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Will They Come in out of the Cold?
Observations of Large Constrictors in Cool and Cold Conditions

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In the winter of 1968, I landed what I considered to be a dream job. I was hired by Mural's Pet Center in Crystal Lake, Illinois, to care for their menagerie. There were fish, birds, rodents, lizards, turtles and frogs. There was a young boa that I stared at, I memorized, I worshipped; eventually it was to become mine, the first snake that my mother allowed in the house.

More exciting, however, was the brooding, dark-natured reticulated python that was housed in the cage next to the boa. The boa was about two feet long; the reticulated python was closer to eight feet and the biggest snake I had ever been near. He was a big-headed, slender, unpleasant snake. He did not hesitate to bite when he had the chance. I was enchanted by him, but I was afraid of him. We all feared him, and the day he was discovered to have escaped from his cage was a day of stressful anticipation.

We searched, cautiously, but we didn't find him. He was a presence in the store for a couple of weeks. Overnight raids on the guinea pigs and hamsters let us know he was there, lurking in the attic by day and roaming the store at night. One cold Saturday morning, we found him in the parking area behind the store. During the night he had left the store through a roof vent, crawled down to the gutter, then down a pipe, and headed back to the alley.

We knew this because there was a fresh eight inches of snow on the ground. We could see exactly where he had been, and how he had arrived at the spot where he was found. He was stretched out in a normal crawling position, breaking a trail through the snow, head up, frozen as hard as a rock.

During the following six years that I lived in northern and central Illinois, I learned of three more occasions when large constrictors left a warm house to die outside in freezing temperatures. In 1971, another reticulated python escaped the same pet store in a manner similar to the first, with similar results. Then there was a young, six-foot Burmese python, and a mature, five-foot Colombian boa constrictor that escaped warm houses to die in snow just feet from the houses.

Burmese Pythons and Cold Temperatures

Skipping forward a few years, the late 1970s were an innovative period for herpetoculture. From my perspective, this was the true advent of captive breeding, brought on, in part, by the discovery of a successful means to "hibernate" snakes in captivity.

In those days, I was employed as a keeper in the Dallas Zoo Department of Herpetology, and I had a large personal collection of snakes as well. My collection was comprised predominantly of kingsnakes and rattlesnakes, all species that hibernated in nature. However, prior to that period of time, there had been a widely accepted belief that it was difficult or impossible to hibernate snakes in captivity.

Snake keepers generally knew snakes could tolerate periods of cool temperatures, 16°C (60°F) or even 13°C (55°F), but it didn't occur to us that those temperatures WERE hibernation for most captive snakes. Many keepers attempting to replicate "hibernation" had been trying to take their snakes down below 4 or 5°C (40°F), emulating the well-known behavior of groundhogs and bears. Few snakes survived those attempts.

One of my two snake rooms was kept fairly warm throughout the year, but the other was a back bedroom in which I experimented with low temperatures by opening the large windows that were on two sides of the room. There was a thermostatically controlled gas space heater that kept the room temperatures from dipping too low.

I had Burmese pythons back then; the species had been breeding in my collection since 1974. I had lots of young Burmese pythons around, and I decided to include them in my experiment with cool winter temperatures. I never even considered that Burmese pythons needed to hibernate, or that they hibernated in nature, but I was curious about their reaction to cool and cold temperatures. I also included two Colombian boa constrictors, for similar reasons, but they both suffered respiratory illnesses when I cooled them and I moved them back to my warm room. The pythons proved to be somewhat more resilient.

I thought of this as an experiment, but really it was just observations. I had mercury thermometers in several places around the room and a few in cages; I constantly monitored temperatures and watched what the snakes were doing. Over the course of three winters, I observed some behaviors from my chilled kingsnakes, rattlesnakes and Burmese pythons that today I believe are generally true of most snakes.

One observation was that my snakes began to lose interest in feeding as the environment got colder. Some Burmese pythons quit feeding at 24°C (75°F); others ate at 18°C (65°F), occasionally even down to 17°C (63°F). In general, the young Burmese pythons were more eager to eat at low ambient temperatures than were the kingsnakes and rattlesnakes.

