalreptiles.com/issues.php on June 25, 2018.

[8] Kay, F., Whitford, W. (1978) The Burrow Environment of the Banner-tailed Kangaroo Rat, Dipodomys spectabilia, in Southcentral New Mexico. The American Midland Naturalist 99(2): 270 – 279.

[9] Kreger, M. (1992) Physiological and Behavioral Effects of Handling and Restraint on the Ball Python (Python regius) and the Blue-Tongued Skink (Tiliqua scincoides).

[10] Luiselli, L. (2006) Why do males and females of *Python regius* differ in ectoparasite load? Amphibia-Reptilia 27: 469-471.

[11] Luiselli, L., Akani, G., Capizzi, D. (1998) Food resource partitioning of a community of snakes in a swamp rainforest of south-eastern Nigeria. The Zoological Society of London 246(1): 125 - 133.

[12] Luiselli, L., Angelici, F. (1998) Sexual size dimorphism and natural history traits are correlated with intersexual dietary divergence in royal pythons (python regius) from the rainforests of southeastern Nigeria. Italian Journal of Zoology 65(4): 183 - 185

[13] Morrill, B. (2011) Qualitative Genetic Analysis of Reproduction Traits in Ball Pythons. Utah State University.

[14] Muryn, R. (2018) Temperature and Heat for Reptiles #05. Retrieved from https://www.facebook.com/groups/ReptileLighting/files/ on May 7, 2018.

[15] Sillman, A, Carver, J., Loew, E. (1999) The Photoreceptors and Visual Pigments in the Retina of a Boid Snake, the Ball Python (Python regius). The Journal of Experimental Biology 202: 1931 – 1938.

[16] Starck, J., Wimmer, C. (2005) Patterns of blood flow during the postprandial response in ball pythons, Python regius. The Journal of Experimental Biology 208: 881 – 889.

[17] Sweeny, C. Jebels by Moonlight (1969) London: Chatto & Windus.

[18] Waller, T., Lichtschein, V., Montgomery, C., Luiselli, L., Toudonou, C., Lettoof, D. (2006) An Assessment of the impact of the pet trade on five CITES-Appendix II case studies.

[19] Zoological Society of London. (2010). [Range map for extant Python regius]. The IUCN Red List of Threatened Species. Retrieved from:

http://maps.iucnredlist.org/map.html?id=177562 *on June 20, 2018.*