Chameleon Hydration – Utilising Fog

The following includes excerpts taken and used with permission from the following sources:

Citation:

- Necas, P. (2020): The Naturalistic Chameleonoculture – a breakthrough in captive management of chameleons Part 2: Hydration and the Mystery of Fog-Drinking. - Archaius 1(4): 8-28

Other sources:

- The 'show-notes' of episode 89 of the Chameleon Breeder Podcast - by Bill Strand.
- Also, P. Nečas, pers comm

"*The natural hydration cycles for chameleons reflect the natural cycles of their occupied territories, biotopes and microbiotopes, with dry daytime, and humid often foggy or misty nights. Chameleons desiccate by exhaling humid air at low air humidity levels, while keeping the previous hydration level at high humidity levels. They hydrate during the night through inhaling aerosols by newly described "fog-drinking". The prevalent practice of chameleon captive management reverts the circadian humidity cycles. It is recommended to adjust the practice to simulate better the natural conditions by adding fogging at night, at low temperatures and with enough airflow as a part of Naturalistic Chameleonoculture*" – *Nečas.P*

How was this discovered?

While in Kenya, in the Nyambeni Hills at the foot of Mt. Kenya, multiple published researcher, and extremely well respected field scientist Mr *Petr Nečas* was on location studying a strong population of Yellow-Crested Jackson's Chameleon (*Trioceros jacksonii xantholophus*) while the area was at the time in its 4th month of drought – he states "the locals reported there was not a single drop of water falling from the skies during this 4-month period".

Then the rain happened one afternoon – did the Chameleon rush out and hydrate? surely, they were extremely thirsty after 4 months of no liquid water for hydration.

This wasn't the case - much to Petr's surprise, the Chameleons ran for the cover of the tree canopy or deep inside bushes, using such as a leaf like umbrellas.

Along with this extraordinary reaction, they also closed their eyes and started to sleep as if it was night-time.

So, this all raised the ultimate question – "how are wild Chameleons hydrating if they are *not* utilising such conditions?"

To come to the final conclusion of 'humid/fog hydration', Petr went through various experiments and theories like linking the 'storm' conditions to that of a nightly condition, meaning;

- Temperature drops
- Lower light conditions
- Concentration of CO_2 in the air raises
- Air humidity raises (due to the drop of temperature from the storm cloud covering of the sun).

Both night conditions, and daytime storm conditions bought the same above environmental factors.

This was the reason the Chameleons slept through the storm instead of running out to lap up the rain.

But how does this link to gaining any hydration?

For the next part of this journey of discovery took Petr to Oman, to observe a locally strong population of the Arabian chameleon, *Chamaeleo arabicus,* and he made a very simple field experiment.

Petr located several specimens during the day and marked their position in-order to find them at night.

Then on three consecutive days, Petr repeated the following procedure:

> *Citation below - The Naturalistic Chameleonoculture – a breakthrough in captive management of chameleons Part 2: Hydration and the Mystery of Fog-Drinking. - Archaius 1(4): 8-28*

1. **Locating:**

Several specimens were located in late afternoon or beginning of night.

2. **1st measurement:**
   I visited their sleeping place after dark between 20:00 and 22:00.
   I carefully took them down from their sleeping position.
   I measured their weight and examined them.
   Then I put them back to their exact sleeping place and waited till they closed their eyes and slept-in again.

3. **2nd measurement:**
   I visited their sleeping place in the early morning hours just before sunrise between 03:40 and 05:10.
   I carefully took them down from their sleeping position again.
   I measured their weight and examined them.
   I took a paper tissue, measured its weight, wrapped it around their bodies, and pushed gently against the skin of the body and head to wipe off a possible moisture.
   Then I weighed the tissue again.
   Then I put the chameleons back to their exact sleeping place and waited till they close their eyes and sleep-in again.

4. **3rd measurement:**
   I visited their sleeping place in the early morning hours after sunrise between 7:30 and 09:30 when they started to bask.
   I carefully took them down from their (unchanged or slightly changed position) again, and
   repeated the second measurement of their weight.
   Then I released them back.

