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Day 1



Wednesday 1st November

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 - Joe Parsons- Aussie Dog

**Starting a training program for Sun Bear (*Helarctos malaynus*) at
Perth Zoo: Incorporating animal management, medical
management and behavioural enrichment.**

**Karen Rotherham
Perth Zoo.**

Abstract

We will soon be receiving two sun bears from Cambodia, I.I. A new purpose built exhibit is under construction and will be completed in a few months. To help manage the bears, a behavioural enrichment program including training needs to be implemented. We have found in the past that training sessions with the bears have provided a valuable husbandry and medical management tool, and has been enriching for the bear. In the new exhibit we will have the option to train the bears on display and we would like to expand the previous program to include more behavioural stimulation while they are on exhibit. The method we will use is operant conditioning, positive reinforcement - protected contact training. While training shouldn't be the only form of enrichment, it certainly can be an integral part of any enrichment program.

Introduction

Perth Zoo is anticipating the arrival of a pair of sun bears from Cambodia. A new purpose built exhibit is under construction and will be completed in November 2006. To help manage the bears, a behavioural enrichment program including training will be implemented. We have found in the past that training sessions with the bears have provided a valuable husbandry and medical management tool, and has been enriching for the bears. In the new exhibit we will have the option to train the bears on display and we would like to expand the previous program to include more behavioural stimulation while they are on exhibit. The method used will be positive reinforcement, protected contact training. While training shouldn't be the only form of enrichment, it certainly can be an integral part of any enrichment program.

Natural history

The sun bear is the least know of the bears of the world. This species formerly inhabited the lowland forests of Southeast Asia from India eastwards into Indochina through Burma, southern China, Laos, Vietnam, Thailand, Malaysia and Indonesia. The range of this species is not well known, especially on the periphery of its eastern range (Servheen, 1999). The extent of this forest has been drastically reduced due to human encroachment for agriculture, forestry and settlements. This has resulted in the assumed reduction in numbers and range for sun bears and other species (Servheen, 1999).

Behaviour

Sun bears have excellent sight and hearing but their sense of smell is even more developed. Like most bears they are very food motivated.

There is not a great deal of information about wild social systems, but sun bears tend to be solitary or sometimes two or three individuals together, probably a family group.

Wrestling play, resting together & copulation are courtship/ compatible behaviours. Roaring, barking, chasing and fighting with purpose are aggressive behaviours. They are

alert and attentive when calm. A fearful bear will be jumpy and nervous, and have poor concentration. An aggressive bear will bark and swipe. Signs of stress may be a humming vocalisation or pacing.

Diet

The diet for sun bears at Perth Zoo has been made up of fruit, vegetables and protein (dog kibble). (Appendix 1) We use insects (mealworms, crickets, and termites) and browse as activity feeds. The daily diet is divided up into several feeds given throughout the day. Some food will be fed in the dens and the rest scattered and or hidden in the enclosure and used in enrichment. The food treats for training will be a part of the diet. Food treats used for training the sun bears consists of fruit cut in approx 1 – 2cm squares and dried fig and raisins. We also use (in a 20ml syringe) weak diet cordial, jam mixed with water or evaporated milk. We did not use honey as a training treat as this has caused too much excitement and the animals would lose focus. We have used it as smears in the exhibit and for oral drug treatments.

A study on the food habits of wild sun bears in Borneo has shown that invertebrates such as termites, beetles and beetle larvae were the predominant food items, occurring in 57% of scat samples. Figs were the most common fruit consumed (61% of the scat samples) during the non mast fruiting season. Sun bears are opportunistic omnivores consuming a wide variety of food items (Wong, Servheen & Ambu,2002).

Medical Conditions

There is not enough information about the animals we are to receive to know if they have any species specific medical problems. In the past we have had problems with dry cracked pads on their paws, we were able to treat this daily with a topical cream. There may be problems caused by excessive exposure to UV-B. The damage is possibly more likely in colder climates where the animals may bask in the sun to warm up. The UV-B radiation is an important factor in the induction of cataracts and skin cancers. Providing shaded exhibits and warm sheltered resting places should help to prevent these problems from occurring. Captive bears have a predisposition to become over weight due to energy dense fruit and veg. Wild fruits and other vegetable matter have a much higher fibre content and lower energy value. Scales will be set up in a raceway in the dens to monitor their weight. We hope to be able to train all the behaviours that we have had in the past. The female may have a skin condition that will need medical management, so we will want to be able to examine her whole body and possibly apply topical medications.

Past training program at Perth Zoo

Previously Perth Zoo has held three Malayan Sun Bears. One male and two females came to Perth Zoo in 1998 from Cambodia, assisted by 'Free the Bears Fund Inc'.

It was understood from the beginning that the management of these animals would be greatly enhanced with the use of an operant conditioning program. The initial aims of the program were:

- To assist the keepers in husbandry management of the bears,
- To have the ability to perform basic non invasive health checks.

At the time Perth Zoo did not have a specialist animal trainer and expert advice was obtained from staff at Underwater World (now AQWA). This provided training for the trainers and a basic assessment of the challenges each bear presented.

The method of approach, communication channels, report and record system were set up prior to commencement of training. Some of the assessed problems were;

- The bears were reluctant to enter the dens together, either through nervousness or aggression. This was time consuming and prevented or delayed servicing of the exhibit and provision of enrichment activities. One of the bears had a cardiovascular medical condition that needed to be monitored.
- Aggression between the bears, and from one, towards the keepers, needed to be modified.

With positive reinforcement training the first behaviours were achieved within six months of the bears' arrival. The commands used a combination of verbal and hand cues.

- Recall, to have all bears enter the dens when called.
- Target, to be able to station and move the animal
- Mouth open, to perform an oral examination
- Chest presentation, to enable the monitoring of any heart/lung issues



A modified dog whistle was used as the 'bridge', and food treats and verbal praise were the rewards. Training sessions were carried out in off exhibit areas. (For more information on the initial program see, Broughton & Rouffignac,1998) The behaviours trained were mainly aimed at medical management and the program was in place while we held the bears at Perth Zoo. (Appendix 2) The ability to be able to recall the bears into the dens so that enrichment could be placed in the exhibit several times a day was a major factor in reducing stereotypic behavior and aggression. (Appendix 3) The bears participated in their training sessions almost 100% of the time.

The new bears

The bears identified for transfer to Perth Zoo from Free the Bears sanctuary in Cambodia are;

Male: Jamran. est DOB 2000. Arrived at Phnom Tamao Wildlife Rescue Centre on 28th August 2001. Microchip (AVID) 123672137A. 57.6 kg April 06. Unable to be housed with other males, he became very defensive, attacking others which caused them to attack him.

Female: Bopha. est DOB November 2002. Arrived at Phnom Tamao Wildlife Rescue Centre on 19th December 2002. Microchip (AVID) 113814734A. 42.3kg 22/5/06. Outer claw missing on hind left paw. Possible nervous hair loss condition, two week course of valium in March 2006.

The two bears will be accompanied by a bear keeper from the rescue centre who will be able to brief us on the bears' personalities.

Exhibit

The purpose built exhibit at Perth Zoo is divided in two areas connected via slides, each side is approximately 480msq. Each exhibit has three natural trees (dead) for climbing and resting (these will be replaced every 2-3 years, as needed), a heated shelter, large rocks and logs. A stream will run through both exhibits, with a deeper pool in each side. There will be five mature trees (10 – 15m) transplanted into the area to provide shade. The live trees in the exhibit will have to be protected with electric wire to stop the bears damaging them.

For the majority of the time we hope that the bears will be housed together with access to both sides of the exhibit. If the bears are not initially compatible, or when the female has a young cub the male can be separated into the other exhibit. There is a separate soundproof birthing den which is designed to allow the female as much privacy and quiet as possible. The animal raceway is at the back of the dens so that the bears do not have to move in close proximity to the keepers to enter the dens.

There will be the opportunity to train the bears on display in an area between the exhibits near the public viewing bay. Initially they will be trained in the night dens, separated from each other.

Proposed new training program

The new program will aim to train the behaviours from the previous successful program. It was found that the behaviours were very useful for the medical management of the bears. We also want the bears to be as comfortable and interactive with their new environment as possible. To achieve this, a combination of training, conditioning and enrichment activities are planned.

Daily management

The new arrivals will be unrelated to the remainder of the regions' animals and it is expected they will be recommended to breed as a part of the regional breeding program. Having them comfortable and relaxed in their environment will be a priority. First we will need to teach the bears recall so that they will happily come into the night dens when we called. This recall behaviour is vital to be able to manage the animals effectively. The bears will have access to their dens and exhibits during the night. They will be locked into their dens early in the day so that the exhibits can be serviced, and a few times during the day so that enrichment can be placed about. Alternatively we can shut them across to one side of the enclosure and place enrichment in the vacant side. Training will initially begin where the bears are most comfortable, hopefully in the night dens. Having the bears moving through the dens as we need them to will be the second goal.

Training tools

The specific equipment needed for training will be: bridging whistle, scales, ear/eye scope, stethoscope, clippers, tooth brush, other dental tools, thermometer, external ultrasound, needle/syringe, station tags and a laser light for remote stationing. The training will be protected contact only. All the mesh areas in the night dens will be suitable for training, so we will be able to use any of the dens. Any medical treatments will be carried out in the dens. There will be an area near the viewing bay that will also be set up for training.

Training area

The initial sessions are planned for the dens, but it will depend on where the individuals are most comfortable to start with. We will need to separate the bears for training, and will need to occupy the bear not being trained. We may train the bears at the same time so they are both occupied, but they will need to be out of visual and sound range so they do not become confused with cues and bridges for the other animal. In the den area we will be able to move the bears around and past each other. The exhibits can easily be divided to separate the bears. In the dens there will be resting benches, we have found that these can be useful to get the bear up off the ground and at an easier level to work with. I would like to use station training to move the bears around the exhibit during a training session. An example of this would be to station the bear to the top of a climbing structure. This would demonstrate their climbing skills, let the bear be rewarded for using the structure and improve their fitness.

Trainers

The primary bear keepers will initially be the trainers, and a vet nurse to help with the quarantine period and as a continuing contact for the veterinary department (as time

allows). Two people will be involved per session so that we can keep the commands the same, (we can each see what the other is doing). We have three keepers who have trained bears previously and several on the section that train other animals and understand the principals of operant conditioning. When and how often the sessions take place will in some degree depend on the bears. As we learn their personalities and individual behaviours we will also learn their tolerances. We hope to initially have at least two training sessions a day. The sessions will be approximately 10 mins, but again it depends on the individual and their concentration span. The initial trainers will be the previous primary sun bear trainers. New trainers will be integrated into the program only when the bears have become confident in some behaviours. The new trainers will initially only train to maintain these learned behaviours. As their skill in training the individual progresses they will be able to start to shape new behaviours. Occasional assistance will be needed from the veterinary team. If we have the female bear comfortable with having an external ultrasound procedure this will help considerably with managing the breeding program.

Starting Training

To start an inexperienced animal in training you first need to build trust. The animal is introduced to a primary trainer; the animal is left to initiate the session and rewarded when it approaches the trainer. You need to identify the reinforcement preferences for each bear, the high and low food preferences, and identify secondary reinforcers (toys, play, scratches etc).

- The bears need to learn the bridge reward association.
- First bridge as food enters the animal's mouth.
- Second, bridge and then give food.

The trainer can then bridge the animal when they are doing something else, i.e. looking away from the trainer, to determine if the animal recognises that the bridge means a food reward.

Basic training such as recall into and out of the den area, and targeting can then start. We have used a closed hand as the target for sun bears. When the bear places his nose to the closed hand he is bridged and rewarded. This can then be used to move the bear around and position them to be able to shape new behaviours.

One trainer will train one behaviour. For example, after the initial target training, one trainer may start training for 'mouth open'. That means only that trainer will train the mouth open behaviour. When the bear is confident and fixed with the behaviour then another trainer can take over and maintain that behaviour. This is to stop confusion for the bear in the shaping process as different trainers may do things slightly differently.

The animals also need to be desensitized to changes in their environment, observers, noise, and changes in routine. It is important to reward the animal only when it is showing calm, relaxed behaviour and only when it is focused on the trainer, not on the distraction.

(Appendices 4 – 7 cover training information and forms.)

Conclusions

We have found in the past that a training program for sun bears has been of great help in the management of the animals. The bears have been keen to take part in the sessions and

it has been easy to deal with minor medical treatments. The ability to have the bears come into their den area at any time of the day allows placement of food and enrichment in the exhibit several times a day. We believe that putting in place a similar training program for the new bears coming to Perth Zoo will be an integral part of their enrichment program, enhanced by the newly built sun bear exhibit. The training will be tailored to the individual animal, at each animals learning pace.

References

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- Servheen, C, 1999. Sun Bear Conservation Action Plan. Chapter 11, pg 219 – 224. *Bears; The Status Survey and Conservation Action Plan*. IUCN/SSC Bear & Polar Bear Specialist Groups. IUCN Gland, Switzerland & Cambridge, UK.
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Photographs; by K Rotherham

Contacts

AQWA- www.aqwa.com.au

‘Free the Bears Fund Inc’ - www.freethebears.org.au

Perth Zoo- www.perthzoo.wa.gov.au

Appendices

1. Perth Zoo Diet, Sun Bear (past)
2. Training Program Analysis (past program)
3. Approved Enrichment, Sun Bear (past)
4. A Frame Work for Training
5. Training Planning Form
6. Daily Training Records
7. Operant Conditioning Terms

Appendix 1.

Official Perth Zoo diet sheet (archived old diet)

Order: Carnivora, **Family:** Ursidae, **Species:** *Helarctos Malayanus*, **Common name:** Malayan Sun Bear.

Species diet

1.0 Introduction

One Male bear is housed at Perth Zoo; suitable enclosure, which contains climbing frames and woodchip substrate. The bear is Sean D.O.B. 30.7.96.

2.0 Diet in the wild

Sun Bears are omnivorous, eating tree fruits, succulent growing tips of palm trees, termites, small mammals and birds, and can cause significant damage in cocoa and coconut plantations.

3.0 Diet in captivity

Their diet mainly consists of various types of fruits along with kibble. These fruits consist of apples, pears, carrots, tomatoes, oranges, bananas, sweet potato, cooked potatoes and various types of melon eg rock melon, honey dew melon.

Three times a week, the P.M kibble is withheld and meat is provided instead. (See 3.3 Variations)

Various species of browse (Banana leaves, palms, mulberry, calipha, caprosma, fichus, willow and sugar cane) is placed around the exhibit for the bears to play with.

Logs and branches is another effective form of enrichment.

