

Target Training and Voluntary Blood Drawing of the Aldabra Tortoise (*Geochelone gigantea*)

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Abstract

Managing giant tortoises can often be quite challenging due to their enormous size and their evasive and sometimes stubborn temperaments. Training can be an extremely useful tool when the need arises to shift an individual animal or an entire herd of tortoises to various locations in or out of their enclosures. Training can also be very advantageous when performing routine health screenings or treating animals in emergency situations. Without formal training these giant but gentle tortoises can become easily stressed, injured or often flee from staff when basic husbandry, medical or emergency procedures need to be performed. This paper details the development and implementation of training 2.2 Aldabra tortoises (*Geochelone gigantea*) at the Audubon Zoo. The benefits of target training and desensitizing Aldabra tortoises for voluntary blood collection and voluntary shifting them on- and off-exhibit heavily outweigh the alternative methods of manual restraint and physical coercion. Not only do the Aldabra tortoises benefit from the training, but Audubon Zoo's veterinary and keeper staff now have a more efficient, less stressful way to impact the husbandry and medical aspects of these giant, gentle creatures.

Introduction

As zoos increase their efforts towards integrating training into various aspects of zoo husbandry, keepers are discovering more effective methods of manipulating the animals they oversee. Zookeepers and aquarists are now becoming more closely involved in both the behavioral and medical aspects of animal husbandry. Focus is shifting toward using safer, faster, less invasive, less stressful, and more accurate techniques of captive management. We are now discovering improved ways to crate animals, draw blood, perform radiographs and ultrasounds, shift animals from one enclosure to another, and more closely examine the animals we care for in captivity. These methods have proven to be elements for success with Audubon Zoo's Aldabra tortoises.

The Audubon Zoo currently manages and exhibits 2.1 Aldabra tortoises. Managing these animals can be quite challenging due to their enormous size and weight. Each adult male weighs nearly 500lbs. (226.79kg) and the adult female Aldabra tortoise weighs nearly 200lbs. (90.71kg). The oldest male is between 80-90 years of age and the younger male is around 70 years of age. The females are roughly 30 or 40 years old. Such evasive and sometimes stubborn temperaments combined with their massive body can make it very difficult to work with these animals when they are unwilling to move on their own. Without a formal training program for Audubon's Aldabra tortoises, shifting them, working around them while servicing their exhibit, or performing medical procedures proved to be extremely difficult to all involved.

Development of the Training Program

Motivation to begin a formal training program stemmed from very rudimentary and frustrating means of manipulating the 2.2 Aldabras in and out of their exhibit during the late fall, winter and early spring months. If temperatures at night fell below the tortoises' acceptable temperature range (55°F/12.7°C) the herd of tortoises were to be brought into their night house for warmth and shelter from the elements. During part of these cooler seasons, it was a time of year when, although the nights got quite cold, the day's ambient temperature was reasonably warm. The tortoises would linger in the last ray of sun that

was in their exhibit and remain there as long as they could. Unfortunately, the warmest area of their exhibit was the farthest area away from their night house and the sun did not lower until after the zoo's hours of normal operation. This put the keepers in a dilemma. Keepers were often staying late to forcibly push the animals inside, carry the lighter (200-pound) tortoises in, and even using rocks to tap or knock on their carapaces (upper shell) until they finally moved. When rocking and pushing the tortoises, or tapping on their carapaces, the males would become visibly aggravated. One male, "Feldspar" would actually lean his weight into the keeper's direction and sometimes try to shove the keeper against an object (a tree or fence) that the keeper was beside. Another male, "Magma" would usually ignore the tapping for as long as he could and then eventually scuttle indoors, but only after all other tortoises had gone inside ahead of him. Visitors were often watching the spectacle as it occurred. This process often lasted for over a half an hour. By the time the keepers were able to force the tortoises inside everyone involved with the process (including the animals) was very stressed, aggravated and exhausted.