The interesting observation in the environment was, that already after sunset, the temperature drops, and humidity raise was quite significant (from max 29°c and below 35% at daytime to 21°c and 86% after sunset). In the morning, the temperatures dropped even more and heavy fog formed condensing on the vegetation (but not chameleon bodies) in form of dew. (17°c and 100% in the early morning before sunrise).

Period		**Mid-day**	**After sunset**	**Before sunrise**	**After sunrise at start of basking**
Time	from	12:00	20:00	03:40	07:30
Time	to	14:00	22:00	05:10	09:30
Ambient temperature		29°C	21°C	15°C	23°C
Air humidity		Below 40%	86%	100%	63%

This was all as I expected from many other field visits to Yemen, Socotra, and Oman, as well as diverse analogical parts of Africa and Asia.

The biggest surprise however waited for me in the form of the results of the measurements.

Results

All chameleons gained significantly weight through night-time! They were heavier by up to 1g in the morning when compared to the evening. The weight gain was stable before and after the sunrise at the beginning of basking.

But: they were sleeping all night in same position and at same place: same tree, same branch, same twig! They were totally inactive, immobile and cold!

Where did they get the gain in weight from? What are the possibilities?

1. They have **eaten** something. *NO!*

   - They do not eat at night; they do not see well in these conditions, so food intake is impossible.

2. They have gained weight through **metabolic processes**, especially digestion through oxygenating nutrients. *NO!*

- The minute gain, theoretically possible through this process is even under normal circumstances hardly measurable. Moreover, all metabolic processes in heterotherms are heavily inhibited and slowed down in the night, due to the low night temperatures.

3. They became heavier through **water condensed on their bodies**. *NO!*

   - The bodies were at the moment of measurement, dry, no excessive moisture was detected at their bodies as the paper tissue weight was same before and after wiping their bodies off. There was also almost no difference between the weight before the sunrise and at the beginning of basking and if, then there was a very slight loss of maximum 0.1g.

4. They became heavier through the **water** condensed on their bodies that was **soaked in by their skin**. *NO!*

   - The chameleon skin is impenetrable by water, the level at which the water can penetrate it, is barely measurable. Their weight was also almost same or even minutely higher before the sunrise and at the beginning of basking.

5. They became heavier because the **water condensed on the casque** of their head and were led by capillary powers as known by "rain drinking" in some other lizards to the angles of their mouth and subsequently reflexively swallowed. *NO!*

   - There was no condensed water on the head as proven by the tissue test as well as the third measurement.

6. The moist air was **condensing in the mouth at the hard palate** (palatum durum) and swallowed down to the digestive tract. *NO!*

   - Chameleons do not breathe at night with mouth open, but through nostrils while the mouth is closed. The air, therefore, has no way how to get to mouth, as it is directed directly through the nasal cavities to trachea and further to lungs and it cannot condense on hard palate, as it simply does not get in contact with it.

7. They gained weight through **resorption of water led to the cloacal opening**. *NO!*

   - There was no condensed water on the body as proven by the tissue test as well as the third measurement. There is also no way how it should be led to the cloacal opening, it remains closed whole night. Even though the cloaca is theoretically capable of a limited fluid resorbing, as utilized by some other reptiles for rehydration and therapeutic purposes, this does not apply here at all.

8. They **inhaled moist air and fog and resorbed it in the respiratory tract**. *YES!*

   - The detailed physiological basis is not yet known, but this is the only realistic way in which the body weight can be gained. The ability of vertebrate lungs to resorb tiny water particles such as fog is known. This ability is utilised as nebulization in human and veterinary practice for the transport of water and water-soluble-medicaments. It is also possible that the water might partly condensate in the nasal cavity and then be swallowed. An indication of this possibility delivered recently by GRANT TAYLOR, who filmed a swallowing of an adult *Calumma parsonii* (Cuvier, 1824) at night when exposed to fog produced by a commercial fogger.

