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Dear Ladies and Gentlemen,

Due to several inquiries and long discussions on the subject of “minimum requirements for husbandry of reptiles” I’d like to share some comments and remarks to improve the existing guidelines for the benefit of the animals.

The successful and species-appropriate husbandry of so-called “exotics” in human hand demands comprehensive knowledge of the matter. To ease reptile keepers’ and respective authorities’ approach to this general knowledge the German expert report on minimum requirements (“Mindestanforderungen an die Haltung von Reptilien”) was issued on 10. October 1997 providing guidelines which have been used as orientation for species-appropriate husbandry since.

As a biologist I have been dealing with the species-appropriate and near-natural husbandry and breeding of snakes for more than 20 years privately and professionally. My current focus at the Institute for Zoology of the University Bonn/Germany is the area of behaviour physiology and sense bionomics of snakes.

Based on my opinion and experience the expert report mentioned above displays several crucial mistakes, some of them concerning the group of pythons (*Pythoninae*), which in part work against a species-appropriate husbandry. My desire is to call attention to these mistakes to improve the enforcement of the guidelines and possibly a revision of the expert report in a new edition.

General:

One decisive factor of every animal husbandry and every guideline for keeping animals are the dimensions of the enclosure for the animal. The enclosure must provide dimensions that suit the animals’ natural needs. Size and dimension of the enclosure must match the specific habits of boids (pythons and boas). Boids are so-called sit-and-wait predators that spend most of their life motionless and secretly. At the same time these poikilotherm animals need a temperature gradient enabling them to thermoregulate. These two conditions must be met for species-appropriate husbandry. Eventually the structure of the equipment is crucial for the species-appropriate husbandry – much more than the absolute exterior dimensions of the cage. The structure of the cage and its setup is crucial to convey the delicate boids a feeling of safety. Many diseases like pneumonia, stomatitis and mycosis are a result of a debilitated immune system due to permanent stress resulting from lack of feeling of safety. One of the most common mistakes concerning this matter is an excessive cage height on the assumption that an arboreal species needs to spend its time as high as possible. Indeed many arboreal species live in a height of ten metres or higher in the canopy of trees, which is a height that can’t be offered in captive care and indoor housing anyway. Question is: Is there any difference between an enclosure of 100 cm height and another one with 200 cm? Is the distance to the ground the decisive factor for the well-being of arboreal species or is it rather something else? In the following I’d like to explain the crucial needs of several species for species-appropriate husbandry based on their natural way of life.

Comments on the species *Morelia spilota* and *Morelia viridis*:

According to the expert report *Morelia spilota* and *Morelia viridis* are semi-arboreal or arboreal species. The report claims a height of 0.75, 1.00 or even 1.50 times the total length of the animal which can be contraindicated for species-appropriate husbandry as I will show subsequently. The absolute height is much less important than the structure of the cage. The causes that lie behind are result from the specific behaviour of this genus and boids in general. Being poikilotherm animals they depend on choosing the preferred temperature which can vary depending on the situation the snake is in (shedding, digesting, etc.). In doing so they tend to avoid insecure areas and sometimes move only several centimetres to a safe warmer or cooler zone. In a very high and unprotected cage boids often

don’t leave the upper area and stay at the possibly wrong temperature for days in the same position. The reason for this is that arboreal animals tend search for the highest position because they want to be as close as possible to the cover of the cage. The cover conveys a feeling of safety and visual cover. In a cage with dense planting the animals also move to lower perches as long as the temperature suits their needs. A substantial disadvantage of very high cages is the fact that it is virtually impossible to realize a species-appropriate temperature gradient even with excessive technical effort. Since warm air ascends heating devices must be set to levels that are dangerous for the animals to reach appropriate temperatures in the lower regions of the cage. At the same time the top regions of the cage reach dangerously high temperatures. It is much easier to realize a temperature gradient that the animals can use in a flatter, longer enclosure. Plus the gradient will be used intensely because the animals can stay “protected” by the low cage cover all the time. A horizontal temperature gradient is much more important than a vertical one. In a poorly structured cage animals can make use of a vertical temperature gradient only if they give up their feeling of safety in return.

Many reports on natural findings of arboreal boids of the species *Morelia spilota* and *Morelia viridis* reveal that the animals were found high in canopy as well as in bushes just below ground level or even in a retreat directly on the ground. Nobody would state that these animals need a high distance to the ground only from time to time for their well-being. In my opinion it is much more likely that the animals make use of their habitat much more flexible determined by factors like visual cover, microclimate, or a good position to lurk for prey. This is more decisive than the distance to the ground.

Therefore, depending on the size of the animal, a cage height of 50 to 120 cm has proved itself as absolutely sufficient for the genus *Morelia* in practical experience. Cages like this allow perfect air-conditioning. Exceptions are young animals of an age of up to 12 or 18 months which should be kept in cages that are even lower. These young animals have an ever higher need for an enclosure where they feel safe than adults. The animals will respond with trouble-free eating and digesting. On the opposite a stressed animal doesn’t feed at all or only irregularly.