After researching the Aldabras' anatomy, the keeper discovered that turtle and tortoises' lungs are located all along the underside of their carapace. Knocking on their back or carapaces was actually hammering on their lungs. The keeper also came to realize that the tortoises' carapaces are so sensitive to touch, that even when sleeping, they can detect the slightest contact. Continually stressing or aggravating the tortoises was also weakening the bond or trust between the animals and their staff. When a keeper or staff member entered their exhibit, often all four tortoises would retreat or avoid the person completely. If the Aldabras were not on land in the sunny area of the exhibit, they were in the moat of their exhibit where the water was warmer than the ambient air temperature. If they were near the water's edge they would often sink into the water or swim away from the keepers trying to retrieve them. The females, who often retreat to the moat on chilly days, were extremely difficult to retrieve from the water because they would submerge themselves in the water's thick, muddy substrate. Once submerged, the females would often try to stay in the water for days. On cooler days, the tortoises would become so cold that they often could not move out of the water on their own. It would then require the keepers getting into the moat and lifting the females out and carrying them to the barn. It was during these instances that it was most difficult to coax them inside to their night house. All of the frustration and time-consuming failures were becoming too stressful for both the keepers and the animals. A solution had to be created somehow.

Implementation of Target Training

After a great deal of research an informal plan was created. Targeting the tortoises appeared to be the solution. Targeting was chosen as the method of training because the keeper wanted to condition the tortoises to come to an object by their own choice, rather than forcing them to move. Targeting is teaching an animal to station or touch an object (Hurley, 1999). The object could have been the keeper's hand, but a longer extension was needed to reach the animals when they were out of the keeper's reach (i.e. the moat). A target was created. The target's design was quite simple. A small blue and white buoy was attached to a stick, roughly 18 inches long (45.7cm). The target stick (or target pole) was, in essence, to serve as an extension of the keeper's arm (Ramirez, 1999). Since the Aldabras are tremendously food-motivated, food was chosen as the initial primary reinforcer. A "primary reinforcer" is reinforcement provided by a stimulus that satisfies an animal's biological motivation such as hunger or thirst (Hurley, 1999).

Conditioning the Tortoises to the Target Pole

The males initially responded much more quickly than the females, but only after many failed attempts. When the keeper first offered the target pole the males responded to it with hesitance by pulling their heads into their shells and hissing. They would recoil from the target pole or stay tucked in their shell to avoid this new object. This is not uncommon for this species. They are naturally apprehensive of new objects or people. The natural predisposition for an Aldabra tortoise is to avoid humans. This is inherent in their natural biology's instinct and survival skills. Human introduction to the West Indian Ocean Islands is the primary cause that led to the tortoises' eventual isolation on the Aldabra Atoll and

Seychelles Islands. Here they became isolated from man (Denburgh, 1998). The females usually retreated from and avoided the keepers whenever possible. Adding a target pole to the scenario only made them more timid. The females withdrew into their shells or ran into the moat of their exhibit. The keeper needed to first desensitize the tortoises to the new object by gradually exposing them to it (Ramirez, 1999). This was easy to do. The blue and white target pole was left in view and out of reach of the Aldabras at every feeding. The tortoises are fed on a raised platform with bollards at the front of the concrete slab. Here they were unable to reach the target pole, but it remained in view of all four tortoises. Eventually, small piles of food were placed around their exhibit at every feeding and each tortoise could eat alone, away from the others. The keeper placed the target next to the food pile while each tortoise ate. This was done at every scheduled feeding (three times per week). The keeper used Tactile Reinforcement, or any reward perceptible by touch, (Hurley, 1999) to reinforce the tortoises. Since our Aldabras greatly enjoy being touched or rubbed, the target stick was placed on the ground in full view of them when the keeper was scratching their carapaces, legs, or necks. Using tactile reinforcement while the Aldabras viewed the target pole helped enormously. After a few weeks, all four tortoises allowed the keeper to hold the target pole directly in front of them without retreating or becoming withdrawn. Now, the keeper needed the tortoises to associate the target pole with a positive reward.