3.1 Presentation

The Fruit and Kibble portions of each feed can either be fed at the same time or fed separately with at least 30 minutes between them. A small part of the A.M. feed is fed to him in the yard of the night quarter area when the enclosure is being serviced and the rest of the feed is scattered around the enclosure. The other feeds can either be thrown into the enclosure from the viewing bay and the meshed area behind the enclosure 10 (opposite the Otters) or he can be brought into the N/Qs, given a small reward and the rest scattered through out the enclosure. The logs in the enclosure can be stacked into piles, with some of the food being placed amongst them to encourage foraging techniques. Diluted honey and jam is used as a treat for the bear. This is painted onto the climbing frames in the exhibit to stimulate the bears for a period of time. Browse is placed in the exhibit in the morning and also at times throughout the day for behavioural enrichment.

3.2 Feeding program – Total feed for 1 bear

Daily Recommended Diet	
8.30am 4.25pm	12.30am
A.M. P.M.	MIDDAY
(chopped into pieces of various sizes) (As for A.M.)	(As for A.M.)
1 x apple or pear 1 x apple or pear	1 x apple or pear
1 x sweet potato or carrot 1 x sweet potato or carrot	1 x sweet potato or carrot
1 x orange or tomato 1 x orange, or tomato	1 x orange or tomato
1 x banana x banana	1 x banana 1

Scattered in exhibit Scattered	Scattered
345gm Eukanuba light 345gm Eukanuba light	250gm Eukanuba light
Scattered in exhibit Scattered	Scattered

A.M. Activity Feeds

Fodder – Banana leaves palms, mulberry, calipha, coprosma, ficus, willow and sugarcane.

PM Activity Feeds

Fodder (one type/day)– Banana leaves, palms, mulberry, calipha, caprosma, fichus, willow and sugar cane .

Termite mound is placed in the wood chip to encourage foraging when available, also mealworms and crickets.

Dilute honey or jam, semolina and condensed milk are applied liberally to pine cones, walls, branches and at the edges of the pool, three or four times per week. (Dilution rate = 2Tbspns in 1.5Lt hot water)

Toys (Bamboo and box style) are also offered (as a variation in activity feeding) with various treats inside such as mealworms, puffed wheat, rice bubbles or large parrot mix.

Due to the bears putting on weight, very little feed (other than the diet) is thrown in. Mainly logs, Banana plants or other fodder is put in as enrichment not feeding.

On an **irregular basis** you can offer, 1 ice blocks (diluted blood or Diet cordial) or 1 half frozen rock melon or honey dew melon or 100 grams of raisins or mixed nuts (walnuts, peanuts shelled and unshelled) [No more than twice in a 7 day shift] or mealworms.

Other: Fresh water is available at all times.

3.2.1 Supplements

3.3 Variations

Some of the fruits that are mentioned above in the diet are only fed in at certain times of the year due to seasonal availability.

The ice blocks are used as an activity feed in (and enjoyed more so during) the summer months.

Three times a week, the afternoon kibble is withheld and meat is provided instead.

For one bear;

Tue: Kibble is replaced with 3 day old chicks or mice (dusted with vitamin powder).

Thurs: Kibble is replaced with 300g of chicken pieces or 3 day old chicks.

Sun: Kibble is replaced with 1 herring and 2 hard-boiled eggs.

Present Sun Bear, Sean, will not eat mice or fish. So offer him day old chicks on Tues, chicken on Thurs and eggs + 95 g Eukanuba light kibble on Sundays.

As a trial for one Month from 25 / 10 / 02 until the 25 / 11 / 02 his kibble feed will be made up of Eukanuba Light only, ie. 345gm for Am and Pm feeds and 250gm for midday feed.

3.4 Nutritional analysis

4.0 Comments

A small amount, equivalent to one large apple, of fruit is used during training. Fruit is chosen from apple, pear, melon, fig, raisins, and fruit bread. Also 3, 20ml syringes filled with dilute honey, diet cordial, condensed milk, jam or yogurt is used, (dilution rate as above). This is in addition to the diet. If quantities increase, this should be taken into account in the whole diet.

5.0 References

The Encyclopedia of Mammals. David Macdonald, Vol. 1

Compiled By Rob Herkes

Reviewed by Anthony Beach 30 March 2000

Reviewed by Cree Monaghan and Trueman Faulkner 12/06/00

Updated by Chris Jones 20 / 12 / 02

Appendix 2.

Training Program Analysis (Perth Zoo, 20/01/03)

Species	Malayan Sun Bear (<i>Helarctos malyanus</i>) 1.0
Number of Trainers Involved	One keeper per training session. Four trainers are available, KC, KS, CJ & KR.
Frequency of Training Sessions	Minimum of five sessions a week, every day if possible.
Length of Training Sessions	Up to 10 minutes.
Behaviours Currently Known	TARGET – allows us to move the bear around the training area. UP/DOWN – allows us to move the bear up onto a platform or down onto the ground. Also assists on and off the scales. THROUGH – allows us to move the bear from den to den. IN – presents chest to mesh. Will hold steady for min 15 seconds so a heart rate can be taken. OPEN – opens mouth so teeth and mouth can be inspected. We were able to brush the teeth of the male bear to prevent build up of tartar. PAW – able to ask for each paw in turn. Will hold for cream to be brushed onto paws and for a burst of spray from a pressurized can, i.e. clorhex. EYE – allows close examination of each eye, using a scope. EAR – allows close examination of each ear, using a scope and taking swabs. PRESENT – presents genital area to mesh. Allows for swabs and rectal temperatures. SHOULDER – will present either shoulder to the mesh. LEG – will present either hind leg to the mesh. ARM – will present either fore-arm to the mesh.

	<p>BACK – will present the left side of his back. We are shaping the right side at present.</p> <p>STEADY – a hold behaviour, for when we need them to stay still, e.g. ‘in’ to take a heart rate.</p> <p>The male bear has also been desensitized to operating fur clippers.</p>
Planned Behaviours	Using a laser light as a target to station in specific areas.
Reasons for Training/category	Medical management.
Comments	<p>The program to date (20/01/03) is at maintenance level with new behaviours added as and when time becomes available.</p> <p>The bear appears to enjoy the sessions and as well as the medical benefits of his training the behavioural enrichment to him from these training sessions should be taken into consideration. The training is all positive reinforcement with a gradient of treats for tasks preformed.</p>

K Rotherham 20/01/03

Appendix 3.

Perth Zoo Table of Approved Enrichment 1 - Carnivore/ ungulate section

SUNBEAR	**		
<i>Helarctos malayanus</i>	E	Jelly blocks	
	E	Box toys with nuts and straw	1 x week
	E	Honey/jam/condensed milk smears	3 x week
	E	Ice blocks (fruit, nuts, raisins, figs)	4 x week
	E	Frozen melons	seasonal
	D	Scatter feeds	Daily
	D	Browse	Daily
	E	Rotting logs	Frequent
	E	Hessian bags	Infrequent
	E	Termite crumble	Infrequent
	E	Cardboard tubes with straw/nuts, raisins, popcorn	1 x week
		Plastic drum (large) with holes	1 x week
		Small buggy tire	2 x week

Appendix 4.

A Frame Work for Training

A good base for the program is vital so that there is no confusion, for the trainers or the bears, about what is required. Clear goals and documentation to track the progress of those goals is an integral part of a training program.

Training **goal-setting** for individual animals

Examples include: recall, being able to move animals in or out of night areas; Training animals to stand on scales for weighing; Targeting to allow for body inspections.

Training **planning** for individual animals

Training plans include describing the behavior to be trained and why. It will outline the specific steps involved and the tools that are necessary.

E.g. a target and a whistle (as bridge). The written plan should be forwarded to the section supervisor and curator for approval.

Managers facilitate the training process by assuring keeper time is allocated for the training sessions.

Training **implementation**

The primary consideration in the actual training phase is consistency. Ideally, a single trainer will work on training a particular behavior from start to finish. Multiple trainers can then maintain the behavior. With multiple trainers good communication is critical. Written descriptions of cues and criteria for trained behaviors should be available to all involved with the training.

Training **documentation**

Documentation is needed in order to track training progress. No one record-keeping form can capture every piece of information. List and prioritize the information that is needed. The form needs to be developed at the start of the program with all trainers consistent with, and understanding of, all the terms used. Record forms and ratings scales that are changed frequently become less useful for tracking trends over time.

Training **evaluation**

Keepers in the program will routinely meet and discuss the progress of the bears. Reviewing the training documentation will let us take a step

back and see how the bear is progressing over time. It will show if there are any trends emerging regarding a particular behaviour or trainer.

Training **re-adjustment**

Using the documentation and evaluation questions can be asked to assess if the goals for the program and individual animals are being achieved. Questions such as: What goals have/have not been achieved? What have been the key to the successes? What are the possible problems? What can we change, or what can we try to do differently to overcome problems?

Appendix 5.

Training planning form

Species:	Individual:	Exhibit:
Behaviour:		
Goal of behaviour:		
Steps involved in training this behaviour:		
Comments (reinforcements / cue / bridge):		
Trainers involved:		
Approval:		
Date training started:		
Date goal achieved:		

Appendix 6.

Daily training records:

Animal:

Exhibit:

Date	Time	Keeper	Session type/ behaviour	Rewards	Comments / Notes	Attitude	Rating

Attitude: 1 = Ignored trainer
 2 = Somewhat attentive to trainer
 3 = Moderately attentive to trainer
 4 = Attentive to trainer
 but slow
 5 = Total attention to trainer
 (very focused)

Rating: 1 = Unresponsive to cue
 2 = Incorrect response to cue
 3 = Partial response to cue
 4 = correct response to cue,
 5 = Correct response to cue, fast

Appendix 7.

Operant Conditioning Terms

Acclimation or habituation: The process of gradually getting an animal used to a situation. By prolonged exposure the animal becomes accustomed to a space that it normally would avoid.

Baseline: The frequency that behaviour is performed prior to initiating a behaviour modification program. The rate of performance used to evaluate the effect of the program. In experimental work, the term is often used to refer to the control group, which serves as a basis for evaluating data from the experimental group.

Bridge: A stimulus that pinpoints in time the precise moment of a desired response and bridges the gap in time between that point and when the animal may receive further reward. A signal that is conditioned to be reinforcing because it is paired with other reinforcers which evolves to pinpoint an instant in time for the animal in training. **Intermediate bridge** signals the animals that at that instant it is on the path to success, but has not completed the behaviour yet. **Terminal bridge** signals the instant at which an animal successfully completes a requested behaviour. The bridge is a stimulus, which signals the delivery of a reinforcer. Often called a secondary or conditioned reinforcer because it acquires its effectiveness through a history of being paired with primary reinforcement, such as food to a hungry animal.

Conditioned Reinforcer: A stimulus, which has been paired with the elements of enjoyment. The animal is conditioned to enjoy a stimulus. Examples are tactile, clickers, playing, playing with toys, and interacting with enrichment devices.

Cue: A signal, which will elicit a specific behaviour or reflex, as a result of a learned association.

Desensitization: Actively pairing a positive reinforcer with a negative event until the negative event loses its ability to influence a behaviour. Exposing an animal to a stimulus using time or experience to drive the stimulus value towards neutral. A process of changing an animal's perception of an event, negative or positive, but usually negative, to a neutral perception. Success is evidenced by the animal's lack of response to the event when compared to a previous baseline.

Differential Reinforcement: Reinforcing selected responses of higher quality to improve performance.

Extinction: Method of eliminating a behaviour by not reinforcing it any longer. This method is most effective when paired with reinforcement of alternative behaviour. Extinction is a procedure where the reinforcement of a previously reinforced behaviour is discontinued. If the animal has no opportunity to engage in the behaviour, then the term extinction is inappropriate. There is a decrease in frequency of the behaviour.

Generalization: Reinforcement of a specific behaviour increases the frequency of similar behaviours. Generalization is the process of comparing events, consequences or objects, which have some trait in common and recognizing that common trait. In training, an animal can be taught to allow a series of specific people to touch it. Eventually, the animal will let all people pet him, even if they are strangers.

Immediacy of Reinforcement: A critical feature of conditioning. The art of reinforcing, exactly following the behaviour, is intended to increase in frequency of the behaviour. If reinforcement is delayed as much as a couple of seconds, the animal may follow some other behaviour.

Incompatible Behaviour: One that interferes with or cannot be performed at the time, with another behaviour.

Jackpot or Bonus: A reward that is much bigger than normal reinforcer, and comes as a surprise to subject.

Negative Reinforcement: Following an action or response by removing an unpleasant event, or stimulus, no matter how mild, that the subject wants to avoid. For example: a loud buzzer, spray from a hose, the side of a restraint chute moving inward, etc.

Operant Conditioning: A type of learning in which the probability of a behaviour recurring is increased or decreased by the consequences that follows. This includes positive reinforcement, negative reinforcement, and punishment.

Primary Reinforcer: An event that is naturally reinforcing satisfies biological drives, and is not dependent on learning. Examples: food, water and sex. Psychologists define a primary reinforcer as any stimulus that reduces a need or motive.

Positive Reinforcement: Following an action or response with something the subject wants: food, praise, tactile contact, play, favourite toy, released to a favoured place, etc.

Punishment: An unpleasant action whose purpose is to reduce the likelihood that behaviour will occur again. Occurs after the response, so subject cannot change the behaviour, and give no information about how to change the behaviour. Punishment is not appropriate during the learning stages of a behaviour. Potential risks: it may actually strengthen behaviour, such as escalating aggression or animal may cease undesired behaviour but replace it with another undesirable behaviour or animal may learn not to perform behaviour in presence of trainer. Examples: spraying animals with a hose, withholding food or water. Routine events can be used as punishment such as separating or isolating animals. A time out is the most appropriate form of punishment to use with primates. The exception is a life/death situation. **Negative punishment** is the removal of a positive stimulus, something the animal seeks to encounter, from the animals environment following a response, thereby decreasing the frequency of that response. **Positive punishment** is addition of an adverse stimulus, something the animal seeks to

avoid, to the animals environment following a response, thereby decreasing the frequency of that response.

Reinforcement: Anything positive or negative, which occurring in conjunction with an act, tends to increase the probability that the act will occur again. It is information that tells the subject what you like or don't like. The consequence can be either the presentation of a positive reinforcer or the removal of a negative reinforcer. Reinforcements are relative, not absolute.

Regression: Deterioration in learning process or performance of a behaviour, usually temporary; a normal part of training process. Also refers to when a trainer retraces the steps in the shaping process to reinforce lesser levels of performance.

Response: The actual performance of the behaviour. Measures of observed behaviour.

Reward: A return for a correct response to a stimulus. The reward can also be a stimulus that when presented upon the successful performance of a task elicits within an animal the feeling of satisfaction.