However, a second point I noticed was that the ability to digest and absorb food seemed to be temperature-related; at some point, a cold snake with food inside of it is forced to regurgitate. In general, the larger the meal, the warmer a snake must be to keep it down. Pythons begin to have problems digesting large meals at temperatures below 24°C (75°F); I observed pythons kept at 15°C (60°F) regurgitate rats that had been consumed two weeks previously, decomposed but not digested.

Regurgitation is dangerous to snakes, particularly chilled snakes. I never kept detailed records that would allow me to make accurate estimations, but then and in the years since, I observed that a significant number of snakes that regurgitate develop serious and often fatal respiratory infections a week or two later. This probably occurs because snakes aspirate some of

the fluids that come up with the regurgitations.

As temperatures drop, snakes become less active. At temperatures of 13°C (55°F), most snakes move about slowly, flick their tongues out in slow motion, and will drink water. As temperatures drop further, most snakes become torpid and are unable to move or to react to stimuli.

As temperatures decrease below the point of torpor, there is an increasing chance that when warmed up the snake will suffer cold shock syndrome [CSS]. However, rarely are snakes killed outright when chilled to core-body temperatures of 4–7°C (40–45°F) for only a few hours; if the duration has been short, most will warm up with few, if any ill effects; however, after even a quick chill, some snakes may suffer CSS or other problems upon warming up. At temperatures below 10°C (50°F), pythons suffer an increasing chance of dying as the duration of exposure to cold temperature increases.

When warmed to temperatures where activity is possible, snakes suffering CSS will not be able to move in a coordinated manner. They may exhibit what appear to be violent seizures if disturbed or handled. Snakes with this condition may die within 48 hours of being warmed; if they survive past that period of time, they likely will recover, but full recovery to normal coordinated movement can take more than a year.

It was my observation that Burmese pythons had an increasing chance of suffering CSS as temperatures dropped below 10°C (50°F). The lower the ambient temperature and the longer they are at a low temperature, the more likely they will suffer CSS. Over the years I've seen six Burmese that were kept at 8°C (45°F) for longer than a couple of days, none survived; some died with CSS when they warmed up while others died while cold.

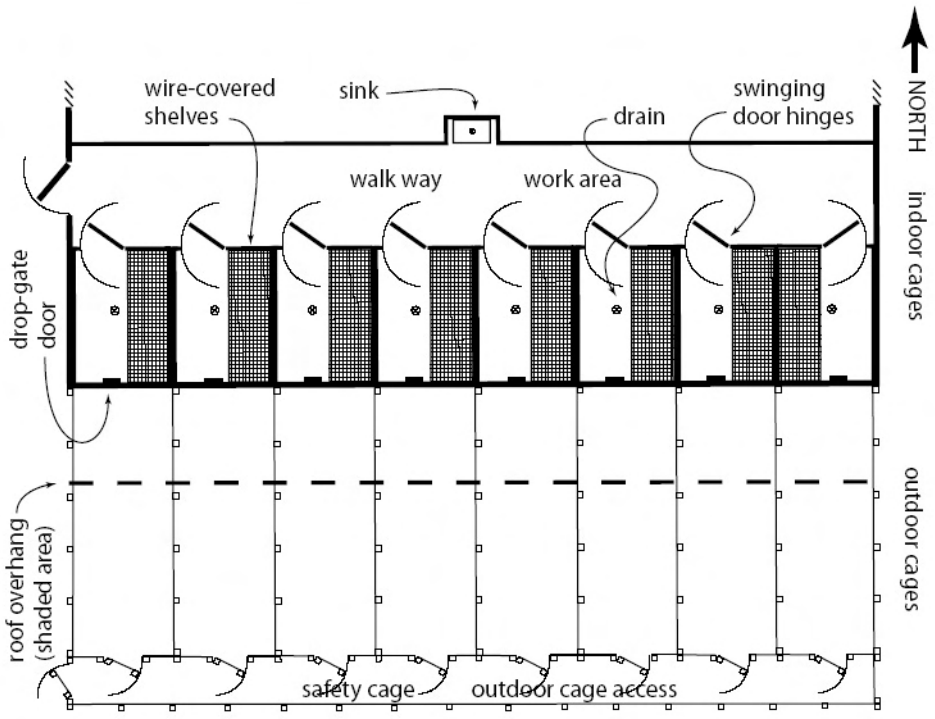
Will They Come in out of the Cold?