Experiments of same process have been conducted on following places with same principal result.

Country	Place	Species, form	Observer
Madagascar	Nosy Boraha	*Furcifer pardalis*	Sergei Prokopiev
Kenya	E foothills Mt. Kenya	*Trioceros jacksonii xantholophus*	Petr Necas
Kenya	Machakos	*Trioceros jacksonii ssp.*	Petr Necas

Mauritius	Vanilla	*Furcifer pardalis*	Petr Necas
USA, FL	Fort Myers	*Chamaeleo calyptratus*	Petr Necas

Fog Drinking

As the discovered phenomenon has never been mentioned in the literature, and the likelihood, it applies to more lizard families exposed to high night-time humidity (which is the case actually for many reptiles), regardless whether diurnal or nocturnal, it seems feasible to define a new physiological term: **Fog-Drinking**.
It refers to the ability of reptiles, especially chameleons, and their regular practice, to hydrate using the capabilities of respiratory tract to resorb water from fog.
As indicated, the physiological basis of the fog drinking is very likely a combination of swallowing the condensate from upper respiratory tract and nebulization; the detailed explanation of the physiological mechanism is to be studied in the future.

As a "black-box" approach so far, let us take as a fact, that the fog-drinking is the actual reason is why chameleons are rarely, if ever, are seen to drink liquid water in the wild – and this is actually a reason why in captivity chameleons are considered heavy drinkers. The need to compensate the hydration disbalance the available way, when the natural fog-drinking hydration way is not yet a rule offered and facilitated properly.

THE MYSTERY OF AIR HUMIDITY AND FOG

A simple experiment has been conducted in captivity to test to what extent the fog-drinking and related weight gains or losses related to the humidity of air and fog in combination, and separately. The results were surprising, but very logical. Captive chameleons of three species (*C. arabicus, calyptratus and zeylanicus*) where exposed, while sleeping, to three and humidity regimes:

1. Air humidity of 30 - 35%
2. Air humidity of 90 - 100%
3. Air humidity of 90 - 100% and fog produced by a fogging system.

Analogically, like in the field study, the chameleons were weighed. We did this in the evening after they started to sleep (20:00-22:00) and then second time early in the morning (04:00-06:00).

Experiment 1

- **Regime:** Air humidity of 30 - 35%
- **Result:** All measured individuals lost significantly weight during the night

Experiment 2

- **Regime:** Air humidity of 90 - 100%
- **Result:** All measured individuals remained exactly same weight the whole night

Experiment 3

- **Regime**: Air humidity of 90 - 100% and fog produced by a fogging system.
- **Result:** All measured individuals gained significantly weight during the night

These experiments in captivity allow us to make the following three principal conclusions:

The low night-time humidity causes water loss - The humidity of the air in the lungs at expiration is around 100%. While inspiring dry air, the lungs dry off from inside and compensate this loss in hydrating the tissues from internal reserves. This leads to water loss and desiccation. Chameleon skin is almost impermeable for water, so the only loss of water that happens either via defecating (the less excess water in the organism the drier the droppings are), urinating (the urates are partly white and partly crystalline orange, while the physiological share of the orange part comprises between 15 and 50%) and, mainly breathing.

The high night-time humidity prevents the water-loss - The high night-time humidity serves primarily to the prophylaxis of desiccation and dehydration; it means it prevents the water-loss. The chameleons exposed to low humidity at night lose weight and show soon signs of severe dehydration. They have a high demand to drink the liquid water either the (semi-)natural way through licking the droplets of water from vegetation and objects or artificially through drippers, pipettes etc. The chameleons exposed to high humidity at night but with no fog, desiccate and dehydrate slower. They still have demand to drink the liquid water either the (semi-)natural way through licking the droplets of water from vegetation and objects or artificially through drippers, pipettes etc. The probable mechanism is simple osmosis. The humidity of the air in the lungs at expiration is around 100%. While inspiring dry air, the lungs dry off from inside and compensate this loss in hydrating the tissues from internal reserves. While if the air is also of high humidity, the tissues do not desiccate and do not loose water from internal reserves.

