

Suggested Guidelines for Reptile Enrichment

Reptiles in zoological institutions are often housed in areas displaying a variety of herpetological species in simulations of their diverse, natural habitats. Enrichment for reptiles may facilitate good exhibitry and husbandry, help to provide the appropriate environment for species-typical behaviors to occur and provide a level of stimulation and activity conducive to good health. The natural history of each species is important to keep in mind when developing a safe and effective enrichment program. Reptile care is highly specialized; resource materials and knowledgeable individuals should be consulted when possible and veterinary and supervisory approval sought prior to initiating enrichment that may lead to changes in animal care.

Reptiles as a group vary widely in their natural history. They are found in an array of habitats and ecological niches. They exist in the temperature extremes of the desert, the moisture of the tropical rainforest and the salinity of marine environments, to name only a few. Reptiles have adapted to each of these vastly different conditions and capitalized on the microhabitats and climatic gradations of each in order to survive. They may be aquatic, terrestrial, arboreal, or subterranean, or in many cases some combination of these depending on stage of development and time of year.

Reptiles utilize a variety of food types and feeding strategies. Species may be herbivores, insectivores, carnivores, frugivores or omnivores. Some are primarily predators while others are primarily prey; however, most are both to some extent. Therefore, placement on the food chain greatly influences a reptile's life history strategies.

Locomotive styles include terrestrial locomotion by means of sprawling limbs, terrestrial limbless locomotion (snakes have six different recognized modes), aquatic locomotion and even aerial locomotion where species parachute or glide to their destination. Other behaviors typical of most reptiles include excavation of nests or burrows, sexual displays and territorial displays. Some of these latter behaviors may only occur in a social context, though reptiles range from gregarious crocodylians to relatively solitary chameleons.

Reptiles are ectothermic, or cold-blooded, animals. Because their body temperature is dictated by external temperature, reptiles can regulate their body temperatures through behavior. Reptile life and reproductive cycles are influenced by the availability and quantity of water. In some species the amount of moisture in the air is critical while in others, access to a pond, lake, river or estuary is essential for their health.

Exhibit Enrichment

Perching in most reptile enclosures is crucial in providing pathways and arboreal access for both semi and fully arboreal species. When supplied in conjunction with heat sources, perching provides an important mechanism for thermoregulation. Perches should be placed near heat sources to allow the animals to bask, with at least as many basking sites as individuals housed. Placing perches at varying distances from the heat source provides a temperature gradation that allows the animals to maintain body temperatures within a

range appropriate to the species. It can also encourage locomotive behavior between sites. Providing locations that surpass the thermoptimum temperature can encourage movement in and out of that area, rather than having the animal continuously bask in the same location. Creating vertical (e.g., a rock pile, vine etc.) as well as horizontal sites can offer additional dimensions to the enclosure and stimulate climbing in some species. For example, rattlesnake species that hunt by positioning themselves above potential prey items can sometimes be stimulated to feed more often with the addition of a large, flat rock or pile of rocks on which they can rest. The emerald tree boa can develop gastrointestinal impactions and/or become obese through lack of exercise. Periodically changing the perching in its enclosure may stimulate a healthy increase in movement as the animal explores its "new", enriched environment.

Misting, whether by hand or via an automated system, can also increase activity and assist with the shedding of skin. Water features (shallow or deep pools, water cascades etc.), where appropriate, can help make the enclosure landscape more interesting and raise the humidity level. Additions of plants, moss and soil can also help to maintain humidity and moisture.

Natural substrates such as soil, wood chips, moss, etc., can give reptiles the ability to manipulate their environments and engage in natural behaviors such as excavating a burrow or creating a nest site. Moisture, texture and temperature gradients may all play a role in the selection of a nest site. It is also important to provide the proper substrate and conditions for potentially gravid females. This can help to decrease the risk of them not depositing their eggs and becoming eggbound. Natural substrate such as bark often contains live insects, which may be discovered at a later time by a foraging animal.

Cover, an important feature for many reptilians, can be provided in ways that allow the animals to still be visible to the public. Plants can be positioned so that the leaves are both above and below the perching. Caves that are forward facing can be created using rocks and logs. These shelters help the animals feel protected while still being visible to caretakers and visitors. Providing them with more than one sheltered location across either temperature (e.g., one near a heat source and one in a cool place) or moisture gradients (e.g., one that uses moist moss, another, dry leaf litter) permits the animal to make choices while still having shelter. The addition of substrates to a cave enables the animals to modify the cave's micro-environment by pushing substrate out or mounding it up as desired. These shelters also allow them to exist where there is less light, a welcome feature for forest floor species that may be more adapted to lower light conditions than exhibits typically provide. For some snakes the addition of a "hide box" to the enclosure promotes eating.

The minimum recommended size and relative dimensions of the enclosure will vary with the individual reptile species according to its preferred temperature range and habitat requirements. Mixed species exhibits ideally would be large enough to meet the standards of each species within it. In general, larger enclosures will be easier to design with more enriching features and be better able to provide temperature, moisture and light gradients. The larger space can also reduce bacteria build up, which can decrease the frequency with

which the substrate needs to be changed. Furthermore, in some species, placing the animals in a larger enclosure space has caused long-term increases in activity level and behavioral repertoire.