Fast forward a few more years. Tracy and I worked with all the largest python species for 11 years, beginning in 1988. During that period of time we experimented with several methods of confinement and housing for the big snakes, some approaching 200 pounds. We worked to evaluate what we felt might be the best way to keep large numbers of large snakes. We placed the greatest emphasis on efficiency of maintenance and on the safety of the keepers of the animals. Our thoughts at the time were that the caging and maintenance protocols that we designed might in the future prove to be valuable if ever there were need to establish large colonies of the largest snakes for conservation or research purposes.

In the winter of 1993, Tracy and I traveled to Australia to research our first *Pythons of the World* volume. There we saw outdoor cages for fruit bats at the Territory Wildlife Park in Berry Springs, Northern Territory. We decided then and there to create a similar cage for the large constrictors we were maintaining at VPI.

We constructed eight cages (see floor plan below), each with climate-controlled, 2.4-m-high indoor rooms that had concrete floors measuring 2 m × 2.3 m. Each indoor cage had two shelves, one above the other, on which snakes could sit; each shelf measured .9 m × 2.3 m.

In the winter we heated the indoor cages using oil-filled electric radiators that were thermostatically controlled to keep the air temperatures at a relatively constant 18°C (65°F). The air was kept moving with oscillating fans, so that temperatures did not stratify. The radiators and fans were placed outside the cages in the walkway that passed in front of all the cages. Each cage had three regulated heating pads, one on the floor



Floor plan and details of the VPI indoor/outdoor cages

The outdoor cages as the wire panels were being assembled. Black PVC-coated, welded wire mesh was used. Each vertical panel sits on a 4-inch-wide concrete beam.

The indoor cages all open to a walkway and work area. Using PVC-coated wire shelves was a very good design; the snakes were comfortable on them and they were very easy to keep clean.

(18°C; 65°F), one on the lower shelf (24°C; 75°F) and on the upper shelf (28°C; 82°F). In the winter, the temperature of the concrete floor during the coldest weather was 13–16°C (55–60°F). Temperatures were monitored with a Raynger non-contact remote-sensing temperature gun.

Each indoor cage connected to a wire-enclosed outdoor run that measured 2 m × 5 m × 2.5 m (h). The substrate of the outdoor enclosures was large smooth river rock. Each enclosure had a large oak log with branches. Access between each indoor and outdoor enclosure was through a small doorway that closed with a vertical drop-gate panel. There was a locked outside access door at the far end of each of the outdoor runs.

Here in the Texas Hill Country we have some winter cold spells, but temperatures on many winter days are suitable for pythons and boas to be outside. Nighttime temperatures, however may dip to dangerous lows; on average there are more than 30 days a year when the daily minimum temperature is ≤ 0°C (32°F or colder). Most years include several "blue northers," each lasting several days. During such periods nighttime lows are -10 to -7°C (14 to 19°F), days are gray and cold, and daytime maximum temperatures may not exceed 0°C (32°F).

From the summer of 1994 through the winter of 1997/1998, we maintained large constrictors in these indoor/outdoor cages. We were excited at the prospect of giving the snakes the option to live inside or outside 24/7, at their discretion. We wanted to know, if given choices, would large constrictors come in out of the cold? We posed the question because it would be an important aspect of the maintenance protocol of large constrictors in this type of enclosure.

Many species of subtropical reptiles and most species of reptiles from strongly seasonal climates are reported to be aware of dangerous low temperatures and react by seeking shelter. Bert Langerwerf had reported success with several large lizard species in indoor/outdoor enclosures in cold Alabama winters. Several turtle keepers told us that some species of tortoises would seek shelter in cold weather. We had seen that some of the larger North American snake species did well year-round in indoor/outdoor cages. If pythons and boas could be counted on to reliably come in from the cold, it would allow them access to their outdoor enclosures during the periods of favorable temperatures that are typical of a Texas winter.

It also occurred to us that indoor/outdoor cages might be very effective exhibits for large constrictors maintained in zoos. This type of caging would allow more space to the snakes at less cost, reduce maintenance, and, done correctly, could increase the level of keeper safety when working very large snakes.

I was particularly intrigued with the project, as I had not forgotten the snakes that crawled into snow. I wanted to better understand that phenomenon.