Stimulus: Anything that causes some kind of behavioural response; a cue or signal. It can be anything the subject can perceive.

Stimulus Control: When a trained behaviour occurs consistently in response to an appropriate cue or stimulus. Use a subjective measure of performance by tracking the response (e.g., 70%, 80%, 90%, 100%).

Schedules of Reinforcement: Rules that govern the delivery of reinforcement.

1. Continuous: Reinforcement is given after every correct response. This is necessary in learning stage and to maintain invasive or unpleasant behaviours.

2. Variable or intermittent: Reinforcing on a random or unpredictable basis. This may be better for maintaining behaviour.

3. Selective or differential: Reinforcing selected responses of higher quality to improve performance.

4. Jackpot or bonus: A reward that is much bigger than normal reinforcer, and comes as a surprise to subject.

Shaping or Successive Approximation: Successive approximation is used to condition performance, which is not currently in the animals repertoire. Building a behaviour by dividing it into small increments or steps and then teaching one step at a time until the desired behaviour is achieved. Steps become a series of intermediate goals. The process of learning a sequence of behaviours that proceeds semiautomatically in a determined order; the last previous response provides the necessary cue that determines which behaviour comes next.

Superstitious Behaviour: When training, sometimes you reinforce a behaviour you don't want. Even though there is no intentional connection between the animal's performance and the reinforcer, there is still an increased in frequency of the performance. It is an undesired behaviour that is unrelated to the desired behaviour, but is accidentally reinforced, and then becomes fixed in the subject's mind as necessary for reinforcement. Trainer is often unaware that this is being reinforced.

Target: A prop, which pinpoints a critical location for an animal in training. This location may be a body contact point on the stationary animal, it may be a destination point, or it may be a place where other critical information will appear. The target can be an extended finger or fist, the end of a pole, a mark on a wall or a paper, a plaque. Essentially, the trainer and the animal each extend a target contact point toward the other, meeting in the middle.

Training: The art of using operant conditioning techniques to obtain desired behaviours.
Teaching. Communication

Time Out: A mild form of punishment in which positive reinforcement and/or opportunity for positive reinforcement is withheld for a brief period of time immediately following an inappropriate or undesirable response. In essence, the animal receives no cues from the trainer, but also cannot influence the trainer to produce a consequence such as food or praise until the "time out" has passed.

http://honolulu.zoo.org/enrichment_operant_cond_terms.htm 14/9/06

Life can be serious.....but it can also be seriously good fun!

Michelle Whybrow
Auckland Zoo

Abstract

Can you imagine having the same routine, day in, day out? Not having the choice to get up or go to bed at a different time? Not being able to leave your property but looking at the same limited surroundings? Eating not only the same meals but at the same time every day? Sounds pretty monotonous to me, and why should it be any different for our animals?

In a captive situation with restricted environmental pressures and often, environmental pleasures, animals have limited opportunities to express natural behaviours and can get bored easily. Boredom affects both physical and mental health and thus captive institutions must find alternative stimulation for their animals' wellbeing.

In the day of the modern progressive zoo, environmental enrichment plays a vital role in animal husbandry, and appears in zoo mission and vision statements and strategies worldwide. Enriching our widely varying collections of animals remains challenging. How do we make sure that our enrichments are continuing to change and evolve to meet the needs of each species? Enrichment that is not evolving can become boring and thus reduces the physical and mental stimulation that it previously provided.

At Auckland Zoo we strive to achieve these goals and enhance the quality of our animals' lives by identifying and providing necessary environmental stimuli and then continually re-evaluating them. Simply put: we enrich, we train, we condition, and then we mix it up a bit.

The sharing of ideas and results is important for this and one way it is achieved is through our behavioural enrichment committee. Each section of the zoo has a representative on the committee but just like good enrichment, the committee doesn't remain static, with members changing on a continuous basis. This adds variety and fresh perspectives. The committee meets to discuss what has been happening on their section, new enrichment ideas are documented, as well as successes and failures. What has or has not worked on one section may be successful in another, or act as a springboard for other ideas.

Even the weirdest and wackiest ideas are discussed, and if feasible, trialed and evaluated. One such idea began with a bird and ended up being a zoo-wide event encompassing a refrigerated truck, a bobcat and a lot of teamwork! This was Snow Day! In winter, Auckland gets a lot of rain but no snow, so the thought of providing an alpine species with a component of their natural habitat was too good an opportunity not to share around. Thanks to a donated truckload of snow from Snow Planet, an indoor skiing venue, just about every species got a taste, touch, look, or the opportunity to ignore(!), the cold stuff.

Some enrichments may create discussion or even be controversial, but it is important to keep creating and thinking outside the square, even if things are rejected. One idea used at Auckland Zoo may be received by others with a shudder, or flat-out turned down. That's because we're talking about urine, not animal urine exchanged between enclosures, but *human* urine. Samples from our male elephant keepers are placed out in the paddock to create an unusual olfactory enrichment for our two female Asian elephants. Of course, using urine isn't a new idea, but it's usually confined to the animal kingdom. The reactions from our elephants have been remarkable, as interestingly, it might appear that the relationship had with the donator, shall we say, is more important than the urine itself. When the elephants came across the urine of a keeper with whom they had formed a close bond over the past seven years, the reaction was intense with much vocalising including trumpeting, roaring and squeaking. In comparison, the reaction to another keeper's urine, who had not long been at the zoo, was very minimal.

Environmental enrichment can vary from this low-tech enrichment where all you need is some privacy, to the more advanced which utilises technology. Certain carnivores, such as the serval, use superior hearing as their major method of locating and capturing prey. An enrichment device was trialled at Auckland Zoo that provided auditory stimuli associated with feeding. A speaker was set up in the enclosure next to a small, closed box containing food. Two sounds were played through the speaker, one a cheeping chick on the ground and the other a rustling in the grass. When the serval approached, the box was opened and once the food 'captured', the sound was stopped.

The kea is a mountain parrot that is considered by some to be the most intelligent bird in the world. This means a challenge for the keepers to ensure the kea stay mentally stimulated. More complex puzzles have been introduced that may look more at home on a primate enrichment schedule. They include the tower; where the kea must stand on the enrichment, take the top off and pull up the containers of treats. The crank handle; in which the handle must be rotated in the right direction for the containers to be pushed into the exit slot. The tilting puzzle; where the kea must move from side to side, tilting the enrichment and rolling the treat down through the maze. And the lever puzzle; in which the kea must work out the right order to pull the levers in order to get the reward.

Enrichment can not only promote natural behaviours and prevent boredom, but it can also assist keepers with their husbandry. Meerkat claws can overgrow in captivity and require regular trimming. At Auckland Zoo, a few enrichments have been modified to assist with this. A rotating tube with insects inside has been covered in sandpaper, and as the meerkats turn the tube for the mealworms to fall out, the scratching action keeps their claws trimmed. Concrete slabs with mince smeared into the holes also help to keep claws down as the meerkats scratch or dig the food out.

Of course, there are times when enrichment is given purely for fun, simply to see the reaction from your animals and to find out what they'll do. The more unfamiliar the item the better!

It is important to remember that an enrichment designed with one animal in mind may be transferred and used with others, and can even cross the species barrier. When I moved from the primate section to NZ fauna, I continued creating BE using the same enrichment items that are used for primates, even though I was now enriching birds. When making ice-blocks for kaka and kea, NZ parrots, I still used a variety of different flavours. To me it doesn't matter that the ice-block itself isn't eaten, rather the fruits and nuts are chewed out, but I think that it is just as important to give a variety of smells and tastes to a bird as a primate. In fact, I observed with the sweeter ice-blocks made with items like honey or jam, the kea lapped at the liquid as it melted rather than just tearing out the treats.

Another enrichment for the kea was borrowed from a felid. These coconut-fibre plant liners are sewn together to form a ball and treats are placed inside. This proves to be a different sort of challenge than to a serval, but a challenge nonetheless.

With a bit of adjustment for size, a primate or panda enrichment can be just as effective for someone much larger, even if most of their enrichment usually goes in the water.

Presentation is another area where enrichment may be made more exciting or novel, or can make enrichment more difficult.

When looking for hay nets to elevate the elephants' food, the section came across the idea of shopping trolleys. These are welded together, hoisted up a pole and work extremely well at prolonging feeds and exercising the trunk muscles.

Presenting food inside a container is a basic enrichment that often forms the basis of an enrichment schedule. By changing the container, the enrichment changes and can offer variety in a simple, easy manner. Containers used with the kea include plastic ice cream containers and the like, cardboard boxes, tins, film canisters, cages and balls. In a completely New Zealand twist, woven flax balls have also been added for our own kiwiana. Cheap, tough, natural and they even work!

An animals' usual diet can also be spiced up with a change of environment and different presentation. How about taking your animals to the food instead of the other way around? An added benefit to this is the public interest generated which can be used as a tool to educate and inspire.

Different presentation can also help provide opportunities to engage natural behaviours that may be more difficult in a captive situation. For ethical reasons, live food may be discouraged, but by presenting food with something like a simple flying fox, the hunting instincts in carnivores can still be promoted.

As part of Auckland Zoo's education program, school students have been challenged to design enrichment for the internet project 'Sniff, Swing, Swipe'. Comments and suggestions are given by keepers to enable students to modify their design before construction. Enrichments are chosen and students are able to trial their prototype with certain animals. The keepers give the children feedback about their design's success or

failure, leaving the students extremely excited at being able to witness their enrichment in use.

But what keeps enrichment enriching? It is important to remember that *anything* given each day will become routine and boring. At Auckland Zoo, our volunteers are utilised not only in the creation of some enrichments but also in the monitoring and review of their use. Animal watch observations are set up so we can determine the continuing effectiveness of each enrichment and make adjustments if necessary.

Enrichment at Auckland Zoo is not only a beneficial part of the animals' lives - it's essential. And if we keepers enjoy the resulting antics of our enriched, active and stimulated animals, and the public are also educated by the variety of behaviours displayed, then it becomes a win / win / win situation as we combine the theory of enrichment with ... fun!

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(In)Valuable, Versatile Volunteers.

Ray Wilton
Melbourne Zoo

Abstract

FOTZ Melbourne Zoo volunteers spend many hours assisting the Zoo's keepers to provide the animals with enrichment activities. Most activities undertaken by volunteers assist the Primate/Monkey Departments. Occasionally help has been given to the Bird Department and the Carnivore area.

This paper will briefly outline the new and re-cycled materials used along with the purpose of each activity.

Nothing is "new" (we try to avoid having to 're-invent the wheel') and the idea is not to "teach others to suck eggs" but simply to show that volunteers and keepers team closely together endeavouring to enhance the welfare of the animals in the Zoo's collection. An opportunity will be given for 'hands on' experience.

VOLUNTEERS AT MELBOURNE ZOO are enormously involved in ANIMAL ENRICHMENT activities especially for Monkeys and Primates.

And the work goes on.....

“With a hank of hair, and a piece of bone, won’t ya be my Honeycomb?”

No our volunteers don’t sing to the animals but they DO provide them with the basic materials to have fun and often honey is one of the items offered.

The song has absolutely nothing to do with the talk except when I was reviewing the items for inclusion in this topic, honey was one such item and the old hit song (too far back for most here to have heard/remember) popped into my mind.

Our Melbourne Zoo Friends volunteers bring an amazing collection of things to be used in enrichment activities such as cardboard boxes of all shapes and sizes; wood fibre; dried fruits; honey; old fire-hose; ropes; acacia gum; pine cones; many varieties of seeds; scents; waste materials converted by the ‘handyman group’ for use in different departments. Specially prepared wooden containers and other items are constructed by our talented band of volunteers.

This brief paper is not a copy of expected comments you might hear during a talk. Instead it is produced to encourage conference participants to do just that – participate. All who attend this topic will be invited to “get into the spirit of the adventure” by actually becoming involved. The opportunity to sit and be a non-communicant will be extremely limited. “Hands On” is the order of the day – therefore intelligent, expert information may be in short supply.

Hopefully fun and laughter will be good substitutes.

This is NOT an activity to try to “teach you to suck eggs”! The activities we will participate in are probably not new to most if not all of you but my role is to share with

you in a practical way the fun volunteers have in supporting keeping staff in their endeavours to provide an enriched environment for our much loved animals.

I apologise if “gems of wisdom” are absent but I assure you it will not be an opportunity to catch up on sleep.

Melbourne Zoo Volunteer, representing the hundreds of *Friends of the Zoos* volunteers at Melbourne.

My heartfelt thanks to the “Enrichment volunteers” who have assisted in having the materials ready for us and for the examples they have produced.

Enrichment – a way of life, not just a novel object

Kerrie Haynes-Lovell
Queensland

Abstract

Over the years I have often heard keepers lament their lack of time and resources to be able to provide enrichment for their animals. Keepers should look at enrichment not as an extra task but as part of their daily routines. Enrichment is not just about complex feeding regimes and devices or novel objects, but more about the animal's whole life needs. Everything a keeper does in their day impacts on the wellbeing of the animals in their care and therefore does, or does not, enrich the animals lives.

A holistic approach to enrichment needs to be integrated into the way a keeper approaches their daily routines. This approach requires keepers to have a basic understanding of the animal's natural history, including social structures, feeding habits and activity budgets. By considering the animal's life as a whole the keeper can have a better understanding of how to make the animals life more enriched.

Stimulating the animal's senses and creating more interesting feeding activities is an essential part of captive management enrichment, but none the less important is providing opportunities for rest and compatible social structures. This presentation will look at ways keepers can integrate enrichment into their daily routines using a holistic approach to enrichment.

Introduction

Before enrichment was a household word in the zoo keeper's vocabulary many good keepers applied the principles of enrichment in their daily routines. They understood the particular needs of their animals and incorporated these requirements in every thing they did for the animals in their care. They understood the natural history of the species and the specific needs of individual animals. There was not so much science but a great deal of art about their keeping skills.

In the modern zoo environment these basic skills have been quantified and evaluated to give us the scientific validation for what amounts to good animal care. The zoo industry has come a long way from the days of menagerie collections with poor exhibits and inadequate diets. We have made progress in many areas of veterinary care, breeding programmes, exhibit design and enrichment. However, in many ways we have lost the art of keeping. We see enrichment as something that is an add-on to our daily routines, something that requires extra effort and time to carry out. Managers and keepers alike often see good exhibit design as the answer to the past criticisms of zoos. Complex, appropriate and well designed exhibits certainly enhance both animal and visitor experiences, but the daily management of these exhibits dictates whether they are truly successful.

This presentation will discuss a "back to basics" approach to enrichment looking at the elements that should be part of every keeper's daily routine.