Pythons spend most of their life inactive in their retreats, that are just big enough to fit their body size. The direct contact with the boundaries of the retreat makes them feel safe. Kept in a cage that is too big many animals try to compensate by searching for a retreat that covers them all around. Often the only solution is the water bowl even when other retreats are offered. Lying in the water bowl the animals gain a feeling of safety being covered all around by water. But this frequently observed behaviour is anything but generic. Even though nearly all snakes are good swimmers *Morelia spilota* and *Morelia viridis* will visit open water only under extreme circumstances in nature, e.g. when they want to get rid of a heavy load of ectoparasites like mites. Again and again rumours say that a large water basin must be offered in captive care just in case the animals will be infested by ectoparasites. But an experienced keeper of *Pythoninae* will recognize an elementary infestation long before the animals would seek the water. An effective control of snake mites just by water is virtually impossible anyway because the mites are about anywhere in the cage. Using the preferred device, a chemical resource, against mites it is indeed useful to take out all water bowls before since the active agents (e.g. organic phosphates) are highly soluble in water. A large water basin therefore is not species-appropriate nor sensible (except for semi-aquatical species). It is much more useful to provide a cage with dimensions that the animals accept as protective and safe. It is necessary though to provide a small drinking bowl that should be cleaned every day. The expert report asks for a water basin which shall cover at least a quarter of the ground area for the genus *Morelia*. Assuming two animals of 150 cm length a cage providing a floor space of 75 x 150 cm is asked. This would mean only 75 x 113 cm ground left for the animals besides the water part. Since *Morelia* is a mainly terrestrial genus as explained above the water basin should be abandoned to the benefit of terrestrial ground area.

Comments on the species *Python regius*:

Python regius lives in the dry savannas and forests of north-west Africa and shows a natural behaviour which is well-adapted to the natural environment. To protect themselves from dehydration and overheating these animals have developed a habitat which is unique for *Pythoninae*: They spent most of their life underground in little caves or in hollow tree roots. Primarily these caves originate from other animals (rodents or termites). The snakes hunt, eat and mate in these underground caves and even incubate their eggs there.

Python regius is the boid which is kept most frequently world-wide and probably in Germany, too. Although the species can reach an age of about 25 to 30 years most of the animals in captive care die much earlier. The commonest causes of death like food refusal or infections are just secondary signs and effects of a husbandry which is fundamentally wrong. Both matters are usually based on stress

evoked by wrong cage dimensions and husbandry conditions. Because of the very specific lifestyle the regulations of the expert report regarding cage dimensions and equipment are not species-appropriate for this species in my opinion.

Python regius is strictly terrestrial and not arboreal as mentioned in the expert report. Of course these animals can climb on a branch, but it doesn't correspond to their natural behaviour. Taking a look at the anatomy of the species it is obvious that they are not able to move securely in the branchwood. It would lead to falls and resulting injuries. An animal with a broken rib under captive care and wrong conditions is therefore no isolated case. That is why no climbing devices should be offered to terrestrial species in the terrarium.

Being a cave dweller and very sensible *Python regius* has an even higher requirement for a feeling of safety as explained before. And since the natural habitat of these animals is a cave this should be transformed into captive care conditions. In other words: *Python regius* should be kept in a "cave", not in a ordinary cage of common understanding which has a height of about two thirds of its body length. It's not only sufficient but absolutely species-appropriate to keep this species in a box as flat as possible (15 to 30 cm height depending on size). Such boxes shouldn't provide insight from all sides to give the animals the feeling of safety they need. The ground area should be adapted to the animal's size, too, but even more important is a small box or solid cave where the animal can hide in close body contact.

Other countries like for example the United States or England are much more advanced in transforming this knowledge into husbandry conditions, and the way of keeping *Python regius* as detailed above has prevailed and is recommended. Therefore it isn't astonishing that breeders in those countries have overcome the known and man-made problems we're facing when keeping *Python regius* like food refusal or increased diseases.

In summary it can be said, therefore, that the majority of python species can be kept in captivity without any problem. It is most important though to offer animals husbandry conditions what meet their natural way of life. The main factors are climatic conditions and the setup of the cage, not the absolute size of it. It seems one cause for wrong husbandry is the tendency to humanize when judging species-appropriate husbandry conditions. For example *Pythoninae* don't have a need to stretch out to full length at all, it is rather the opposite. Even if animals can swim it isn't species-appropriate at all to create a cage that forces animals (by size or set-up) to visit a water basin. Many species react very sensible to wrong husbandry conditions. This must not necessarily to the death of the animal, the animals can survive facing a variety of conditions. But just surviving shouldn't be the considered to be a sign for species-appropriateness or well-being.

But which criteria can prove species-appropriate husbandry?

One of the most important criterion for species-appropriate husbandry of pythons is constant breeding success. Opposite to other animals pythons don't breed regularly if kept under insufficient conditions. Wrong conditions mean stress for the animals which leads to reduced intake of food and weakening of the animals. Malnourished and weak pythons can't reproduce because the egg cycle of the female controlled hormonally by the fat content of the blood. Pythons that are kept species-appropriate like detailed above normally don't refuse ingestion except during natural fast periods during winter. In the wild pythons are opportunistic feeders that make use of every opportunity to feed. If they refuse to feed in captive care it's manifest evidence for too much stress due to inappropriate husbandry, more than likely an enclosure too big and high in which the animals don't feel safe. Another criterion for species-appropriate husbandry of pythons is to attain old age and the absence of infectious diseases caused by stress. Desirably the arguments discussed above should therefore be considered in the expert report.

As a final note I would like to express that it is much desirable to offer animals as much room as possible with a maximum of individual alternatives. But when it is down to minimum requirements it is crucial to have exact knowledge of the specific needs of a species because the animals won't have the choice between alternatives under minimum conditions. Unfortunately the expert report doesn't fulfil this responsibility in every aspect. It rather seems the report attempts to offer a compromise which isn't appropriate at all when it comes to the well-being of animals.

Yours sincerely