Dietary Enrichment

Many enrichment options that have been successful with birds may also work with reptiles. Naturally rotten logs with insects inside or fake logs with time-released (on a random schedule) insects can elicit foraging behaviors. For some species such as chameleons, a daily variety of live insect prey items can be essential to healthy feeding on a regular basis and can therefore be extremely important to their health. For other species, live prey, if infrequently offered or offered as a novel item, can be very stimulating. For example, goldfish for turtles or anacondas, feeder fish for tentacle snakes or crocodiles and wild crickets and other insects from a pesticide free area, for lizards and turtles can promote foraging. Adding earthworms to a box or wood turtle's substrate can also stimulate foraging behavior. Hand scattering of routine dietary insects can also be enriching if the quantities are unpredictable and fed at irregular intervals. Iguanas will readily feed on a variety of nontoxic browse plants. The branches can be arranged within the enclosure as temporary leafy perching, with the animals feeding on it for days or even weeks (if misted or maintained in water, the browse may stay fresh longer).

Rattlesnakes typically release their prey after striking with venom. The prey then wanders off to die, only to be tracked by the snake. The snake then engages in a high rate of tongue flicking and searching movements to locate and follow the prey's trail. Tongue flicking is a behavior that will sometimes decline in captive snakes over time if novel stimuli are not presented. Live prey can stimulate an increase in this behavior, as can an a blood trail (made by dragging a dead prey item around the enclosure and then hiding it under substrate such as leaves or exhibit furniture). The scent trail of lactating mice may also be appealing to snakes, as tracking them in the wild would lead to a tasty litter of young. Varying the feeding schedule can lead to an increase in predatory behavior and therefore an overall increase in activity.

Novel Enrichment/Social Enrichment

Chemosensory behavior in snakes can be stimulated with the addition of a shed of another (healthy, parasite free, etc.) snake. This will typically elicit tongue flicking and olfactory investigation. Rotating animals into a conspecific's enclosure (preferably of an opposite sex) can also stimulate these behaviors in species such as bushmasters. Creating either a group exhibit (many lizards are colonial) or a mixed species exhibit can also lead to a more interesting and socially complex environment, increasing the likelihood of territorial behaviors. In some social situations, such as with crocodylians, the addition of visual barriers can help to alleviate competition and stress at feeding times. Animals in mixed species exhibits such as aquatic turtles, terrestrial lizards, and arboreal snakes may benefit by occupying different strata which would minimize competition for space. In addition, exhibiting species from the same locale together can decrease the likelihood of deleterious pathogen transmission between species. Finally, using behavioral training to introduce animals to shift boxes, side shifts (clear tubes for snakes or an area off exhibit where the

animals can be safely examined, can assist with husbandry, health and safe handling of the animals, as well as present them with a challenging and rewarding event.

Safety Considerations

A major consideration in reptile care and enrichment is that form is not equal to similarity. Two snakes can look superficially alike and yet come from entirely different habitats. It is the species' natural history that should be considered in the implementation of enrichment. The natural history of the pine snake, for example, suggests that because this animal would have a large home range in the wild, it may require more stimulation, have a higher overall activity level and need a larger cage size than a species of montane rattlesnake occupying a much smaller territory. It is also important to avoid a super-stimulus effect. For example, a gila monster which is native to the desert, if given a bowl of water all the time, may sit in it to the extent that algae begins to form on the animal's back. Something is triggered that would be appropriate in the wild, but would not necessarily shut off in captivity. Over misting can also be a problem for some species depending on the specific climate they were adapted for. Caution should be taken when supplying new water sources. Drowning in (relatively) deep, smooth-sided pools has been known to occur with reptiles that are not good swimmers or floaters. Baby turtles have drowned under dense moss in aquatic tanks. When new water bowls or pools are added to turtle or tortoise enclosures, it is important that the animals can right themselves from a "turned over" position in the water or they may drown. To test for this the animal should be placed in the water on its back and observed to ensure it can "flip" itself right side up. If the animal cannot do this the water depth should be increased until it can.

Enrichment in an enclosure can create new opportunities for escape or injury and therefore should be well planned out in advance. In addition, adequate ventilation must not be compromised by new items in the exhibit. Modifications to an existing habitat can create new hazards, such as drains trapping animals or perching placed too close to cage mesh causing skin abrasions. Observation following exhibit changes is critical to ensuring safe enrichment. The potential for an animal to experience stress as a result of changes to its environment should be considered. These stressors can create subtle problems that can be monitored by observing body conditions, obtaining regular weights etc..