Elements of a holistic approach to enrichment

Many of the elements of a holistic enrichment programme are imbedded in a keeper's daily routine. They are not always thought of as enrichment and are therefore often not considered as important as perhaps novel object or food presentation.

There are five basic elements of holistic enrichment:

- Physical habitat
- Social
- Sensory
- Food
- Cognitive

All the elements are as important as another. In some species the importance of one element over another may occur. In animals with higher cognitive abilities the complexity of the environment and sensory stimulation may require extra attention. In solitary or gregarious species the social structure may have important implications. However, all elements are necessary and should be addressed when looking at the overall management of the species and the exhibit.

Physical habitat

Exhibit design is an area that has improved considerably from the days of barren cages made from bars and mesh. Complex exhibits that reflect the natural habitat of a species are now more the norm than not in modern zoos.

I believe that this progress has become a double edged sword when assessing the effectiveness of zoos to house animals in human care. On the one hand it is seen as an improved living space for the animals and gives the visitor a greater appreciation of the species natural environment. On the other hand it often limits the keeper's ability to continue to enhance the animals' environment by adding elements that may not "fit in" to the overall picture that was envisioned when the exhibit was designed. Management spends considerable expense to develop these exhibits and many do not take kindly to having the aesthetics marred by non natural additions.

The other problem with these complex habitats is the time and resources involved to maintain them as they were intended. Complex habitats should not be viewed as the final picture but as the base coat for the keeper to continue to enhance the inhabitants' existence. It is therefore important when management and keepers are planning new exhibits to consider the time and resources required to maintain them as ongoing projects, not as static displays that address all the needs of the animals.

The back of house design should be considered as important as the main public exhibit. Many species spend as much time in these areas as they do on the public environment and the elements that are important in the public exhibit should be replicated as much as possible in these off exhibit areas. An added advantage of adequate off exhibit areas is the ability to house animals for longer periods of time while making major changes to the

main exhibit. In the long term this saves costs by not requiring animals to be displaced while an exhibit is updated. It also reduces the stress of animals that need to be housed apart from the main group for medical or breeding management reasons.

The physical environment should address the animals basic requirements of space, complexity, required elements such as pools, elevation, visual barriers, substrates, vegetation and shelter. The elements may be permanent or semi-permanent but all elements should be addressed when looking at the overall management of the species and the exhibit. The semi-permanent structures should be easy to replace and adequate access for equipment required to move larger items is important when designing entry ways.

Social

There are known social requirements for most species and in the majority of facilities this is taken into consideration when planning a collection. The best laid plans may be upset by individual animals when it comes to social structure.

We often house solitary species as pairs when they are not naturally found in this situation in their wild state. This can cause considerable stress on both animals and may lead to stereotypical behaviour patterns and/or aggression. The importance of having compatible companions can not be over emphasized. If the animals can not be given their own space then exhibits must be designed to give adequate space and visual barriers to reduce the social pressures. Polar bears are an example of a solitary species that are greatly impacted by social structure. Females have a much greater spatial requirement to males as they do not naturally interact with any other individuals other than their offspring. Similarly once the offspring reach two years of age in the wild they would be going their separate ways and if not given enough space may develop behavioural problems, particularly the subordinate sibling.

The current scientific evidence suggests that gregarious animals may not breed if there are not enough opposite sex partners to choose from within the group. This may require larger groupings than is practical in metropolitan zoos. An illusion of greater numbers by using devices such as mirrors does not address this problem as the animals recognize individuals and a replication of the same animals is not an answer to greater partner selection.

Some species of felid and primate need to breed and raise offspring to maintain a healthy social structure. This is can be a major dilemma for zoos as it can create a surplus of animals that can not be housed adequately in the facility or the general zoo community.

Regardless of the species it is paramount to good management to understand their social requirements and have contingencies in place to deal with individuals that may be socially incompatible or to address the need for larger or family groupings.

The keeper's understanding of the natural social grouping of a species and the individual character of each animal in their care is essential in providing the most appropriate social structure for an exhibit collection.

Sensory

Sensory enrichment is often the element that first comes to mind when keepers are considering how to add stimulation for their animals. It covers a range of senses and items that could enhance the animals' environment.

For active animals and those whose activity budgets include extensive exploration behaviours this is probably the enrichment element that occupies most of a keeper's physical and mental time.

Some examples of these sensory enrichments could include but not be restricted to:

Manipulanda – objects that an animal can manipulate and explore.

Texture – various substrates, different structure and furniture textures, browse and vegetation, various bedding materials.

Scent – various natural scents; vegetation, naturally occurring animal scents, artificial scents; perfumes, essential oils

Taste – foods that are not necessarily part of a normal daily diet, herbs and spices

Sound – sounds that are found in the animal's natural environment as well as those that may not occur in an animal's normal environment could be considered as enriching. Lack of sound should also be considered in this form of enrichment, as often very noisy environments are far from enriching.

Visual – changes in the exhibit furniture and substrates, the ability to have vistas outside the exhibit via structures and varying exhibit terrain.

The list of sensory enrichment items is limited only by the keeper's imagination and willingness to explore new ideas. There is an abundance of publications on this topic and even more information available from other keepers who specialize in particular species.

Food

Locating, hunting and gathering and consumption of food takes up a large proportion of an animal's existence. It is therefore an important element to consider when looking at enrichment opportunities. Advances have been made in understanding the nutritional requirements of species and providing them with adequate diets. The development of specially processed diet foods that contain all the nutritional requirements has in some cases reduced the variety of foods provided to animals on a daily basis.

Nutrition is only one consideration when it comes to providing food for animals. The variety of textures and tastes, the dispersal and placement of food items and the opportunity to forage for daily rations needs to be incorporated into the daily routines of animals.

The natural hunting and/or gathering behaviour of the animal should be considered when deciding on feeding strategies and routines. The strategies should as much as possible stimulate species appropriate behaviour. These strategies may include opportunities to forage for food items, investigation of the environment and manipulation of novel objects

that contain food items. Variation in feeding times may be appropriate but not when anticipatory behaviour promotes abnormal behaviour patterns e.g. Polar bears.

The variety of presentation methods for food items gives the keeper increased opportunities to enrich their animal's lives by stimulating natural behaviours.

Cognitive

All the elements that have been previously mentioned can be incorporated in this next element. How and why we design species appropriate exhibits, have compatible social groups, provide various feeding strategies and stimulation for a range of senses all comes together in the cognitive abilities of a species. How they use their environment, what level of enrichment is required and how we prioritize the level of enrichment a species requires is often determined by their cognitive abilities.

When we think of animals with cognitive abilities dolphins and primates are often the species that first spring to mind. Robert J Young discusses in his "Environmental enrichment for captive animals" (2003) the varying opinions in the scientific community on how to assess the cognitive ability of a species and which is the most useful method to utilize when measuring the welfare of animals in human care. In the past the ratio of brain to body weight was one method considered. This has been further refined to consider the neocortex (the part of the brain that controls cognitive processes) ratios, of a particular species. Social-group and complexity is another aspect of cognitive evaluation, as found with parrots that live in large flocks.

The display of abnormal behaviour in the captive environment may also be an indicator of cognitive abilities that are not adequately addressed. Work done at the University of Oxford by Ros Clubb and Georgia Mason (1998) looked at the life-history and home range size of carnivores as predictors to abnormal behaviour and may also be a useful tool to assess an animals cognitive abilities.

From the information Young constructed the following selection of rules for prioritizing environmental enrichment:

- Does the species have the ability to predict future events?
- Do cognition experiments support the proposition that the species functions at a high cognitive level?
- Does the species have a large neocortex ratio?
- Does the species live in large social groups with complex and long lived interactions?
- Does the animal demonstrate high levels of curiosity or exploratory behaviour?
- Is the species known usually display abnormal behaviour in captivity?
- Is the species opportunistic or omnivore?

The list is not a definitive indicator of cognitive abilities but rather a guide to assessing the possibility of providing a particular species with enrichment that addresses its mental abilities as well as providing for the animal's physical wellbeing.

The keeper's observations and understanding of their animals is a valuable tool in assessing species requirements where the scientific information is lacking. Species may not comply with all of the categories but obviously require special consideration when it comes to cognitive stimulation. An example would be Polar bears, who display abnormal behaviour in captivity, demonstrate high levels of curiosity at certain times in the life cycles, are opportunistic but are solitary and do not have a high level of supporting information on their cognitive abilities. Keeper observation and experience has added considerable information to the management of this species in the captive environment.

Most animals in captivity need to use cognitive functions such as memory to locate resources (e.g. food) within their environment. Stressors such as being handled can impair cognitive functions e.g. memory. Thus protecting cognitive function is an important factor of environmental enrichment (Young 2003).

Rest

I would like to add an additional element to the five most commonly recognized enrichment categories and that element would be rest.

One of the greatest pressures incurred by keepers and managers alike is the public's insistence to see animals continually moving. This often motivates the zoo community to devise more ways to keep the animals constantly stimulated with little regard to the animals need to rest. Both keepers and managers should understand the need for animals to have the ability to display all their natural functions and this includes nesting and resting behaviours. It is a challenge for zoological facilities to educate the public in this important aspect of behaviour and they should be actively promoting resting animals as animals that are comfortable in their captive environment.

The provision of bedding materials in both back and front of house should be an integral part of all daily routines. I have heard all the arguments for not providing animals with appropriate bedding, from the extra work factor to the clogging of drains. None of these arguments should be used to deprive animals from having the bedding material they require to engage in nesting and rest behaviour.

Conclusion

For a holistic approach to environmental enrichment to function within a zoological facility both keepers and management have to have a united and coordinated mindset. Each has a part to play in the development and implantation of enrichment as an integral part of the daily routines of the collection.

Managers have to understand that complex exhibits are only the start of the process and that ongoing resources are required to fulfil the expectations of the original concept. Keepers have to see everything they do in their daily routines as a way to further enrich the lives of the animals in their care. All parties have to remember that the animals should be the primary focus and that public expectations should be met through education and the highest levels of exhibitory.

If we delude ourselves that "natural" exhibits alone are the answer to criticisms regarding captive facilities we reduce our advances to the old menagerie ideals where animals are only for the public's amusement.

We can all go home at the end of the day our animals can not, it is our job to make sure they have the very best we can give regardless of expense or effort.

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Evaluating Enrichment: Why and how?
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Abstract

Increasingly enrichment is becoming an inherent part of the husbandry routine with weekly or monthly schedules of daily enrichment providing an increase and consistency in the provision of enrichment and greater variety of devices. This has long been an aim of enrichment enthusiasts but it does raise other questions. How do we know if this process is effective and what do we mean by “effective”? Does effective mean that the animals respond to the enrichment or does it mean that it changes their behaviour in a desired direction? Are the two measures connected?

The only way of measuring effectiveness is to evaluate in some way. Methods for the quick evaluation of enrichment responses have been developed but do they give the answers we need about changes in behaviour? The classic methods of behavioural data collection take time – a scarce commodity with zoo staff. Can the classic methods of evaluation be modified to better suit zoo time constraints without losing their scientific validity? To measure changes in behaviour clear measurable goals are important. This presentation will explore these issues and demonstrate both in theory and in practice, different evaluation methods and look at how they can help you to provide effective enrichment.

The documentation of enrichment

There is much confusion in the enrichment literature between documentation and evaluation.

Documentation – the factual recording of a real event.

Evaluate – to ascertain the value of; to appraise carefully

To me documentation is the daily recording of what enrichment was given and responses to it and evaluation or assessment is the longer-term measuring of its effectiveness.

Enrichment documentation should become a daily keeper task. Ideally it should be documented in a designated column in the section or species diary or better still have a special diary or spreadsheet. There should be a consistent format for recording, so that the records are readily accessible for summarising.

What to document

- What was given?
- When and how it was given?
- Responses. There are simple response grading codes available.
- Any unusual events

Particularly with the scheduling of enrichment good documentation becomes more important and may form the basis of enrichment evaluation, when responses to enrichment are included. Zoo accreditation in some regions includes a requirement for a documented enrichment program.

So why evaluate enrichment?

The reason to evaluate enrichment is so that we know what we are doing is valuable

- worthwhile for the animal
- worthwhile for the people doing it

The generally agreed major purpose of environmental enrichment is improved animal welfare. The basic concept of enrichment is that appropriate mental stimulation is as important to animals as is physical well-being. On this level it is important to know that what we are doing is working, that it is actually providing the animal with the opportunity and stimulus to behave naturally.

This brings us to the questions of what is good welfare and can we measure it?

What is Animal Welfare?

The 'quality' of life that an animal experiences

Measures of Good Welfare

- The variety of normal behaviours expressed
- The extent to which preferred behaviours can be expressed
- Physiological measures of pleasure
- Behavioural measures of pleasure

The secondly point highlights the time, effort and cost involved in providing dynamic enrichment and the need to know that the effort is worthwhile. We all resent time we are forced to put into things that we feel are in-effective or a waste of time and conversely are happy to spend extra time preparing something that we know will achieve goals or be really enjoyed.

Increasingly enrichment is an inherent part of the husbandry routine with weekly or monthly schedules of daily enrichment. This provides a consistency in the implementation of enrichment and more variety of category, methods and devices. This has been found to be more effective than treating enrichment as an add-on that only happened when there was time but it adds another dimension to the evaluation – the effectiveness of the program in addition to the effectiveness of each device or method – the cumulative effect of a combination of enrichments.

There is a feeling is that by simply increasing exhibit complexity we are automatically improving animal welfare but is this a cop-out?

To evaluate enrichment we must think about what we want the enrichment to achieve and how we can measure that?

Enrichment Goals

- Provide a more stimulating environment
- Increase physical fitness
- Increase adaptability and ability to cope
- Increase the diversity of behaviour
- Increase activity or exhibit space use
- Increase exploratory behaviour
- Increase foraging time
- Decrease intra group aggression
- Decrease an existing abnormal behaviour

Often the commonly stated goals of enrichment are too general and difficult to measure so need to be refined so that they are directly measurable. Some of the above goals are very difficult to measure and would require long-term behavioural studies and/or the use of a variety of measures – physiological measures of stress or health, post-mortem measures such as longevity, reproductive success, disease occurrence; others are more easily measured with simpler behavioural studies, studying the animals with and without enrichment and these will be our focus here.

Measurable enrichment goals

Enrichment goal	Measurable?
Provide a more stimulating environment	Not measurable
Increase physical fitness	Difficult
Increase adaptability and ability to cope	Difficult
Increase the diversity of behaviour	Quite difficult
Increase activity	Measurable
Increase exhibit use	Measurable
Increase exploratory behaviour	Measurable
Increase foraging time	Measurable
Decrease intra group aggression	Measurable
Decrease an existing abnormal behaviour	Measurable

How to evaluate enrichment.