The night-time fog serves Fog-Drinking and hydrates - The night-time fog serves primarily to the hydration; it means

it facilitates the water gain through Fog-Drinking. The chameleons exposed to fog at night gain weight and show signs of good hydration. They lose the demand to drink the liquid water and often stop drinking it at all even if water remains widely available. An experiment lasting 31months with *Chamaeleo calyptratus* and 26 months with *Trioceros melleri*, when the animals were exposed to fog via a fogging system from 1AM till 6 AM, every day showed physiological urates, all signs of good hydration and executing all biological functions including repeated reproduction without any single drop of liquid water. How the actual water intake happens, must be a subject of further research. The probable mechanism is nebulization in the respiratory tract, very likely in the lungs. Another alternative is the condensation of fog in the nasal cavity and subsequent swallowing.

Hydration method	Desiccation	Hydration	Drinking
None	Yes	No	Intense, hysteric
High humidity	No	No	Occasional
High humidity and fog	No	Yes	Almost stopped

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So, as mentioned in the above, this method was not new in discovery both in its philosophy and utilisation in several documented species. But it certainly was for wild Chameleons.

This method of hydration Petr states has been used by himself on tree-dwelling vipers and geckos since the 1990's – and all from gathered results via previous field studies done by Petr and his teams over the past 30 years (*P. Necas, pers comm)*

But its implementation as a hydration method into a captive keepers' enclosure has, and still does require more publicity.

This is where Bill Strand and his 'Chameleon Breeder' podcast came in.

Petr has been a guest on the show a number of times, and these methods were discussed in detail.

With this information now 'out there' in the community, this certainly got many Chameleon keepers thinking.

But it's utilisation and reasoning were still a little confusing for so many – and many keepers already had healthy and hydrated Chameleons - so why mess around and change things? it's a risk many keepers didn't, and still don't want to be taking with their seemingly already health and hydrated Chameleons.

But it's not just about the hydration for Chameleons in a captive environment, or whether you believe or know your Chameleon is perfectly healthy and hydrated – it's about providing the conditions to which the species has evolved over millions of years to utilise - and then implement such within their captive environment.

This would only be beneficial, right?

As Bill explains in his show-notes regarding episode 89 of his Podcast, it's all vital for the 'Complete hydration cycle'. He answers several questions often asked by his Chameleon keeper listeners, all based on the information gathered by Petr, and a number of other long-term keepers already utilising this method in the captive environment.

The following is from the show notes of the Chameleon Breeder Podcast: Ep 89: Naturalistic Hydration for Chameleons – and Pers Comm with Petr Nečas over podcast interviews.

I want to start off this segment by reminding you that there are between one and two hundred chameleon species living from the deserts to the frigid mountain peaks and everywhere in between. There is no one chameleon environment. So, we are talking in generalities and will put together a hydration plan that will work for just about any chameleon. But if you are getting a fringe species such as *namaquaensis* it goes without saying that you will be doing much more species-specific research. Though for veiled chameleons, *panthers, jackson's* and any species you are remotely likely to find in a pet store, what I talk about today will apply.

What hydration methods are utilized by Chameleons in wild conditions?

So, let's start with the basics of hydration. Throughout the day, chameleons encounter moisture in four ways. Rain, dew, humidity, and food.

Rain is the most obvious. The rain level each species gets varies with environment. It is common for there to be both a wet and a dry season where there is a deluge of rain during the wet season and very little rain during the dry season. In some environments, the dry seasons are so traumatic to the environment that it can wipe out chameleon populations. *Chamaeleo calyptratus* is literally killed off by the dry season starving them and blasting them with sun. The entire world's population of *Furcifer labordi* doesn't even wait to be killed by the dry season. They just hatch at the beginning of the wet season, grow, mate, lay eggs, and then die before the dry season can kill them. Other chameleons brumate or hibernate to make it through the harsh dry season.

But it is the milder dry seasons and the chameleons that go about their lives during these times that have puzzled us the most over the years.