Targeting - Simple, Complex and Follow targeting

Initially, the keeper focused only on the males, “Feldspar” and “Magma”. The males were less likely to retreat from their keeper due to being more aggressive with food and sometimes more curious about new objects. “Magma”, the oldest, calmest and most relaxed tortoise, was the first one to begin training. Learning “simple targeting” was the first step. Simple targeting is the act of presenting the target anywhere in the vicinity of the animal’s head and the animal should move to touch the target (Hurley, 1999). The target pole was presented in close proximity to Magma’s head. There was not a significant response from the tortoise. The keeper soon realized that asking the tortoise to actually touch his head or rostrum to the target this early in training was much more than what could be expected of the Aldabra. Small or simple steps are more effective (Ramirez, 1999). The keeper realized she needed to take a few steps back for the tortoise to grasp the concept. The target was presented again. When Magma even faintly responded to the target pole; a glance in the direction of the keeper or a shift in his body weight in the target’s direction, he was rewarded with his favorite food. For Magma, it was sweet potatoes. The food was held directly in front of the tortoise’s face, in the keeper’s hand. The tortoise was allowed to bite the food and while he chewed or swallowed, the target stick was removed from view. Once he had finished eating the bite of food the target was again placed directly in view of the tortoise while the food was removed from the tortoise’s view. If the tortoise responded to the target in any way, he was rewarded with his favorite food again. This process continued for approximately 10-15 minutes daily.

After the males began to grasp the concept, the keeper repeated these steps with the female tortoises. When the target stick was offered to them it was not always possible to instantly reinforce them for touching or coming toward the target pole. A “bridge” or signal was used to alert the tortoises that he or she behaved correctly. This is a secondary reinforcer that bridges the gap between the completion of the behavior and the delivery of the primary reinforcer (food) (Ramirez, 1999). This “bridge signal” is a secondary (or conditioned) reinforcer that communicated to the tortoises at the precise moment at which they performed the correct behavior and that they would receive further reinforcement, food (Ramirez, 1999). Two “bridges” were used. One bridge was saying, “Good!” at the moment the tortoise looked at the target, moved in the direction of the target pole, or touched the target pole. The second bridge was tactile. A light touch was given to the tortoise when he or she responded correctly to the target pole. This tactile bridge was not as effective as the verbal bridge, especially in the beginning. When the keeper would even lightly touch the tortoise, he or she would extend their neck as far as possible and stand motionless for several seconds and sometimes for several minutes. This behavior was an obstacle in the training process. It delayed the timing between the completion of the behavior and the delivery of the primary reinforcer (food). All four tortoises behaved this way because of their natural biology. Giant

tortoises in the wild will often have external parasites such as ticks. The island birds will pick at the giant tortoises' necks, legs and feet to consume the parasites (Swingland, 1989). When the birds begin pecking at their skin, the tortoises will stand fully erect, with their necks and legs extended while the birds clean their skin of any parasites. Extending their necks and standing fully erect while being rubbed by their keeper mimics this natural behavior (Putnam, 2005). Patience played a tremendous role during this training. Eventually, by simply touching the target pole to the tortoises' head or rostrum, then bridging and reinforcing, the tortoise quickly became conditioned to initiate the touching (targeting) on his own. The keeper repeated the same steps for several minutes. The simple targeting sessions lasted for five to ten minutes and training sessions occurred only once a day. The keeper always ended the session on a positive note by allowing the tortoise to be successful at the last step.

As Magma became more comfortable moving in all directions; left, right and forward of the target pole, distance between the target and his head was increased. Magma was clearly the fastest at learning to associate the target stick with food. He mastered simple targeting within almost one week. After Magma had learned simple targeting, the keeper increased the difficulty. Complex targeting was the next concept Magma needed to learn. Complex targeting is teaching an animal to touch a target relatively high over its head. This is often more difficult because the animal must exert more energy to lift its head up to touch the target (Ramirez, 1999). This concept was tested while trying to get the older tortoise out of the moat one day. "Magma" had no trouble with mastering this concept as well. He quickly learned how to target while in the water, and then exit the water when asked to target to the stick. The next step was to get Magma to learn to follow the target. "Follow target" was the third targeting step. The purpose of this is to get the animal to follow the target wherever you take it (Hurley, 1999). This would eventually replace tapping on their carapaces with objects or pushing and shoving them to get them to move. A simple concept in theory, but this proved to be more of a challenge once Magma was on land.