In each cage we propped the drop-gate open and masked most of the opening to create a passageway that was 25 cm × 25 cm. We draped a piece of soft carpet over the opening to block some of the coldest air, creating a "doggy door" for snakes. They readily went in and out of the opening. When we were not supervising the snakes closely, the drop-gate panels could be shut, closing access to the outdoor cages.

When the weather was cold, we checked the snakes at dusk, 10 P.M., sometimes at midnight, and just after dawn. Over the four winters that we watched the snakes, we worked with Burmese pythons (from Thai lineages), reticulated pythons (two from Thailand, one from Borneo, three of unknown provenance), African pythons (from Ghana) and boa constrictors (from Colombia, Peru and Argentina).

Our evaluations of indoor/outdoor cages were positive. The snakes prospered, they reproduced, maintenance was dramatically decreased, and it was possible to safely work with the biggest snakes. However, it became apparent that this would not be an effective way to exhibit snakes in a zoo for the reason that snakes rarely ever went outside voluntarily during daylight hours. From May through mid-October, it was extremely rare to witness any snake in the outdoor cages during daylight hours. In fact, no reticulated python was ever witnessed to go outside in daylight, no matter the time of year.

However, at night all the snakes roamed their outdoor enclosures. They stretched, they prowled, and they climbed on their logs. Often they would emerge at dark, investigate around for a while, and then coil in a hunting position, to remain motionless

Tracy handles one of the reticulated pythons living in the indoor/outdoor cages.

until dawn when they would return indoors.

During the early spring and the late fall, the Burmese pythons and the African pythons would occasionally remain out in the cool mornings until the sun shone strongly on them, then returning indoors.

Pythons in the Cold

During the winter, December through mid-March, we never saw any python go outside in the day. What we observed was that the pythons spent most of the winter sitting indoors on the floor. Most of the winter they maintained body temperatures of 16–18°C (60–65°F), even though warmer temperatures were possible by sitting on the various heating pads. In very cold weather the extended low temperatures and the howling winter winds would overwhelm our heaters, and chill the floor below normal winter temperatures; pythons on the floor would have a body temperature of 10–13°C (50–55°F).

We took most temperatures the quick and easy way, using a RayTech Raynger noncontact temperature gun. In the first year, when the snakes were so cold as to be relatively immobilized, we did take some cloacal temperatures with a mercury thermometer. When the snakes had been sitting in one position for longer than a day, we found close agreement with values registered by the temperature gun for the surface temperature of the snake and for the temperature of the substrate on which the snake was sitting.

At temperatures ≥ 10°C (50°F or above) the snakes could voluntarily move. Their big tongues flicked out slowly, and they seemed very deliberate in their movements. Every now and then, each animal would rouse, and change positions, maybe get a drink. Once in a while a python would sit on the coolest heat pad, sometimes for a few days in a row. These big snakes would sometimes remain coiled and motionless for longer than a week. Most movements that we observed were when we happened to encounter a snake getting a drink. They did seem to us to drink fairly often, but there were extended periods when they were not being observed.

Every now and then, a snake would go outside, usually at night. Sometimes when we checked at night we would find them prowling slowly in the cold air, even below freezing; in those cases we always dragged them back indoors. But sometimes snakes would move in the night after our last check. At the morning check we would find them outside, coiled, at the point of torpor and sometimes completely unable to move. Again, we would drag them indoors and in a short time they had warmed back up.

It appeared to us that their movements to the outside were relatively independent of the temperature. They were about as likely to go outside and coil when it was a fatal -5°C (23°F) or a survivable 16°C (60°F).

All of the large pythons were observed to move outside in dangerously low temperatures—always at night. Twice we found a Burmese python and once an African rock python that were coiled outside after nights with low temps of -4 to -7°C (20–25°F), covered in frost and insensate. We nearly started an autopsy on the first python we discovered in this condition before we realized it was still living. We took cloacal temperatures and found that these chilled snakes had internal temperatures of 4 to 7°C (40–45°F). We pulled the snakes inside and put a 21°C (70°F) soft spray of water on them, and in the period of an hour, all three appeared to recover.

Boas in the Cold

The boas provided an interesting contrast to the pythons. There were six large adult boas housed together in one of the indoor/outdoor enclosures. Two large females were captive-raised Colombian boas (*Boa constrictor imperator*), two large females were captive-raised Peruvian boas (*Boa constrictor constrictor*), and there was a captive-bred pair (male and female) of Argentine boas (*Boa constrictor occidentalis*).