Why are our chameleons drinking so much during the day in captivity when they appear to have no rain in the wild? How do they get their hydration in the wild?

The answer is that there is a great deal that goes on during the night.

The humidity spikes and the temperature drops. This lowers the dew point and water condenses on surfaces in what we call dew. Thus, the chameleon wakes up to moisture available to be lapped up.

This is not a totally satisfying answer as it is hard to imagine there being enough dew to be available to supply the same amount of water as some of the long drinking sessions we see in captivity.

To address that we go back to what creates the dew in the first place – the high night-time humidity.

Reports from the field share that even in the dry season, night-time fog or mist rolls in and settles until it is chased away by the sun the next morning. The chameleon is immersed by the high humidity and breathing in the moisture. This is our most overlooked aspect of chameleon hydration. It is well known that we lose water through breathing.

I was amused to find a UK government website educating about condensation and mold explaining to people that just by breathing they contribute ½ a pint of water to the air each night. But what about reptiles? Do ectotherms – or cold-blooded animals – do the same? - and who makes a lizard breathe into a breath analyser? Well, who do you think? Our tireless army of scientists whose job it is to answer these kinds of questions!!

In conversations with Dr. Chris Anderson, he relayed that that there was a study where an anole species was measured to lose **.43%** of its body weight per hour through its breath. So, I think it is safe to assume this dynamic is the same in chameleons.

Here is where we need to pay attention - That high humidity surrounding the chameleon would reduce or completely halt the moisture loss during the night due to breathing. If the air is as moist as the lungs, there just isn't the water transfer from the body.

How does this night moisture process "hydrate"?

The lung membrane can absorb and pass through medicines we nebulise and nicotine we smoke and, if there is a humidity imbalance between the air breathed in and the lungs, we could even get moisture absorbed from breathing.

The important dynamic here is that nature has given chameleons a way to *not* lose moisture during the night so the dew in the morning is just to "top it off". This explains why we see so much drinking in captivity during the day. They are trying to make up for the moisture lost during the night.

In our indoor homes, our humidity comfort level varies depending on temperature but hovers between 30 and 60%. Our heating and cooling tend to suck moisture out of the air, so this creates a situation where the chameleon wakes up like we do – lighter due to water loss. You can do this experiment with yourself. Weigh yourself before going to bed and then in the morning before going to the bathroom and see that you lost weight overnight!

I did this experiment with two male veiled chameleons. I weighed them just after they went to sleep at night and then just before the lights went back on in the morning.

One slept under a fogger and one slept in normal ambient humidity that ranged from 50% to 60%. The dry male went from 45 grams to 44 grams – so he lost a gram, presumably through water loss, because he did not poop during the night.

The male that slept in the fog maintained his 52 grams all night.

Now please understand that this was a standard kitchen grade gram scale, so it is not worth calculating percentages, but it is enough to know that this phenomenon is easy to check yourself.

How we can recreate this complete hydration cycle in captivity?

First let's set up a target strategy and then we will figure out how to pull it off with the standard equipment available to us at this time.

Midnight is as good as any place to start. We are looking for a fog bank to roll through our cage from midnight until early morning while the chameleon is sleeping. It is after midnight that it gets thick. When the chameleon wakes up, we would like to have dew waiting on the leaves. The morning basking lamp needs to come on and start the drying process.

One thing we have known for a while is that surfaces that are constantly wet will cause problems in the form of mold, bacteria and fungus. The cage surfaces absolutely need to dry out.

Then, sometime in the middle of the day, let's give an afternoon rain shower. Since we are dedicating ourselves to the study of their natural environment and conditions, let's time it so we give those afternoon rain showers only during the months of their wet season. Research your species. For example, Veiled chameleons in Yemen have their rainy season from April through August - while Kenyan species such as *Jacksonii xantholophus* have two rainy seasons from March to May and from October through December.

How do we create these 'fogs' over night with our captive Chameleons?