Magma was more than willing to target to the stick at any direction or area in the exhibit, but when the keeper would come close to the Aldabras' night house doors, Magma would immediately stop and sit about five feet from the doorway. This behavior probably occurred because of being forced on- and off-exhibit over the years. Magma had learned to associate going into the night house with being locked in until the next day. Everyday this continued until the keeper decided to target Magma to the doorway, let him relax, then bait the ground up to the doorway with some of his favorite foods. "Baiting" is a form of bribery. It is offering a visual of the reinforcement to encourage an animal to perform a behavior (Martin, 2004). The keeper found that Magma was much smarter than she had given him credit for. Once Magma had eaten the last piece of food in the doorway, he still would not enter the barn. He would begin to back up and walk out into the exhibit. The keeper decided to bait the route to the doorway, then leave a large pile of food or browse inside the night house. This large pile of food is often referred to as a "jackpot". A jackpot is food or any other item that is a reward much bigger than the normal reinforcement and one that comes as a surprise to the subject. A jackpot may be used to mark a sudden breakthrough in desired behavior (Pryor, 1985). The jackpot in this instance was a food pile placed inside the barn directly ahead of the tortoise. While Magma ate the individual pieces of food in the doorway, he eventually noticed the large pile of food inside the barn. The tortoise came inside to eat the jackpot once he noticed it, but he was still determined to not get locked inside. He would manage to position himself inside the barn with enough of his rear in the doorway so the keeper could not shut the doors. He clearly knew what he was doing. After he finished the food pile, he would again back up and exit the barn. Trying to force a 500lb. tortoise in the opposite direction that he wants to go is next to impossible. This is when the keeper realized that locking the tortoise inside after he entered the night house proved to aggravate him. She learned that she could not lock him inside after he came in to eat his food reward. The keeper realized that entering and remaining in the night house needed to be a positive experience for him, or he was not going to cooperate. The tortoise needed to associate not only being inside the night house but remaining there as a positive experience. Allowing Magma to enter and exit the barn freely at will proved to be the answer. He must want to go in and stay on his own accord if this was going to work.

The keeper repeated the same steps as before but instead of trying to close the doors while he was inside she left them open for him to come and go freely. When he came through the doorway and stepped inside he was rewarded with much tactile and food reinforcement. As Magma eventually realized that entering the barn resulted in these rewards plus not being locked inside, he was soon willing to enter the doorway of the barn, go inside and remain inside on his own accord.

Out of the four tortoises, the oldest male, Magma, was the most adept at learning. He associated the target with food within almost a week. It was clear to the keeper that Magma understood that the target was not actually food. He was the only tortoise to realize this. He would target his nose to target pole then relax and passively wait for his reward. This was amazing to discover that an Aldabra tortoise could distinguish the food reward from the actual target stick.

“Feldspar” was the next tortoise to be trained. He is the younger and more easily agitated of the adult males. He was extremely wary of staff, new objects & new situations. Despite this, Feldspar learned the target-reward concept within three weeks. Although the two males learned quickly, it was evident that the females were going to take much longer to train.

Both females were especially timid around people and avoided keepers when possible. Patience played a major role with the females. The female Aldabras’ concentration was much shorter than the males. “Xaviera”, the smaller and more timid female, took the longest to associate the target pole with food. She often became easily distracted, emotionally disengaged during almost every training session and would stand motionless with the target in her face. Often she would merely walk around the target and keeper as if they were not even there.