The addition of substrates in a reptilian enclosure can provide opportunities for variety of behavior, including foraging and locomotion. However, with the exception of desert-dwelling reptiles and some aquatic turtles, sand is not recommended as a substrate because of the risk of gastrointestinal impaction if ingested. For the same reason, ground corn cob is also discouraged as a substrate. There is no single substrate that is acceptable across all terrestrial reptile species. Some may be too absorbent and cause a decrease in the humidity level in the exhibit, leading to animal dehydration; others may not absorb well enough and cause too great of a moisture build up. The frequency with which the substrate will need to be changed to maintain hygienic conditions will depend greatly on the type of substrate, the species housed with it and how they are maintained (e.g., how frequently are they misted, number of animals etc.). Gastrointestinal impaction, suffocation and providing a medium for pathogens are all risks associated with the addition of substrate to reptile exhibits.

Substrate can be a great asset in an enclosure; when used appropriately, the benefits of its use will, in most cases, far outweigh the risks.

Dietary enrichment often incorporates variety into the animals' diets; however, this can be problematic, especially with snakes. Variety can create finicky eaters, leaving keepers without food options if a snake goes 'off feed'. Live prey items (even crickets) also pose potential danger if not eaten immediately as they can bite and injure the animal being fed. This risk can be minimized by: 1) monitoring the situation and not leaving live prey in the enclosure for any length of time if the reptile seems uninterested, and 2) offering a live prey item food, for example, providing rodent blocks for mice which are offered as enrichment. Prey items may bite the predator out of their own hunger. Insect prey should be removed from the enclosure regularly as the nutritional value of the prey may diminish over time. When insect prey is collected locally it should be gathered from areas that have not been sprayed with pesticides. It is also important that browse offered is nontoxic and free of pesticides. The same caution employed in providing mammals and birds with browse should be used with reptiles.

Keepers should always be careful when working around and handling reptiles as even non-venomous species can have septic bites and anticoagulants in their saliva. Some people develop skin rashes from even garter snake bites as a result of a mild reaction to the snake's saliva. Reptiles frequently carry salmonella in addition to many other transmissible pathogens that pose a risk to both humans and other reptile species. This should always be a consideration when exchanging sheds, increasing the number of conspecifics in an enclosure or forming a mixed species exhibit. When mixed species exhibits are created, care should be taken to select species that will tolerate one another well without predation, aggression, an unhealthy amount of social stress or undue dietary competition.

The implementation of new enrichment involves a number of considerations to ensure the health and well being of the animals involved. Consultations with those experienced in reptile husbandry and researching appropriate sources PRIOR to the implementation of enrichment can help prevent mistakes and greatly improve the lives of the animals.

The following are examples of enrichment that may be appropriate for reptiles, as well as an overview of safety issues that should be considered in the implementation of enrichment.

Exhibit Enrichment

- Perching: to allow for basking sites with temperature gradations, provide arboreal access, create vertical sites (rock piles, hanging vines), encourage climbing; changing of perching can stimulate activity and maintain a healthy environment.
- Misting (hand or automated).
- Water features: shallow pools, deep pools, water cascades, etc.
- Natural substrate: soil, wood chip, moss, leaf litter, orchid bark, sand, etc.
- Cover: plants, forward facing caves made from logs or rocks, hide boxes (feeding snakes).

- Increased enclosure size to add complexity, facilitate temperature and moisture gradations, and increase activity and behavioral repertoire of the animals.

Dietary Enrichment

- Naturally rotten logs with insects.
- Insect dispensers e.g., fake log with timed release insects on a random schedule.
- Variety of insect prey.
- Novel live prey: goldfish, feeder fish, insects.
- Scattering of routine dietary insects in unpredictable quantities and intervals.
- Varied feeding schedule of prey items.
- Scent trails: blood trails, lactating mouse odors/trails.
- Nontoxic browse (e.g., escallonia, willow) for herbivorous reptiles. -Can also be used as temporary perching while they feed.

Novel Enrichment/Social Enrichment

- Snake sheds.
- Rotation of animals into conspecifics' enclosure.
- Animals housed in natural social groupings.
- Mixed species exhibits with appropriate species.
- Visual barriers to reduce social stress and feeding competition.
- Behavioral training to introduce animals to shift boxes, tubes and squeeze chutes.

Safety Considerations

- Form does not equal similarity; the natural history of each individual species should be considered.
- The super-stimulus effect should be avoided, e.g. water at all times to desert animals can cause problems.
- Over misting in some species can cause health problems.
- The potential of animals drowning in deep (relative to the species), smooth sided pools should be minimized.
- Substrate, if used improperly, can cause impaction, suffocation or be media for pathogens.
- Sand should be avoided as a substrate for most non-desert species; corn cob can cause problems if ingested.
- Dietary variety in snakes can create finicky eaters.
- Live prey items can bite and injure the animal being fed.
- Browse should be checked for pesticides and other chemicals.
- Mixed species exhibits should be designed to avoid species preying on exhibit mates, aggression, social stress and dietary competition.
- Keeper safety: even non-venomous reptiles can have septic bites and anticoagulants in their saliva. Care should be taken when working around them and handling them.
- Transmissible pathogens such as salmonella pose a risk to humans and other reptiles

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