Okay, it is now time to execute on this. Our first task is to create a fog bank at night. This is going to be the most difficult part for those of us with screen cages. Screen cages are great to make sure that the cage does not get muggy and stagnant. It does this by air flow. Well, that works perfectly for our humidity if your home is between 90% and 100% relative humidity. Unless you live in a greenhouse, I can almost guarantee this is not the case. So, we are going to be fighting against the airflow.

Therefore, you see many advanced keepers keeping their chameleons in at least partially solid sided cages. Solid sides cages give us the ability to control the humidity in our chameleon's environment with the recognition that our humidity is not always best for them. But it doesn't mean you have to throw away your screen cage. You can get more humidity control by enclosing sides of your screen cage. Anything from clear plastic painter's tarp to cleanly cut plastic panels can be attached to the sides and back of your cage to give you a pocket to work with. I have found success going a step further and putting clear plastic on the front as well leaving only the bottom front service door and the top panel screen. This way I can keep my humidity in with just enough airflow to keep things moving.

The fog itself can be created with a humidifier. There are cool mist humidifiers that whip water into the air using a fan and there are ultra-sonic humidifiers that create a fog. Cool mist can cover a larger area, but ultrasonic fog can be focused much easier. I use ultrasonic humidifiers in my set-ups. The fog coming out is so fine that it is easily breathed in and it takes a while before it starts getting surfaces wet. We have all night for this, so I am in no hurry.

The one thing you must deal with concerning the ultrasonic fog is that it can be too focused and only affect a small area of your cage. The more ventilation you have, the more this will be a problem. A fully screen cage can easily have a small beam of fog going through the middle of the cage and dissipating before doing the chameleon in the corner any good.

I suggest adapting the cage to contain humidity rather than just humidifying the entire room.

As cool as that sounds, take it from a guy who had this bright idea and turned his garage into a very cool fog bank, standard walls, paint, and everything else in the room is not meant to be immersed in fog like your chameleon is. It was fun while it lasted, but this is the reason why it is good to listen to the people who have been around the block a couple times. You can avoid some of the learning experiences that have made us such interesting folk to talk with.

Dew in Morning

You may get a layer of dew as a result of your humidifying efforts during the night. But I like to make sure by using a mister to lay down a coating of dew before the morning lights turn on.

So, 30 minutes before he lights come on, I run the mister for another minute.

Do we need to let the setup dry?

So, we went through all that work to humidify the cage, and now we need to dry out the cage. Now you wish you had all that ventilation! As you may gather, our chameleon husbandry is always a give and take. There are no perfect solutions to our husbandry challenges! - any way you go you will have to compensate in some way.

So, morning is the time for the heat lamp to come on. By mid-morning, there should be no wet branches. Constantly wet branches can cause foot infections and it will make for an unhygienic environment. Heat must be maintained at a safe basking temperature for the chameleon so if that is not doing the job then you must create more air flow. This can be done by using a fan. But create a gentle breeze. Point the fan so it blows across the top panel, not directly at the cage

How do we replicate those afternoon showers they get in their wild environment?

In nature when an afternoon shower is on its way the chameleon gets many signals. The sky darkens with cloud cover and barometric pressure changes. Granted, the weather tends to be harder to predict closer to the equator, but there are some rain drops and then more so when you gather all these bits of information together you pretty much have an idea there will be some rain.

Our chameleons aren't getting that warning when we suddenly flip on a misting system. One second your chameleon is comfortably basking and the next he is suddenly blasted with mist.

If you are replicating an afternoon shower, let's do our best to give some indication of what is coming - I have done this by turning off the heat lamp 15 to 30 minutes before my misters will go on. I might add in the turning on of the fogger right before the mister to further cool the area down. Even a two-minute misting session is enough, but you can make it go as long as you want.

If the chameleon has ample foliage to retreat into, and you give environmental warnings, then your chameleon will choose for itself how it wants to deal with the afternoon shower. After the shower and fogger are turned off, I wait for another 15 minutes for turning the heat lamp back on if it is going back on.

Then we come back to the night-time.