“Obsidian” was the slightly larger, more confident of the two females. The keeper noticed one important factor that helped during training. At every feeding, Obsidian always went for the apples first. “Xaviera” always headed straight for the tomatoes. After the females were desensitized to the target pole, but still not associating it with a primary reinforcement, the keeper had an idea. The target was painted red. Both females appeared to show a greater interest in the target after it was painted, but they were not grasping the concept of the target and its reward. Obsidian learned to associate the target with food within a couple of days after it was painted red. Xaviera took significantly longer. With Xaviera, there was often a “Delay of Reinforcement”. This is an interval between a behavior and the delivery of the reinforcement (Hurley, 1999). During target training the keeper had to learn to not reinforce her with tactile in any manner, because she enjoyed it so that she would remain motionless for several minutes. Although it actually took Xaviera several months to master the concept of target & reward she never forgot what the target pole represented. She responded to the target every time it was offered to her, even if it was not immediately. It could take her several seconds and sometimes minutes to focus on the target, but when she recognized the cue, she focused on nothing else. “Obsidian” was also quite timid around the keepers, but over time she began to learn that she could trust the keeper and that she would only be rewarded with positive responses (tactile or food) when she approached (or was approached by) the keeper. Obsidian had a greater learning curve and responded to the target pole much more quickly than Xaviera. Once trust was established she quickly learned that coming to the target stick was very rewarding. Both females often enjoyed the tactile reinforcement more than the food reinforcement.

There was one important aspect that was learned by the keeper within the first week of training. The Aldabras were so food-motivated that if they were not hungry for browse or salad, they were unwilling to respond to the keeper or target stick. The Aldabras’ diet needed to be adjusted. In the summer months when training was occurring, the Aldabras were fed three times a week. The diets were reduced on the scheduled feeding days. The food subtracted from the diets was used as reinforcement during training

sessions. This was very helpful. Feeding smaller quantities and scheduled feedings enabled the keeper to maintain the animals' motivation without reducing their overall diet.

Prior Methods of Performing the Aldabras' Physicals

Successfully training all four tortoises to target on command was an accomplishment that enabled the keepers to more effectively manage the animals on- and off-exhibit. There were, however, other measures that could use either significant improvement or a completely new solution. The medical procedures performed on the Aldabra tortoises were very rudimentary. When it was time to perform the Aldabras' annual physicals it became an ordeal, to say the least. The measures taken to draw blood and perform physical examinations on our Aldabras were often unsuccessful through the crude, forceful means. The methods of drawing blood for their yearly examinations were labor intensive, time consuming and resulted in distressing the animals.

To examine the tortoises' plastrons, they were flipped onto their backs for several minutes while the staff carefully inspected their shells for any infections or damage. Although the tortoises were not kept on their backs for an extended period, the entire ordeal left the Aldabras stressed, withdrawn and apprehensive of the keepers again. All of the desensitizing and trust that had been built during the prior months of training were hindered immensely after their physicals were performed. There had to be another way to effectively and quickly perform the Aldabras' physicals without regressing the training.

Voluntary Blood - Its Value and Implications

Collecting blood from a reptile must be done under very exact measures and conditions if one desires a sanitary and more accurate reading of their blood levels. Yes, it is true that one can easily wrestle an animal to the ground and forcibly obtain blood or fluids, but there are straightforward, more predictable, safer and less time-consuming methods. Forcibly collecting blood or fluids from a reptile can result in injury to the animal or veterinary staff; unnecessary stress to both parties involved, and can result in inaccurate or skewed blood results.

A reptile that is calm and relaxed during an examination and blood extraction will not only be an advantage to staff and their safety, but also will reflect more accurate reading of the animal's blood chemistry levels. When a reptile is under a great deal of stress, the flow of blood slows significantly. This often results in the inability of the veterinary staff to extract blood. If the staff is actually able to extract blood under very forceful means, there is often contamination of the blood sample. In this instance, we initially used the method of a caudal stick. We inserted the needle in or toward the hind part of the body, specifically, the tail. Often there was contamination of feces and soil in the blood sample, due to the Aldabras defecation under stressful conditions and their tail being adjacent to the ground.