All boas did well in the indoor/outdoor cages during the warm months. However, the boas from Colombia and Peru did not do well when cold weather arrived. Unlike the pythons, they often sat on the middle-level and upper-level heating pads for extended periods of time. They persisted in going outside during the day and at night. Several times we found them cold to the point of torpor. One Peruvian boa came down with a severe respiratory ailment by the middle of December, and by the end of December we felt it in the best interests of the remaining three snakes to remove them to the warm main snake building.

Of all the snakes that we kept in the indoor/outdoor cages, boas and pythons, only the Argentine boas did well in the winter. They never went outside at night, and they never went outside in the day when the weather was unfavorable. They regularly went outside in the winter when they could bask in sunlight. If the weather was calm and clear, they sometimes would emerge from the indoor cage in mid-morning to sit on the dark log or beside the log on the sunny side even when the ambient temperature was as cool as 8°C (46°F). When they were basking, we often measured them with the temp gun to have a surface temperature as much as 12–14°C (21–25°F) warmer than the ambient air temperature. They could be warm to the touch even when sitting on rocks that were still cold from

the previous night.

Conclusions

As has often happened, what started out as an investigation of one thing ended up unveiling other revelations more interesting and, perhaps, of greater significance. Tracy and I built the indoor/outdoor cages to investigate their practicality and efficiency as a means to house large colonies of large constrictors. However, in light of the questions currently being raised regarding the possibilities of nonnative boas and pythons becoming established in the continental United States, our observations of the responses of boas and pythons to cold weather seem particularly significant. To our surprise, we can find no previous reports of any similar experimentation that has been done with this particular group of animals.

I publish this account of our observations as an anecdotal report simply because it was not any sort of quantified experiment. However, I consider that our observations are of interest and importance in the matter of ascertaining the risk of any of the large constrictors to become established and invasive.

Based on our observations, we came to the conclusion that large tropical pythons and boas are able to tolerate "uncomfortable cold" and will modify their behaviors accordingly. Undoubtedly, some of the behaviors seen were the metabolic consequences of significantly lower body temperatures—the snakes moved slowly, they moved less, they quit eating. However, we observed that the snakes made conscious decisions on how to react to colder temperatures. The pythons usually chose to not sit on warm heating pads that were always available to them. The boas did sit on the heating pads for extended periods of time, apparently less willing to allow a lower body temperature.

However, based on the behaviors and actions that we observed when the weather was near or below freezing, Tracy and I, much to our keen disappointment, concluded that the pythons and the four tropical boas did not appear be motivated to seek shelter in an environment of "fatal cold." They did not appear to us to be able to behave in a manner that reflected the reality that in certain weather conditions it is not an option for a snake to fail to seek shelter. They were less likely to go outside at night in the winter than in the summer, but in the winter they were as likely to go outside when it was fatally cold as when it was only uncomfortably cold. They did not or could not make the distinction.

In fact, the pythons in the indoor/outdoor enclosures all were descended from tropical populations of animals where freezing weather is unknown. I suggest that the simplest explanation of their apparent inability to shelter from fatally cold temperatures is that such behavior is unnecessary in their native ranges where fatal cold extremes are unknown.

This is in contrast to the behavior of the two large Argentine boas. Even though they were strongly nocturnal during the summer, and spent nearly every night in their outdoor cage, once winter arrived they were not observed to venture outside at night. Even though this particular pair was captive-bred, and had never been outdoors before, they behaved as having strong instincts to shelter from cold extremes.

Argentine boas are a subtropical species found at lower elevations in central northern Argentina from the area of the border with Paraguay south to about 33°S latitude. The climate in the range of the species is moderate and seasonal; there are periods of cold winter temperatures. The species is known to shelter underground in the winter. This is a race of boas that has made morphological and behavioral modifications to live in a temperate climate, a rarity among the larger boa and python species.

Finally, it is my conclusion that the action of a python or boa to seek shelter in response to cold winter temperatures is not an innate behavior common to all species in the families Boidae and Pythonidae. Quite the opposite, it is a rare ability of only a few taxa. It is my observation that those species native to the tropics and other areas where low winter temperatures are unknown have no specific ability to protect themselves from periods of fatal cold.

Acknowledgments

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