Rapid evaluation (or is this really documentation?)

The simplest to do are quick evaluations by the staff placing the enrichment

Stay a few minutes after enrichment is put into an exhibit and note:-

- how quickly the animals respond to it,
- how much time they spend at it,
- how they use it
- how long they keep using it: still being used on a later visit to exhibit?
- note indirect measures of its use - when you go back to the exhibit during the day and the next day when you remove it.

– there are scoring scales available to quickly record direct responses, indirect responses and appropriate use to enrichment (DAK, 2003).

Is response to an enrichment device a good measure of effectiveness? Not necessarily!!

Examples: 1. In a primate research project carried out at Paignton Zoo (Magnusson & Melfi, 2004) nine enrichment methods were evaluated with four primate groups comparing the results of a long-term study of their effectiveness in promoting ‘positive behaviour’ with four rapid indicators

- Lag time until 1st use
- Duration of initial contact
- Number of re-visits in the first half hour
- Total time spent at enrichment in first half hour

Though the 2nd and 3rd indicators tended to be higher in successful enrichments there was too much variation between species, individuals and enrichments for the rapid assessment to be useful.

2. Again from Paignton Zoo, a whole watermelon was found to be avoided by the tigers, so response to it was minimal, but the pacing behaviour was minimal in its presence so it was a highly effective enrichment at decreasing pacing.

So what do the results of rapid evaluation tell us?

- The level of response to the enrichment item or method
- Whether this response changes with time ie habituation – if responses are well documented
- Very limited information about the effects on goal behaviour

The longer evaluation methods: are they practical in a zoo situation?

1. You must have measurable goals and work out exactly how you would measure effects by prediction and refining your questions.

Enrichment goal	Measurable?	How?
Provide a more stimulating environment	Not measurable	Needs to be broken down into more measurable segments
Increase physical fitness	Difficult	Physiological measures of health and fitness Activity levels. Level of locomotive skills
Increase adaptability and ability to cope	Difficult	Stress hormones Behavioural measures of stress Reactions to uncontrollable events Longevity, disease, reproduction history.
Increase the diversity of behaviour	Quite difficult	Variety of observed behaviour. Compare to detailed ethogram

Increase activity	Measurable	Use 'state' recording methods. Good definitions of active/inactive. Appropriate activity
Increase exhibit use	Measurable	Use 'state' recording methods. Good mapping of useable space. Appropriate expectations
Increase exploratory behaviour	Measurable	Use 'state' recording methods. Good definition of exploratory behaviour.
Increase foraging time	Measurable	Use 'state' sampling methods Definition of foraging / feeding
Decrease intra group aggression	Measurable	Use 'event' sampling methods Grouping of likely interaction events into agonistic or affiliative & their definition
Decrease an existing abnormal behaviour	Measurable	Use 'state' or 'event' sampling depending on problem. Pattern of occurrence.

2. Develop an ethogram of behaviours relevant to your goal

An ethogram is a list of behaviours defined so that any one can recognize them. In your enrichment evaluation ethogram, concentrate just on the behaviours relevant to your goal. To simplify your data collection other behaviours can be grouped under "other".

3. Decide on an observation schedule

Are the relevant behaviours states (long duration) or events (short duration)? States are behaviours the length of which can be easily measured for example rest, feed, play, pace and evaluating your goal would involve a comparison of the length of time spent performing one or more of these behaviours with and without enrichment. e.g. The simplest way to collect data on behavioural states is by instantaneous sampling, that is by noting the behaviour on successive instants separated by a consistent time interval. The classic way of collecting this sort of data would be every minute for a one or two hour session but it can also be done in a series of 10 minute sessions spread evenly through the day, a half hour session in the morning and another in the afternoon or on the hour or half hour for eight hours a day. With a group where you can scan the whole group and you can gather a lot of data quite quickly and do not need to be able to recognize individuals. Events are either behaviours too short in length to be easily measured or discrete behaviours such as an interaction or vocalization so are counted rather than timed. Events can be counted within a time interval and the collection sessions can be organized as above (except for the last option i.e. infrequent points over the whole day)

4. Design a study schedule

The classic behavioural study methods are not usually practical in the day to day zoo situation.

- What you can do depends on the time you have available and how you organize it
- Make every effort to keep all other conditions as similar as possible
- Randomise conditions you cannot control
- Maintain consistency of method, schedule and recording

There are two main study designs to choose from (BIAZA 2006, Plowman 2006).

a) Block design, where you have a block of pre-enrichment observation days, a block of enrichment days and a block of post-enrichment observations. This is practical if the enrichment is difficult to move in and out of the enclosure or for student projects. There are management and welfare disadvantages of depriving the animal of enrichment for an extended period and possibly habituation. There may also be control problems with weather and visitor numbers etc.

b) Randomise enrichment and non-enrichment days. This method allows a great deal of flexibility of study days and it also automatically randomizes for such factors as weather and visitor numbers.

You will need to observe with and without enrichments on at least 5 days to be sure that the differences you see are the effect of the enrichment.

5. Analysis of results

Once you have collected your data you can compare your daily averages between the different conditions.

To work out your daily averages:-

For state behaviours add the number of times each behaviour was scored in the session and work out the occurrence as % of the total number of time intervals in the session – eg. if pacing was recorded on 3 one minute intervals in a thirty minute observation session you would calculate that pacing was occurring $3/30 \times 100 = 10\%$ of the time. You can calculate this for the group as a whole or for each individual animal. Then if you did more than one session a day calculate a daily average from all the sessions for each observation day.

For event behaviours work out the frequency of each behaviour, eg. if there were 5 aggressive interactions in a 30 minute session, that is a frequency of 10 per hour. Again calculate the average from several daily sessions and compare the daily averages with and without enrichment.

The comparisons can then be graphed and statistics used to confirm any differences in goal behaviours. Sometimes the graph will show obvious differences but often statistics are necessary to confirm if the differences are significant (BIAZA Research Guidelines 2006).

**Fishing cat:
Effect of Enrichment on Exploratory Behaviour**

0

5

10

15

20

25

30

No enrichment

Fishicle

Deer faeces

Fresh herbs

Ball

New logs

Woodpile

Scatter feed

Hidden food

% EXPLORATORY

Conclusions

1. It is important to document and evaluate enrichment methods and programs to confirm their effectiveness
2. Setting measurable enrichment goals is essential for evaluation.
3. Rapid evaluation methods measure response to items or methods but do not reliably evaluate effectiveness.
4. Classic evaluation methods can be modified to be to make them more user friendly in a zoo situation.

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Captivating Canids; Dingo enrichment at Healesville Sanctuary.

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Abstract

Dingoes have been an iconic Australian native species displayed at Healesville Sanctuary for many years. Through out this time, the dingoes, like many zoo species have experienced change for the better. Traditionally, the animals had standard exhibits with little physical and mental stimulation. With lateral thinking and consideration into dingo behaviour, the dingoes now receive varied stimulus allowing them to utilise different skills and senses through out the day. Many of the enrichment ideas offered to the dingoes are common methods of enrichment offered to captive carnivores. Dingo enrichment tries to cover both aspects of physical and mental stimulation. A variation of permanent and removable items within the display, allow for physical enrichment and wellbeing. Items such as food, fragrant herbs/oils and human interactions, allow for mental stimulation. At the end of the day, we aspire to stimulate these intelligent animals allowing them to utilise and exhibit natural behaviours and skills.

Healesville Sanctuary has a long association with dingoes. In the past, dingo numbers were rather excessive allowing very little interaction; let alone enrichment. With better management and control, stock numbers were reduced allowing more time to be spent creating an interesting environment for the animals. As we now know, enrichment is a key element of animal husbandry. With better understanding of the species and utilising the given space we hope that dingo enrichment has increased, and will continue to diversify.

Many of the enrichment's given to the dingoes try to focus on elements of natural behaviour. Display furniture and fixtures are also constructed with this in mind. Much of the enrichment revolves around food, while others are olfactory, tactile and interactive where the mind of the animal is stimulated to achieve the desired result.

Today Healesville Sanctuary has 6 Dingoes consisting of three pairs; Harry and Opal (9 years of age), Macreadie and Ernie (7yrs), Kuma and Manuka (4yrs). Traditionally, the dingoes have been housed in Male/Female monogamous pairs. Two of the pairs would have access to a display with an adjoining off-limits yard, while the third pair would be held in the largest of the off-limit yards. Pairs were rotated from yard to yard approximately every 6 months.

The off limits yard consisted of a grass yard, with brick kennels. The Kennels were tall, allowing the dingoes to sit on the roofs giving them a vantage point; a key element to dingo happiness. The dingo displays and off-limit yards offered little stimulation for the animals. The displays were built with dry moats allowing varied elevation for the animals. A den was incorporated into both moats. In addition the displays were fitted with a shallow pond.

In recent years additional items have been added to the yards to allow for more opportunity. A series of platforms and hay bales placed in the yards, allow for a variation in height and vantage points. Ideally the height of the tallest platform was going to allow the dingoes to see over the solid fence, to observe the visitor activity on the other side. The risk of injury was a concern, should the dingoes jump from the full height of the platform, therefore a height reduction was necessary.

Hay bales, old wire reals and brush fence panels have been positioned, allowing solid objects for the dingoes to hide and chase each other. Hay bales are cheap, organic and easy to reposition. Old wire reals left on the rubbish pile, have found a new use as platforms or obstacles to run around. Waste not want not is a great motto. Moving exhibit furniture and re-arranging it has become much easier due to the light weight. The brush-fence panels are a more permanent fixture, which like the wire reals, were made from recycled material. The panels allow for another obstacle to be hidden behind or chased around. They are also great for hiding food at an elevated level, making the dingoes use their sense of smell.

Each display is fitted with a small pool which is approximately 20cm deep, while the off limit yards only have water bowls. Dingoes are not keen on water, yet will wade if there is an element of interest. Child clam pools were purchased and placed in the yards allowing the dingoes a form of water body in their off-limit yards. To make the pools more appealing, goldfish and trout are offered. So that the fish are not caught straight away, other objects such as leaves are placed in the pools, making the hunt a little more interesting and difficult. This is proving a great form of enrichment as the dingoes would be fascinated by the fish for lengthy periods. It was not long before the dingoes learnt that sitting and waiting for the fish to stop swimming to then pounce on them, was a lot easier than just chasing them around the pool.

Digging pits are a new addition to the dingo yards. In the past, scatter feeds were mixed amongst the mulch through out the display. Recently our trial digging pit was built in the dingo display. Two metres² in size and 50cm deep, the pits allow for food to be buried at a depth between, 15-20cm. The practice of digging for buried food is often seen when the dingoes cache their food or are digging up grubs. It became quite obvious that the dingoes had to really think about where the food was hidden, as their enthusiastic, fast pace of traditionally finding food near the surface slowed right down to stop and think about where the scent of food is actually coming from.

Other forms of exhibit furniture include old koala browse. At Healesville Sanctuary the koalas receive fresh browse daily, therefore the old browse is removed. The koalas often defecate and urinate on several browse branches if they are purchased above them. All of the koala smells just add to the assortment of aromas detected by the dingoes. The browse may be left on the ground for the dingoes to roll in and smother those selves in “Essence de la Koala” or urinate all over the top of it. The latter being the most frequent. With this being the case, the branches are often tied up against the platform or visual barriers. The browse branches then become scent posts for the dingoes to urinate on. Scent posts are a

major contributor to the dingoes' communication, which leads to the next form of enrichment.

The dingo complex is a series of interconnecting yards and raceways. The three pairs of dingoes are rotated on a regular basis; some times daily sometimes weekly. A great deal of natural behaviours, were observed when the frequencies of rotation increased. Shy animals became more confident on display as enthusiasm to explore was observed in body language. Head and tails carried high, hackles raised and the look of intent was often the appearance of the dingo urinating on the scent post to then be followed by raking the ground. A 1 hour rotation was always great to see when the designated pair of dingoes went out for their daily walk. Their look of surprise and curiosity to arrive home to find that somebody else had been sleeping in their bed while they were out.

Other forms of olfactory stimulation are those often used with carnivores; oils, herbs, species etc. such items are used randomly, some working better than others. Out of all essential oils, herbs and spices on offer, the one item guaranteed to get the role of approval is curry powder.

The role of approval is usually given to an object found on a walk. Healesville Sanctuary is known for walking its dingoes around the park and amongst its visitors. Every day, a pair of dingoes is walked around the park. If time allows, a second pair may be taken out.

There are no limitations to where the dingoes are allowed to go in the park. By choice the most desirable of destinations would have to be nature trail. Nature trail is an area of natural bush within the boundary of the sanctuary. The area is frequented by staff walking dingoes and the occasional class lesson being held outside of the education room. Nature trail is "time out" for the dingoes as it is bounding with free range animals such as Eastern Grey Kangaroos, Swamp Wallabies, wombats and Echidnas. Much to the disgust of the dingoes, they must remain on lead. Nevertheless, the dingoes treat themselves to the abundance of bush truffles along the way. If it's not worth eating, more than likely it will be worth rolling in.

Food enrichment is offered in a number of ways depending on the pair in question. As mentioned earlier, scatter feeds may be buried or literally scattered around the yard. This may be a treat i.e. dry liver or may be their actual food for the day. The morning breakfast of day old chicks lasts a bit longer if the chicks are cut into smaller pieces. Dog kibble is occasionally used as a scatter, yet this is not a favoured food item from the dingoes' perspective. When possible, blood trails are often worked in conjunction with scatter feed, just to make the food item that little harder to find.

Bungee cords and food balls are used, depending on the pair in question. Such objects may instigate a fight, so care is taken. Euthanised quail sized chickens are often fed to the dingoes using a bungee cord which is attached to a suspended wire. The suspended wire is high enough to then make the dingoes jump up for the food. The dingoes really appear to enjoy the bungee. As for the food balls, the incentive is not there and they give up very easily.

An item that could be considered as a food is snow. What better way to view Alpine dingoes than in snow. In August 2005, Mt Bulla was kind enough to transport several tonnes of snow to Healesville as a form of enrichment. The dingo display was first on the list. With many keepers and wheelbarrows falling on top of one another, it was great to see the reaction of the dingoes. The older dingoes approached with caution, while the younger dingoes ran straight in. By the end, all dingoes happily ate, rolled, urinated on and ran through the snow.

Over the past few month the dingoes have been exposed to a new form of enrichment, training. Over the next year all our dingoes will be trained to sit, drop and wait, with the youngest pair being trained to open mouth, present feet for claw trimming and roll for stomach inspection. Although the purpose of training is to increase ease of medical examination it also stimulates the mind. Enrichment is a tool used to make animals think about there surrounding and what better enrichment than mental simulation and learning. Already our oldest female, Opal has shown that 'you can teach an old wolf new tricks' by sitting on queue for a treat.