Contamination of the sample was not the only problem. Producing the tail for the veterinary staff to locate the vein was extremely difficult and it took several strong staff to pull the tortoise's tail out from under its plastron (lower shell). Aldabras have very strong tail muscles and due to the awkward angle, it was extremely difficult to grasp their tails long enough for the veterinary staff to stick the tail and attempt to draw blood. The majority of the attempts were unsuccessful or we could only grasp the tail for a few seconds. Keeping a 500-pound tortoise stationary during this procedure was next to impossible. Several staff needed to stand in front of the tortoise pushing on him with all of their weight, and often this was not effective. Unintentionally during one attempt, our oldest male, Magma, received a scratched cornea which became infected and required medical attention for several weeks. After the ordeal, all four tortoises relapsed to their behavior prior to the training. All reverted to their naturally apprehensive state.

Voluntary Blood - How it is Accomplished

When initially starting the training program Audubon Zoo housed 2.2 Aldabra tortoises. One of the adult females, "Obsidian" did not survive to the completion of the voluntary blood training program. She died

prematurely due to unrelated medical complications. However, before her death Obsidian was successfully target trained and had become greatly desensitized to most of the keepers' presence. It took a great deal of patience with all four Aldabras to achieve this end.

Finding a method to extract blood from an adult Aldabra tortoise without a setback to all of the training and desensitizing proved to be easier than expected. "Xaviera", the female Aldabra, was the key. The decision was made to begin with her. The keeper decided to take advantage of Xaviera's inherent behavior. This is the same behavior that tested the keeper's patience during target training: standing motionless and unresponsive for minutes after touching her. Xaviera enjoys any type of touching and rubbing any place on her skin and carapace. Every time she was slowly approached and touched on her neck, she would stand on the tips of her rear feet and extend her neck completely. This would often continue for several minutes, even if the staff were no longer touching or standing next to her. Taking advantage of this was the key. Since she was now willing to hold a position that enabled blood to be drawn from her neck, desensitizing her to a needle prick was the next obstacle. This was amazingly easy. The object used to mimic the needle was a large paper clip. When uncoiled completely the flat end of the paper clip was firmly pressed into her neck in various places. While Xaviera stood with her neck fully extended the keeper would scratch and rub along her neck while pressing the paper clip with moderate pressure into her neck. Soon the scratching and rubbing was reduced to using only the paper clip pressure. This technique continued for roughly two weeks with daily sessions lasting five minutes. The next step was more aggressive. First the keeper would gently pinch the skin along her neck while rubbing or scratching her in the usual manner. After about a week the gentle pinch became more firm, then elevated to a sharper pinch and twisting of the skin. Soon the keeper was surprised to realize that even without rubbing her while using the paper clip and pinching her neck, she did not react negatively. She appeared content with the pressure. Once the keeper felt that Xaviera could hold the position long enough the veterinarian was included.

The first attempt to draw blood was organized in the Aldabra exhibit. As before, Xaviera extended her neck after receiving tactile stimulation. Several attempts were made to locate the jugular vein. This can be difficult, depending on the individual tortoise. Sometimes the jugular vein is positioned to the left of the neck. Some are located on the right. We found that it is helpful to locate the vein during training sessions, before the procedure begins. It should also be noted that unsuccessful blood draws were helpful, because this was still a form of training. After the vein was located an alcohol swab was used to clean the site. The veterinarian then inserted the needle through the skin. The tortoise did not flinch or withdraw into her shell, even when reinserting the needle again and again to find the best position. Within minutes we had successfully drawn blood from our female Aldabra tortoise on the first endeavor. Although we were successful at the first attempt, there was one important factor that needed to be adjusted.

Although Xaviera could hold the position while the needle was inserted and blood was being drawn, she would flinch if an object or person came into her peripheral view or directly in front of her. This is a natural behavior of the Aldabra tortoise. Fleeing or hiding is their only defense in the wild. Their primary form of defense is to pull their head into their shells. Xaviera's inherent behavior needed to be desensitized to any movement during the medical procedure. For many weeks, the keeper would continue to desensitize her to any movements around her head. While her neck was extended, the keeper would slowly rub closer to her head, then cover her eyes & face with her hands. Initially Xaviera flinched considerably. After several weeks of the desensitizing Xaviera eventually became more confident and less skittish when people came near her head. The keeper also realized that this desensitizing needed to be continuous and that it needed to occur with all staff working with her on a regular basis. The tortoise would regress if daily interactions were not met. After many months of this individual training she was more secure and less anxious around new and familiar staff.