I have my misters set-up to go off for a minute after the lights are all off. This lays down a good start to the humidifying actions for the night.

I will also indulge my chameleon with back-up hydration. I firmly believe that we should replicate the natural cycle as closely as possible, which we are talking about now, but that doesn't mean I don't stack the odds in my favour.

I will start a gravity dripper around 8AM that will run a couple hours until the water runs out. This is my insurance. By adhering to the natural cycles, I make my husbandry as close to what their body was designed for. By adding in a

dripper, I am including a failsafe measure, just in case. This also helps me with live plants because I place the dripper over a different plant every day which ensures my plants get watered too!

How the hydration and waste is processed?

Water is used in the chameleon kidneys to produce the urates. The urates then go through the intestines and this is where the chameleon reclaims the water so as to not waste precious moisture. The amount of water reclaimed from the urates varies depending on the hydration level of the chameleon. The drier the environment the more water is needed; the more water is sucked back out. When water is removed, the urates crystallize into an orangish coloured substance.

From field observation (*P. Necas, pers comm*), normal content of orange in the urates is 15 to 50% of the urates. If there is greater orange content, then the chameleon's body is wanting more moisture back and that is a sign that we need to provide more hydration in the appropriate form.

If the urates are totally white, then the body has more than enough moisture and Is actually rejecting the normal water reclaiming process. In this way, the urates can give us a window into our chameleon's hydration level.

Of course, nothing can be simple. How much orange should be present is subject of debate? It is common for veterinarians to advise to hydrate until urates are completely white. The logic is that if the body does not extract any water it doesn't need to, and your chameleon is hydrated. But this isn't what is observed in the wild.

So, do we target our hydration to what is observed in the wild, or do we decide to give it the ole superior conditions approach that we like to do in captivity to make our super specimens? And I fully admit that my personal decision to target up to 50% orange in the urates is based on the field observations of *Petr Necas* - and there really isn't much more. He is one of the few field scientists that keep captive husbandry and field observations in mind at the same time to determine their relationships. I have asked a number of other field scientists and apparently, they had better things to do than observe the composition of wild urates. So, admittedly, the data sources are limited. In this case, which do you choose to trust? It is really up to you. Both measurement scales have been in use and neither has left bodies of chameleons in the streets. So, it is a subtle effect. But it is an important issue to consider.

Why would we do this? What is broken that we are trying to fix?

Half my listeners are excited for this new, more naturalistic approach. The other half are asking the glaring and completely valid question: *why change how we do things? What is broken that we are trying to fix?* The commonly kept chameleons are already living longer in captivity than they would in the wild. Do we really need to re-evaluate? The answer is, yes, at least some of us do. We need to constantly re-evaluate.

If you are listening to this podcast you have probably gotten the idea that we are on a journey. It is not me sharing end all be all chameleon secrets and extracting information from others. It is the record of my personal growth and the continual growth of our community. I have invited you to come along as we explore this process via this podcast. But that means I am constantly growing and challenging my husbandry methods. It means I am striving to make my husbandry as close to what we see in their normal environment. We have multiple milestones ahead for our community. Our current husbandry is insufficient for successful breeding almost every species of chameleon. Granted, *panthers, veileds*, and carpet chameleons are doing well. *Parsons, quadricornis, Jackson's*, and even *deremensis* have had success. But shouldn't we be logging many more species? So yes, it is still very much our responsibility to continue to push forward!

Summary of schedule.

So, let's summarize this ideal schedule:

- The chameleon goes to sleep
- I spray the cage down with the mister for a minute and put down a layer of mist
- The fogger comes on around midnight and brings in the fog
- The mister goes off for a minute, half an hour before lights come on

- Lights come on
- Dripper starts dripping
- If I am doing an afternoon shower, I turn off heat lamps 15 minutes before the shower
- I start the fogger right before the mister
- Run the mister for 2 minutes
- Fogger and mister go off
- Heat lamp goes back on 15 minutes after misting is completed
- Lights go off at night, and we are back to the start