The most rewarding enrichment is the quality time we can offer to the dingoes. Having the ability to handle them, we can undertake certain activities that may not be possible with other carnivores. As previously mentioned, the dingoes are walked through the park, changing their day and enlightening the day of our visitors.

The dingoes receive a great deal of human interaction with the keepers. Time is spent just sitting with them, grooming them, wrestling with them and generally bonding with them. Whether this is more enriching for the keepers or the dingoes, we will never know, but I think the howl given on our departure is a dead give away.

Environmental Enrichment for shelter cats and dogs

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Abstract

Confined and restrictive environments impose significant stressors upon animals housed in them. This is particularly true for shelters and pounds, where the animals have also experienced a disruption in their relationship with their owner, loss of established routines and may have experienced neglect or abuse. Shelter environments are also highly stimulating. Typically they are very noisy, with high levels of activity during the day but have little or no activity for fifteen or so hours overnight. Animals are kept in relatively close quarters and in exceedingly spartan surroundings, with very limited opportunity to interact with people. As a result they often become very vocal, hyper-reactive to other animals (including humans) and have an increased tendency to develop stereotypical behaviour.

Maintaining socially acceptable behaviour and the psychological well-being of these animals is critical. Not only does it literally determine whether they live or die, but it also affects their ability to be successfully reintegrated into family homes and may also affect public safety.

This paper will detail some of the enrichment measures introduced at one Melbourne shelter. These include manipulating food presentation, social interaction with peers and humans and introducing behavioural training to preserve, or even enhance, socially desirable behaviour in the cats and dogs housed there. The enrichment protocols had to comply with the requirements of infection control and government regulation, yet require few resources. The presentation will include video footage taken at the shelter and identify the impact that enrichment has had upon adoption success rates.

Behavioural deterioration can occur when animals are confined in restrictive and unnatural environments. This phenomenon was originally observed in zoos, where the well-being of irreplaceable exotic animals was compromised (Weiss & Wilson, 2003; Markowitz & Aday, 2004; Zulch & Harman, 2004);, and in experimental laboratories (McCune, 1995; Bayne, 2003), where the resulting abnormal behaviour made it impossible to accurately gauge experimental effects.

Shelter cats and dogs are confined in highly restrictive, barren environments where they are often deprived of social interaction with conspecifics and humans. Shelter animals are often subjected to other stressors, including a disruption in attachment relationships with their owner, loss of established routines and they may have experienced physical neglect or abuse. Behavioural deterioration resulting from being shelter stays accounts for 10% of all dogs euthanased in shelters in Melbourne (Marston, Bennett, & Coleman, 2004). Yet, for shelter animals maintaining socially acceptable behaviour is critical in determining not only whether they live or die but also whether they can be successfully re-homed, without taking behaviour problems into the new home.

Dogs and cats often arrive at shelters having experienced a very stressful time (Marston et al., 2004; Marston, Bennett, & Coleman, 2005b). They may have been spooked by fireworks or thunder and wandered, lost for extended periods of time, without food and water. Some animals may have been abused or suffered neglect through owner ignorance and have been malnourished or received inadequate veterinary care. Others have been intentionally abused. Every year a number of dogs are admitted with cigarette burns, others have been confined in small and inappropriate areas for extended periods, and a lesser number have been physically brutalised. Or perhaps they've simply been abandoned by their owners. Each year a number of people move on from rental properties and leave their animals behind, locked up in the garden or house. Each and every kitten season cardboard boxes will be left at shelter doors, containing mother cats with their kittens. Sometimes people have problems of their own that cause them to give up loved animals, for example one dog was found tied to a tree in a suburban park with a big bag of dog food, bucket of water, some dog toys, a blanket and a note that explaining that 'Rex is a really good dog but I just can't cope anymore. I trust God will find a good master for him'. For some animals a welfare shelter might provide the most secure and safe place that they have ever known, but for others it will be a noisy, smelly, unknown and stress-inducing place.

Shelters are highly stimulating environments. Typically shelter dog kennels are very noisy with levels measured of 120db (Sales, Hubrecht, Peyvandi, Milligan, & Shield, 1997). This is similar to the perceived noise of a jumbo jet flying at two hundred feet above you. Staff are required to wear hearing protection, but whether the hearing of shelter dogs and cats is affected is currently unknown. Behavioural changes, including increased reactivity and arousal, have been associated with socially and physically restrictive environments for dogs (Beerda, Schilder, van Hoof, De Vries, & Mol, 1999). Shelter stays are also stressful for cats, who acclimatize to shelter life far more slowly than dogs (Rochlitz, Podberscek, & Broom, 1998b) and may affect how easily a cat can develop subsequent bonds to a human (Rochlitz, Podberscek, & Broom, 1998a). Environmental enrichment has been shown to be effective in ameliorating the behavioural indices of stress in many shelter cats (Gourkow, 2001).

During work hours there are high levels of activity from shelter staff, volunteers and public visitors, but overnight there is little, or no, activity for fifteen hours. This means that shelter animals have very limited opportunity to interact with people, which particularly affects those dogs that are well socialised to humans (Coppola, Grandin, & Enns, 2003). These animals often become very vocal, hyper-reactive to other animals (including humans) and have an increased tendency to develop stereotypical or self injurious behaviours such as 'lick granulomas'.

Environmental enrichment strategies suitable for use in shelters emulate many of those used in zoos and include manipulating food presentation, social interaction with both conspecifics and humans, and introducing behavioural training to preserve, or even enhance, socially desirable behaviour. The enrichment protocols must be conducive to stringent infection control, comply with government regulation and require relatively few

resources. The following techniques have been implemented at Animal Aid Trust, Victoria, progressively from 2002, with great benefit to the animals.

Some environmental enrichment can be offered in the runs, including food puzzles and toys, which must be easily disinfected or disposable. Food puzzles might involve Kongs or treat balls for dogs, whilst cats might receive dried fish in scrunched up toilet roll tubes which are disposed of, after use. These techniques are suitable for animals held in quarantine or post-operative recovery areas. In summer the Kongs may be frozen, or small treats might be frozen into ice-blocks, and then placed in paddling pools with a few inches of water to allow dogs to bob for them, making the experience three dimensional and therefore more interesting.

Olfactory stimulation includes sprinkling small treats sparsely around fenced exercise areas, aromatic oils such as lavender, mint and sprinkled in the areas, allowing the 'house' cats, sheep and other 'exotic' shelter guests to wander through an exercise area before a dog is allowed in. Cats get rubs, made of heavy-duty rope wound around a broomstick, which are scented with aromatic oils, bleach or Feliway. The 'rubs' can also serve as scratching posts. The odour of green living things is a de-stressor for some mammals (Akutsu et al., 2002; Sasabe et al., 2003) and so the dogs get 'Time Out' in green yards, surrounded by trees and wild birds, whilst cats have an enclosed 'garden' where they can climb things, chew or smell pots of grass, catnip and lavender and sun themselves. Placing the animals in such areas also provides visual stimulation and expands the very limited view of the world that they would normally get from their run.

A major element of the environmental enrichment for dogs involves obedience training. All training has a problem-solving component i.e. what must I do to get this person to give me a treat or pat? This is a deliberate strategy to provide dogs with some control over their environment, thus countering the effects of learned helplessness (Seligman, Maier, & Geer, 1968; Seligman, Weiss, Weinraub, & Schulman, 1980; Dess, Linwick, Patterson, Overmier, & Levine, 1983). Of course, dogs only get rewarded for the socially acceptable and desirable behaviour, but they have to work this out for themselves. Also, interaction with humans is effective in reducing the cortisol levels in sociable shelter dogs (Coppola, Grandin, & Enns, 2006).

Shelter dogs cannot be taken off the premises for exercise (unless there is a special exemption to the regulations), with the result that walks tend to be limited in duration and uninteresting in nature. At the beginning of the program implementation, one side of the Animal Aid Trust property was densely bushed and not used for anything. A path has been constructed which wends its way through this area, taking dogs from the kennels to the front exercise area. This area contains a number of 3-D activities such as gates, ramps, balance beams, steps, weaving poles etc. Interestingly, structuring these activities has resulted in volunteers spending more time walking individual dogs. This is a definite bonus for the dogs. Not only is extra time with people rewarding in and of itself, but it also allows the dog a greater opportunity to relax away from the intense kennel environment.

What difference have these changes made? Unfortunately we cannot separate the benefits of Environmental Enrichment from the introduction of rehabilitation training and some structural changes, such as introducing extra gates to prevent dogs 'running the gauntlet' when being moved around the site, which were implemented at the same time. However, it has been possible to objectively evaluate the overall effect of these changes on the dogs using admission statistics. Quite simply more dogs are being re-homed. After the changes 96% of dogs that pass the behavioural assessment were re-homed, as compared to 73% previously. Not only were more dogs being re-homed but fewer dogs were returned post-adoption (3.5% compared to 11%). The effect of repeated shelter admissions on 'boomerang' dogs has not been quantified, but is likely to be significant and result in animals that are progressively less likely to fit into normal pet homes. The reduction in returns is especially encouraging when it is recognized that these figures include dogs that previously would not have been re-homed, due to relatively minor behavioural problems or timidity. These animals now undergo rehabilitation training specifically targeted at the problems identified as problematic for new owners (Marston, Bennett, & Coleman, 2005a).

Dogs are also being re-homed more quickly (an average of 15 days instead of 24). The rate of euthanasia for behavioural deterioration, occurring during the shelter stay, has also decreased, from 10% of all euthanasia to approximately 3%. Although not directly measured, the kennels are so much quieter than in the past, that staff no longer need to wear earplugs and the public frequently comment on how calm and quiet the dogs are. Whilst we don't have any statistics for the cats the public and visiting international shelter experts have commented on how welcoming the cattery is and how happy, relaxed and social the cats are.

Future areas for research include identifying non-invasive measure of stress, studying the time-course of an animal's adaptation to the shelter after admission and evaluating the effects of auditory stimulation (Wells, Graham, & Hepper, 2002), increased peer socialisation and species-specific pheromones (Pageat & Gaultier, 2003).

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A Behaviour Enrichment Plan for Tasmanian Devils *Sarcophilus harrisii*

Mandy Smith
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Abstract

"Enclosures should enable animals to show as wide a range of behaviours as possible, failure to provide opportunities to achieve this end can lead to apathy or relentless spursuit of impossible objectives"(Poole1996). Tasmanian Devils have always had a reputation of being a challenge to exhibit successfully with the displaying of varying degrees of undesirable behaviours being well documented. Developing an enrichment plan that will achieve its objectives and be effective in the long term requires careful planning and, as with everything, the better the plan the better the result. This paper discuss' the formation of a complete protocol using a six step framework SPIDER developed by Disney's Animal Kingdom. The plan firstly addresses the undesirable behaviours and develops a working hypothesis as to why they might occur. The importance of understanding natural behaviour is emphasized, as well as, and often overlooked, methods to evaluate the program and modify according to the results. Finally the plan incorporates diet, timing of feeds, enrichment with a high sensory based component and also takes into consideration the ease of implementation to ensure minimum demand on keeper time for maximum effect.

Enriched Learning

Rick Hammond
Melbourne Zoo

Abstract

Environmental enrichment for animals can be a great way to create personal connections between people and wildlife. Making something special for an animal, and then watching the animals engage with it, can be an emotional experience. It removes the sense of detachment that our school visitors often display towards captive animals, and can also be a great hook into many different educational themes from survival requirements of animals, to the role of zoos in conservation. Involving a school group in browse planting can lead to a whole school community getting involved in fundraising and other action around endangered species. From a keeper's perspective, students are a largely untapped resource to create enrichment items; from basic food treats through to high tech play items and problem solving challenges. They can also come up with fresh ideas and designs for new items to ensure enrichment does not become repetitive. It's an exciting new field for conservation education where partnerships between keepers, educators and students can be of benefit to all.

Enriched Learning

Rick Hammond- Education Officer, Melbourne Zoo, Australia. As a zoo educator my primary role is to provide opportunities for students to connect with wildlife. Special experiences such as touching or feeding animals can engender greater respect and care for them, but on a large scale this is difficult for a zoo to provide. The Zoos Victoria vision is to ‘... build enduring relationships between people and wildlife for a future in which humans live in balance with the natural world’. If we are to move closer towards achieving this vision we need to look for more ways to provide experiences that compel our visitors to participate and engage with wildlife rather than just view our exhibits passively. Creating environmental enrichment for animals, and then watching them engage with it, can be an emotive experience. It removes the sense of detachment that our school visitors often display towards captive animals, and can also be a great hook into many different educational themes from survival requirements of animals, to the ethics of keeping animals in captivity and the role zoos play in conservation.



The new curriculum for Victorian Schools, the Victorian Essential Learning Standards (VELS), has a greater emphasis on social development to better prepare students for life beyond school. Learning in a real life context is now recognized as more important than learning a whole lot of content, much of which will be irrelevant as soon as students leave school. By incorporating enrichment design and development into our behaviour and ethics learning programs, for example, the learning experience becomes more real and hands on and ultimately more enriching for the students. Concepts such as ‘associative learning’,

‘foraging behaviour’, and ‘insight learning’ make sense when students are directly involved in influencing animal behaviours through enrichment. Learning becomes more than just an intellectual experience but also an emotional one, which is what we’re aiming for if we are to influence students attitudes towards wildlife.



As part of the VELS, schools are also looking for opportunities for students to engage in projects that can be undertaken across different subject areas. Environmental enrichment can be studied through art/craft, science, design and technology, humanities and communication, and has the potential to become a whole school theme. One of the challenges for zoo educators is to involve schools in real action towards a

sustainable future. Rather than just engaging students while they are at the zoo on an excursion we hope that for some schools a zoo visit is just part of an ongoing conservation partnership. The orangutan browse-planting pilot project highlights just how enrichment can hook many people into a conservation cause. Groups of students from St Monica’s Primary School and Whitefriars College have been planting trees at their school for Melbourne Zoo’s orang-utans to use for nesting materials. This small effort has



inspired their wider school communities into fund raising and awareness raising activities. Local newspapers have featured stories about this partnership between schools and the zoo, which has spread our conservation messages further than just the school community. It’s a true snowball effect where by actively participating in a zoo experience students are motivated to take action to help endangered species. It’s also a great way to get positive publicity for the zoo in the media.