Now, over two years later, Xaviera is conditioned to most movements around her. She has not regressed to her previous timid responses. Her confidence has increased dramatically. Staff can now approach her from any direction and near her head without startling her. We are now able to move her out of the Aldabra exhibit and to the Animal Health Care Center on zoo grounds. There she has blood drawn, and receives radiographs and an ultrasound to check for eggs.

While the training of Xaviera was progressing, our other female Aldabra, "Obsidian", passed away. She would have been trained next, but "Feldspar" the younger male, was chosen next due to his stubborn, virulent demeanor. This was going to be a challenge.

"Feldspar" was similar to Xaviera and also needed more desensitizing to peripheral movements. Feldspar was not desensitized to the number of people that were present at the time of his first voluntary blood procedure. For instance, if the vet was attempting to insert the needle into his neck and a staff member walked in front or near him, he would quickly hiss and withdraw into his shell. This resulted in bent needles, punctured veins, and negative results. It was evident that we needed to step back a bit and work with Feldspar more intimately, focusing on his head. For one month the keeper had Feldspar position and fully extend his neck while a second or third staff member would rub and scratch his favorite spots: neck, inner legs, and carapace. While Feldspar was focused and enjoying the attention from the other keepers, his trainer would slowly place her hand near Feldspar's face. He would initially flinch, but a deliberate effort was made by the staff to not move away or stop. Slow movements were helpful to build his trust. Soon Feldspar let his keeper rub his entire head without flinching and cover his eyes completely. More individual daily attention strengthened his trust of staff. Once he learned that he was unthreatened, he was willing to let his primary keeper approach as close as she needed to without withdrawing into his shell. Soon the veterinarian and hospital staff were able to stand directly in front of him while medical procedures were performed. We were then able to draw blood from Feldspar without incident.

After Feldspar reached the keeper's goal we repeated the same procedures with "Magma", the oldest of the Aldabras. The keeper chose to train Magma last due to his extraordinary calm, relaxed disposition. Drawing blood from his neck was almost effortless. Again, on the first attempt we were successful.

Conclusions

Training is not just a tool useful for bringing the herd of tortoises inside on cool nights. Training also strengthens the bond between the keeper and the individual animal. A level of trust is built over time and the overall stress levels of the tortoises and staff is greatly reduced. Daily sessions with the tortoises have now given us a greater awareness of any behavior or diet changes they may have. As reptiles commonly hide signs of illness, careful observation when working closely with them can prevent health concerns

Staff and animals are not the only ones to benefit from the training sessions. Visitors benefit from these training sessions as well. While a staff member is working with the tortoises on exhibit, the public can view the work. This is a great opportunity to perform an impromptu chat and educate the public about the animals and the advances zoos are making. Visitors at Audubon Zoo have responded positively to this.

Individual training sessions performed daily were vital to the success of each tortoise. Only 5-10 minutes of training and desensitizing was necessary. The keeper discovered that if this is not completed daily they will regress to their more naturally apprehensive state. The keeper also discovered that any staff involved (in any manner) with the animals on a weekly or daily basis must be willing to participate in the training. This is a crucial factor if the training program is to succeed. Adding new individuals with very different styles of managing these animals can set the progress back enormously. There must be consistency in every component of training if it is to become a success.

There are many noteworthy concepts that were elements for a successful training program with Audubon Zoo's Aldabra tortoises. It began with extensive research about this particular tortoise species. Learning their natural history, anatomy, and physiology were essential pieces of information. Knowing the specific history of each animal was incredibly valuable as well. Discovering their individual temperaments was a crucial factor when determining how to formulate and evaluate each tortoise's training session. Finding each individual's reinforcer was also a key factor. Allowing each of the animals to develop trust with the primary keeper was a vital component. Tremendous amounts of patience, always ending sessions on a positive note, and not being afraid to take a few steps back were all crucial factors that gave way to advances in the medical and behavioral advancements of these magnificent, intelligent, gentle creatures.

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