For younger visitors our aims are to instil a love and respect for nature so that they will be motivated to care for wildlife throughout their lives. Again enrichment is a great road in to develop those personal connections with our animals. Through making popcorn and dried fruit treats for primates in pinecones, raisin boards and bamboo tubes, or piñatas for meerkats and bilbies, children learn a lot about the natural behaviours of these animals. As they are able to personally do something special for these animals they will be more likely to remember the experience years later, than they would just by visiting the zoo. Certainly in the case of our Zoo Adventures holiday program we have created many young zoo ambassadors through these enrichment activities, which are an integral part of their day at the zoo.

From a keeper's perspective, students are a largely untapped resource to create enrichment items; from basic food treats through to high tech play items and problem solving challenges. Schools are a great collection point for recycled materials that are used for enrichment such as cardboard tubes and milk cartons. Woodwork and art rooms enable construction, drilling of raisin boards or bamboo tubes, piñatas, or the creation of new items not yet imagined. Through consulting with keepers we can provide guidelines to schools about safe materials to use and the natural behaviours that we want to encourage with different species. By involving students in the process we are not only helping connect young people with wildlife, we are also making use of their creative energy to come up with fresh ideas and designs for new items to ensure enrichment does not become repetitive.



The primate keepers at Melbourne Zoo worked closely last year with students from RMIT to develop some new enrichment ideas for the orang-utans. This is a great example of how tertiary students with advanced skills in design and engineering could become involved in enrichment projects for our zoo animals. There was a recent news story about a zoo that had created a robotic toy zebra for the lions to chase around. That might not be exactly what all keepers imagine when it comes to enrichment but by working with zoo

educators, and developing partnerships with learning institutions, the possibilities of creating low cost innovative high tech enrichment solutions are very real. It's an exciting new field for conservation education where partnerships between keepers, educators and students can be of benefit to all...especially our wildlife.

**The Challenges of enriching the birds and mammals of the
Australian Bush Precinct at Melbourne Zoo, November 2006**

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Abstract

The goal of enrichment is to increase activity and stimulate natural behaviours of animals as they interact with their environment. Mental and physical stimulation occurs by adopting methods such as various food delivery techniques, scenting the environment, providing natural and artificial objects of interest and conducting training sessions. Enriching the birds and mammals of the Australian Bush Precinct is part of the daily husbandry role of the keepers on this department. This can often be quite challenging, particularly with marsupials, as there is not an extensive range of options available to encourage natural activity. Results amongst this group of animals can be more difficult to gauge in comparison to other mammals. One of the most successful enrichment programs on this precinct is the conditioning program undertaken with the Goodfellow's tree kangaroo. This species has been maintained at Melbourne Zoo since January 1990, as part of a managed captive regional population. An established conditioning program ensures all husbandry needs of these animals are adequately met, important morphometric measurements are obtained and an educational and entertaining experience is provided for our visitors. It is also an important source of enrichment for these animals through keeper contact and mental stimulation. This program will be discussed in detail during a PowerPoint presentation along with other methods of enrichment used with birds and native mammals on this department.

Introduction

Enrichment on the Australia Bush precinct at Melbourne Zoo is considered an integral part of daily husbandry. A variety of methods are used to create an environment in which animals are stimulated both mentally and physically whilst encouraging natural behaviours and creating a healthy state of mind. It is often quite challenging to enrich marsupials and other native fauna, as success can be difficult to measure. A naturalistic approach is usually more successful taking into account the behaviors and habitat of wild populations. Our keepers' intimate knowledge of the natural history of the species with which they work has allowed the development of numerous successful enrichment methods on the Australia Bush precinct. These are provided through exhibit design, training sessions, food delivery techniques, scenting the environment and providing natural and artificial objects of interest. The various methods used for different species will now be discussed in greater detail.

Birds

There is a wide range of techniques that can be employed with birds. Food delivery techniques can be explored such as the scattering of mealworms, crickets, moths and maggots. These live food items can also be placed in a suspended plastic container, such as a Chinese food container with lid, with holes cut in the bottom to gradually dispense food items throughout the day. On a warm day, fly pupae placed in a similar container with a hole made in the lid, will eventually hatch and provide a good live food source and

much activity. Citrus plants carrying caterpillars are supplied by our butterfly house and give the birds the opportunity to forage throughout the foliage. Pinecones with a variety of seeds and nuts adhered with gum acacia are hung in aviaries for parrot and finch species and fresh browse is supplied for all birds. Natural foods provide a variety of colours, tastes and textures. Flowering browse can be added for nectar feeders, fruit staked on trees are especially loved by lorikeets and scarifying mulch encourages foraging behavior for invertebrate life.

Other enrichment techniques encourage a variety of natural behaviors. Blue items are offered to the male Satin Bowerbird for use in his bower, snake sloughs are used for a predator response in birds of prey, dirt baths are utilized by emus as well as billabongs for lying in during summer. We have also found some of our interpretive pieces have been quite useful in encouraging incubating behavior in our Emus and Brolga as both these species sit on artificial nests and eggs during the breeding season. This situation is of course not appropriate in species where breeding is desired but allows natural nesting behaviors in those that are not to breed. Care must be taken that prolonged periods of sitting, which may be detrimental to animal health, do not occur.

Platypus

As live food is given to our Platypus daily this allows them to forage for their food in a natural manner. A variety of food items are offered and these are varied in type, amount and location in which they are offered on a daily basis. Activity levels are also increased after the water level in the display tank has been dropped and is then refilled via a high pressure water outlet, which provides a strong current for the animal to swim against. We also provide opportunities for digging in the form of a dirt bank in the outdoor section of our holding facility. This area is used as the sleeping burrow for one of our male platypus on a regular basis and the outdoor ponds allow a more natural environment for animals through the use of dirt banks, submerged logs and large array of aquatic plants and nesting material. These furnishings can be rearranged regularly to provide a changing and stimulating environment.

Echidna

Melbourne Zoo has had success with a number of different food delivery techniques for echidnas. Food can be placed inside a cone with multiple holes drilled into the sides so the animals need to insert their beak and tongue to access food as they would with a termite mound or ant nest. This provides more of a challenge than food simply placed in a bowl as well as deterring birds and these two methods can be interchanged. We also provide termites and ants in logs when available to allow foraging behaviour. Our echidna enclosure provides a variety of substrates such as sand, mulch and dirt to allow animals to dig and bury in. During the summer months a pond is added to the enclosure to allow swimming. Male echidnas are removed during the non-breeding season and reintroduced at the commencement of the breeding season. This produces a lot of activity as the males begin to show interest in the female and breeding behaviour begins. Some of our animals have also been conditioned to be handled for use in animal encounters and to allow health checks to be performed more easily.

New Holland Mice

Fine washed sand is used for substrate in our mouse enclosures to encourage digging and tunnelling. Furnishings such as PVC pipes and boxes can also be utilized for hiding and nesting. Natural vegetation such as native grasses and acacia browse are also used in enclosures to provide a variety of smells as well as cover. We have also had some success with the use of ping-pong balls with a small hole drilled into the side filled with seed as a more challenging food delivery system.

Eastern barred bandicoot

Our bandicoots are given scatter feeds of live mealworms and crickets 3-4 times a week as this encourages foraging behaviour. Live food can also be placed in PVC pipes with holes drilled in the side, or plastic food balls to allow invertebrates to be released slowly. Mulch is added to the enclosure along with meadow hay and native grasses, which provides nesting opportunities and a variety of smells. We also scarify the mulch regularly to encourage invertebrate life to flourish.

Macropods

Macropod species at Melbourne Zoo are housed in appropriate social groups, which allows for enrichment through intra species interactions, allowing for natural mob behaviour. Fresh browse such as Eucalypt and other native species as well as the introduced Mirror Bush are offered to encourage browsing, particularly for browsing species such as Kangaroo Island kangaroos. These items can also stimulate the olfactory senses as they contain a variety of smells due to the fact that they have been sourced from the koala exhibit. Placement of browse at height using Velcro straps to attach branches to trees encourages the animals to stretch upwards and browse as they would naturally. Hay feeders are also used to supply feed and are moved around the exhibit on a daily basis. All of our macropod enclosures contain substrates such as soft soil and sand to encourage digging and dust bathing.

Koalas

We have found the best source of enrichment for our koalas is to provide them with ample opportunities to climb and explore their surrounds, as well as offering a variety of eucalypt species. Eucalypt browse is offered in PVC pots that are located at various points around the exhibit so that food can be placed at different points on different days. Another stimulus is changing the dynamics of the group. We have a young female who is slowly being introduced to a breeding pair and this encourages the animals to vocalize, the male may scent mark and the female becomes more active. This stimulus encourages a lot of the natural behaviours that would be occurring in a wild population. Two of our koalas have been conditioned for handling and are regularly taken out of their enclosures for keeper encounters with the public. These two individuals often seek out the keepers for interaction.

Southern hairy nosed wombat

One of the most important forms of enrichment for any wombat species is providing them with the ability to dig. At Melbourne Zoo this natural behavior is catered for by the provision of a large area of one-meter deep river sand within the enclosures. Keepers fill

in any new burrows dug over night to encourage new digging each evening. Southern hairy nosed wombats have a keen sense of smell and the addition of objects with a particular scent is always of interest. This appears to be particularly successful when the scent is that of other wombats. This can be as simple as placing an object such as a plastic bucket in with each group of animals and rotating these items on a regular basis. Faecal matter from other wombat groups can also be used to arouse interest but it must be ensured that each group of animals is parasite free before this occurs. The provision of browse is also great enrichment as it has a two fold effect, initially providing bark and wood to chew on and then as these items are rotated through enclosures the olfactory senses are also once again engaged. At Melbourne Zoo we recycle old koala gum for this purpose and therefore introduce a variety of scents. Food items such as sweet potato and carrots can also be placed around the enclosure, buried and placed down burrows so that there is some effort required to locate them. As with most species, housing Southern hairy nosed wombats in appropriate social groups also provides enrichment in the form of intra species interaction. This species is a communal species and at Melbourne Zoo we house our breeding animals in groups comprising one male (due to aggression between males) and two females. This allows for natural interactions between animals as well as breeding without the negative effects of excessive aggression between males. Socialisation of wombats, particularly young ones is very important to instil normal wombat behaviours and artificial objects such as bowling balls provide a stimulus for young wombats to play.

Goodfellow's Tree Kangaroos

There is a wide range of methods employed to enrich the lives of the tree kangaroos at Melbourne Zoo. Being an arboreal species, a good climbing structure erected with many aspects to explore is essential. For example, we have rope ladders that are a challenge to climb both vertically and horizontally positioned. We also provide them with a height that they feel comfortable to retreat to, with many resting platforms. Furnishing changes such as new logs or new mulch being added always create excitement. A variety of browse species can be selected seasonally and this stimulates olfactory and taste senses. We provide this in PVC pots and position bunches of foliage and flowers at different points around the exhibit with Velcro straps. Pinecones with food wedged in the gaps, which require some work to obtain the food, can also be placed in the exhibit. A plastic treat ball hung up in the enclosure periodically stimulates much interest. Food items are hidden inside the ball, or avocado is smeared on the outside surface and both techniques provide great interest as they are food focused and the animals spend time manoeuvring the ball to gain a treat. Another option with this device is to swap it between exhibits. The males in particular focus on the new scent of the ball and sometimes it encourages territorial or sexual behaviour. In summer months we have explored the use of large blocks of ice containing fruit and freezing fruits such as bananas. These items seem to be enjoyed as the animals spend time licking them. The olfactory senses can also be stimulated with a range of pure essential oils trialled at different points around the exhibit. We have found this creates an immediate interest but it is only short lived. We house our animals in breeding pairs and young usually remain with parents for at least 15 months until they are weaned. This companionship allows social enrichment in a captive environment. Many tree kangaroos in zoos are housed individually until breeding time

and are removed after mating. A conditioning program for this species has been in place at Melbourne Zoo since 1998. In 2000 the program was revised and it relies on the food motivation of the animals. The tested method of positive reinforcement is employed and a consistency of approach is an essential action directed at gaining trust and confidence with the animals. A verbal and visual cue is given, a target stick is used as an extension of our hand, the animal is bridged at the point when the command has been carried out successfully, such as touching the target and reinforcement is provided with a favourite food item. The main goal was to have the tree kangaroos come down to a level where we could physically examine them and also display them well to visitors. A suite of activities such as locomotion on the ground, balancing on thick ropes strung between enclosure furniture, climbing down vertical or angled branches and reaching up to mount a rope are some examples of natural behaviours we ask to be displayed. This conditioning allows us to have the animals stand on scales for weighing, box trained for easy movements, pouch check females and record the development of young. The significance of these actions has been woven into a keeper presentation at the Zoo which captures the interest and imagination of visitors and highlights the importance of conserving this species in Papua New Guinea. The animals actively engage the keepers for interaction and it is beneficial to have a close bond, which helps enrich their lives. This provides both artificial and natural situations that allow the animals to display their instinctive behaviours, assimilate into a captive situation, breed and display natural behaviours effectively.

Conclusion

Enrichment for native birds and mammals need not be complicated. Some of the more simple forms of enrichment have proven to be the most successful at Melbourne Zoo. As smell is an important sense in marsupials this has been a large part of our focus and food based enrichment appears to work well in both birds and mammals.

APPENDIX I:

Native browse species:

- Eucalyptus species- *E.viminalus*, *E.obliqua*, *E.ovata*, *E.camaldulensis*, *E.radiata*, *E.goniocalyx* and *E.botryoides*.
- Acacias
- Melaleucas
- Banksias
- Native grasses such as Kangaroo grass, *Poa*

Exotic species:

- Tree Lucerne
- Various willows
- Poplars
- Wild plum
- Mirror bush
- Chinese lantern
- African hemp
- Bamboo
- Various grasses such as Elephant grass, Kikuyu grass

When Enrichment Goes Bad

Dr Kate Bodley
Melbourne Zoo

Abstract

Development of environmental enrichment devices/techniques must include careful consideration of possible risks to animal safety. Veterinarians can play an important role in assessing a device for possible safety risks. It is difficult to make an enrichment item completely safe for use in all circumstances. Young (2003) provided a comprehensive list of questions and testing procedures that should be satisfactorily completed before allowing an animal access to a new enrichment device. Veterinarians frequently manage the adverse effects of enrichment objects in domestic animal practice (e.g. gastrointestinal foreign bodies +/- intestinal perforation, dental fractures), and this experience means they can provide a useful perspective on the design of enrichment devices and their safety. Key points that should be considered in every case are illustrated by examination of several cases of injury or illness induced by enrichment objects in a zoological setting:

- *oral trauma, including dental fractures:*
 - *foreign body entrapment in the oral cavity of a giraffe (Giraffa camelopardalis rothschildi)*
 - *oral trauma in a maned wolf (Chrysocyon brachyurus)*
 - *dental fractures in African wild dogs (Lycaon pictus)*
- *gastrointestinal obstruction resulting from foreign body ingestion:*
 - *gastrointestinal foreign body in a fishing cat (Prionailurus viverrinus)*
 - *potential for gastrointestinal foreign body ingestion by Hamadryas baboons (Papio hamadryas).*

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Environmental Enrichment Plan for Elasmobranchs at Shark Bay. Sea World, Gold Coast, Australia

Sara Smith

Abstract

With the construction of Shark Bay, a new exhibit at Seaworld, Gold Coast Australia, the opportunity has arisen to establish an enrichment plan for the inhabitants of the exhibit, in particular, the elasmobranchs that are our focal animals. This Enrichment plan encompasses past techniques that have been used sporadically within the park as well as suggested ideas and enrichment items that have been utilised in other aquaria. Being a unique environment that is open to the elements and housing unique animals and unique combinations of animals (e.g. Tiger sharks with Whaler species) enrichment items do have some limitations. But, in particular, the fact that all areas of the enclosure are constantly on show to the general public there are some significant limitations to the enrichment that can be used in this exhibit. The animals on exhibit are constantly visited by guests who swim in the enclosure with them. This creates further limitations so as to not include food based enrichment whilst guests are in the water, as well as to not use enrichment items that can detract from the guests experience of Shark Bay or even be hazardous to the guests. This enrichment plan hopes to overcome these limitations of the exhibit whilst still providing an enriching environment for the inhabitants of Shark Bay and identify future directions that the environmental enrichment can move towards. It is also hoped that a training program can be developed and implemented within this exhibit with some of the elasmobranch species currently housed in Shark Bay.

With the construction of Shark Bay, a new exhibit at Seaworld, Gold Coast Australia, the opportunity has arisen to establish an enrichment plan for the inhabitants of the exhibit, in particular, the elasmobranchs that are our focal animals.

Existing Conditions

Present animals:

There are currently a large number of animals housed at Shark Bay (approximated at over 10,000). Of these there are the following elasmobranchs:

- 0.1.0 Tiger Sharks *Galeocerdo cuvier*
- 1.4.0 Dusky Whalers *Carcharinus obscurus*
- 0.1.0 Bull Whalers *Carcharinus leucas*
- 1.0.0 Bronze Whaler *Carcharinus brachyurus*
- 0.1.0 Lemon Shark *Negaprion acutidens*
- 11.29.9 Mud Rays *Dasyatis fluviorum*
- 5.3.0 White spotted Eagle Rays *Aetobatus narinari*
- 0.0.8 Giant Shovelnose Ray *Rhinobatos typus*
- 1.1.5 Eastern Shovelnose Ray *Aptychotrema rostrata*
- 0.1.0 White spotted Guitarfish *Rhynchobatus djiddensis*
- 0.0.4 Eastern Fiddler Ray *Trygonorrhina faciata*

0.4.0 Zebra Sharks *Stegostoma fasciatum*
5.2.3 White tip reef sharks *Triaenodon obesus*
6.4.0 Black tip reef sharks *Carcharhinus melanopterus*
1.0.0 Nervous Shark *Carcharhinus caudatus*
0.1.0 Scalloped Hammerhead Shark *Sphyrna lewini*
0.0.1 Grey Gummy Shark *Mustelus sp. A*
3.1.19 Grey Carpet Sharks *Chiloscyllium punctatum*
1.1.7 Epaulette Sharks *Hemiscyllium ocellatum*
0.1.0 Port Jackson Shark *Heterodontus portus jacksoni*
0.0.1 Colclough Shark *Brachaelurus colcloughi*
1.0.0 Spotted Wobbegong Shark *Orectolobus maculatus*
1.6.1 Blue spot lagoon rays *Taeniura lymma*
3.3.18 Blue spot mask Rays *Dasyatis kuhlii* (plus recent births, number unknown)
0.1.0 Reticulated whip ray *Himantura uarnak*
1.2.1 Mangrove whip ray *Himantura granulata*
1.2.0 Blotched Fantail Ray *Taeniura meyeni*
1.0.1 Smooth Stingray *Dasyatis brevicaudata*

Husbandry routine

Reef Pool:

700-930 Divers in reef pool cleaning windows, basic pool clean and target feed all elasmobranchs.

1030-1300 Guest snorkel tours in reef pool.

1430-1630 Guest snorkel and SCUBA dive tours in reef pool.

1630-1700 Feed offered to all animals in reef pool. All elasmobranchs are hand fed a portion of their Daily Food Allowance as well as excess food being scattered throughout the pool to encourage natural foraging behaviour.

Shark Pool:

Tuesday, Thursday, Friday, Sunday:

700-900 Divers in shark pool cleaning windows.

1000-1230 Divers vacuuming in shark pool

1400-1630 Divers vacuuming in shark pool

1630-1700 Chopped fish scattered in shark pool for pelagic fish species Monday,

Wednesday, and Saturday:

700-900 Divers in shark pool cleaning windows.

1000-1100 Set up for shark feed (lower feed cage into pool, attach to suspended rope at set location.)

1230-1430 Shark feed offered from feed cage

1430-1500 Feed offered from Eastern Beach to Tiger shark(s)

1500-1530 Feed cage removed from pool.

1600-1630 Chopped fish scattered in shark pool for pelagic fish species

Current enrichment:

Nil planned enrichment.

Current behavioural problems:

There are very few notable behavioural problems within the collection at Shark Bay. The majority of the elasmobranch species housed in Shark Bay display normal wild behaviour as we understand it. The Tiger shark currently housed in the shark pool however has a habit of patrolling the edges of the exhibit although there is no set swim pattern that she appears to follow. The cause for this patrolling behaviour and the resulting scraped tail is still unknown despite considerable behaviour monitoring of this specimen. Surface Breaking Behaviour has been observed in some of the ray species (Blotched fantail rays, Mask rays and Whiptail rays), but not very often. The white spotted guitarfish displays surface breaking behaviour at various times throughout the day, not at a regular time of day (prior to feeding) as is usually observed in other aquariums. The natural behaviour of elasmobranchs in the wild is greatly unstudied due to the constraints of the ocean environment and the elusive nature of most elasmobranch species. The implementation of enrichment of any type is suggested to be beneficial to the animals that inhabit Shark Bay with particular attention to enrichment that will encourage foraging behaviour, particularly from the rays and benthic sharks.

Wild Behaviour**Physical Habitat:**

The physical wild habitat of Elasmobranchs varies dramatically. The Shark Bay exhibit has been developed to provide a variety of habitats, from the intertidal zone, to the reef, and the open ocean. However, each animal is housed in one zone, chosen to be most like their natural habitat. The reef environment houses species generally found in and around coral reefs. Pelagic or open water species are housed in the large shark pool as there is more room to move and swim freely in this environment. Ocean traversing species however will always be limited in an aquarium and for this reason highly migratory species such as the Great White Shark and the Whale Shark are not housed in this exhibit.

Activity Patterns:

Not much is known about the wild behaviour of elasmobranchs as they can be a hard species to study considering the constraints of their natural environment. Sharks are highly sensory aware animals and appear to be constantly smelling and sensing the environment around them for food when they are awake. Elasmobranchs appear to be most actively hunting and foraging at dusk and dawn and it is at these times that food is offered to the animals in the reef pool. The large whaler sharks are constantly swimming, they tend to investigate the divers during their time in the pool and although they react occasionally to injured or stressed fish, there is usually little other active behaviour during the day. On occasions, there is notable social or mating behaviour between the animals but this activity is not recorded on a regular basis. In the reef pool, with the benthic sharks and ray species, daytime is usually spent resting and avoiding the guests snorkelling and diving within the exhibit. Overnight foraging is assumed throughout the elasmobranch population, although no behavioural studies have been conducted on these animals.

Locomotion:

There are a variety of locomotive strategies employed by different species of elasmobranchs but most species are highly mobile and able to maneuver themselves very well throughout the reef system and negotiate coral bommies, rocks and other obstacles in the ocean. Some must keep swimming; others have been seen to spend a great deal of time in a stationary mode, some even using their pectoral fins to 'walk on'. Many of the large whaler species of sharks are unable to ventilate their gills if they stop moving. Rays and benthic sharks have developed the ability to pump water over their gills while at rest; however the larger species of whaler sharks must keep moving in order to keep water moving over their gills to breathe.

Feeding behaviour:

Elasmobranchs have a wide variety in their diet and are known to generally be active hunters of bony fish, cephalopods, crustaceans, molluscs and various worms. It can usually be identified through dentition analysis as to what the main diet consists of for each different species. E.g. serrated teeth are designed to cut through flesh, flat crushing plates are designed to crush crustaceans between them. The Tiger shark is the only known shark species to eat garbage. They are a true nonselective scavenger that will consume anything they encounter from carrion to plastic and other garbage floating in our oceans. Large species of sharks in the wild often do not know where their next meal will come from and as such are will often gorge themselves on an available meal in case the next meal is not obtainable in the next few days. This is often replicated in the shark bay exhibit as new animals arrive they eat very enthusiastically and put on a great deal of weight before settling back into a regular slower feeding pattern.

The food requirement of different shark species varies, for the bull sharks; a consumption of 0.5% of its body weight per day is required, ranging up to the energy consuming Mako, which is required to consume 3% of its body weight per day. A shark's stomach will expand to hold up to 10% of its body weight, allowing for food storage and therefore the animal only needs to feed 1-2 times per week if large prey is consumed. Smaller sharks and rays eat at least 2 times per day as they consume a smaller prey that is generally more readily available. Sharks and rays also like to disable their prey before consumption it to reduce the amount of damage a prey can do to them whilst feeding. Bottom dwellers will often ambush their prey, they lay in wait for prey to swim past and react with incredible speed to capture their prey where as pelagic species rely more on their speed to capture prey. Elasmobranchs can learn behaviours as to where to find food at various times of the year (e.g. Whale sharks at Ningaloo coincides with coral and fish spawn; tigers in Hawaii when fledgling seabirds take flight.) and this cognitive ability should be harnessed in the captive environment. In other aquaria, sharks and rays have been trained to target to different objects, colours and shapes to feed and have shown that they have the ability to learn when and where food will be available.

Sensory abilities:

Elasmobranchs in the wild spend a great deal of their life hunting and foraging and reacting to smells, sounds, movement and anything else that can be sensed with their electro-receptors. Elasmobranch senses can be divided in to four categories: Vision,

Chemoreception (including smell and taste), Mechanoreception (hearing and touch) and Electroreception. Vision is highly developed and sharks can perceive a wide range of wavelengths. They have a larger amount of rods in the retina which increases their sensitivity to low light levels but the large amount of retinal cones also suggest colour vision, a ability that has not yet been proven, however, it is known that they can distinguish between contrasting colours (e.g. black and white). Elasmobranchs have an acute sense of smell and recent studies have shown that there are also taste buds in the mouth and throat of some species and food preference has also been noted.

Mechanoreception in elasmobranchs is exemplified by the lateral line. This system utilises two specialized nerve terminals: the sensory hair cells of the lateral line (a number of free neuromasts or pit organs scattered over the head and body) and the inner ear. The inner ear of elasmobranchs has an enlarged macula neglecta in active hunters suggesting that they utilise their auditory sense a great deal when hunting for prey. Sharks hearing range is much lower than that of humans which means they can hear much lower frequencies than we as humans can and therefore can detect low frequency vibrations like those emitted by distressed or struggling fish. This range only detects such frequencies within a 25-30m area. Electroreception is the sense that detects bio-electrical fields from prey with voltage gradients as low as 0.01V cm^{-1} these are detected by the ampullae of Lorenzini receptors situated on the animals head. However, the threshold for detection falls steeply once the range exceeds one metre. What this means though is that an Elasmobranch swimming at 2cm second^{-1} through the earth's magnetic field creates a voltage gradient of $0.05\text{-}0.5\text{V cm}^{-1}$ (this varies with the direction of movement) and creates a personal geomagnetic compass in each animal which aids in its long range migrations.

Social Behaviours:

Most species of elasmobranchs do not appear to have much social interaction outside mating season. They are mainly solitary animals and with precocious young, no family groups or cooperation has been observed. However, as previously mentioned, the behaviour of these animals is highly understudied. In groups of sharks however, dominance hierarchies are often established and this has been seen to occur in aquaria as well. Preliminary studies of the whaler population in both the shark pool and reef pool suggest that a dominance hierarchy does exist and becomes upset and more obvious to observers with the introduction of new animals. Schooling reef sharks, however, often cooperate by all targeting one fish to corner it and stop it escaping out a different end of a coral bommie. Once the fish is caught however, there is no sign that the sharks try to share their meal at all. Whether it is cooperation or the sharks all just react to the stress of the cornered fish is unknown.

Goals of Enrichment Plan:

This Enrichment Plan is proposed to encourage further foraging behaviour amongst the resident elasmobranch species housed at Shark Bay as well as ensuring against the development of possible behavioural problems from developing, in particular, surface breaking behaviour in the rays, stereotypic swimming patterns in the larger sharks and especially the dependency on divers for feed and future associations with divers and food

which would pose problems and possible injuries with guest divers entering the pool without food, a problem that has been encountered in the past with turtles in this exhibit.

Pre-enrichment studies:

Studies are to be conducted to observe the current behaviour of a variety of species of elasmobranch and their reactions to current enrichment (feeding sessions), and other events that occur regularly in the exhibit (guest tours and exhibit maintenance dives). A Data Sheet can be found in Appendix B.

Suggested Enrichment Ideas

Food:

Live food such as worms, yabbies and crabs, snails and pippies. (Food and Sensory)

Suspending large fish (2kg +) in the water column.

Ice Blocks with frozen fish pieces.

Large surface floating Meat snacks

Bucket to dispense food at the bottom of the pool, not on the surface.

Hiding food throughout the exhibit in rock holes and caves.

Creating new caves (e.g. milk crate) to hide food for the animals to negotiate.

Social

Mirrors placed in the pool in random places for various amounts of time.

Changes in the population, births and additions of new animals from the wild or other aquaria.

Physical

Change the substrate of the exhibit in areas for the rays to use.

Add/ remove some of the additional rockwork. Creating or closing caves and holes.

Add/ remove artificial Kelp forests and other obstacles for larger sharks.

Sensory

Blood and Burley balls – frozen or hard packed pellets

Live foods are also a sensory enrichment tool as the animals need to utilize many different senses to source out the live prey.

Electro devices – adjusting the magnetic fields in the exhibit.

Cognitive

Kong Puzzle Balls (hidden foods inside the Kong)

20L water containers with fish and octopus stuck inside. (Food and cognitive)

Live rock – an additional food source that requires thought and effort to remove the inhabitants (such as shellfish) attached to the rock.

Training program to be constructed and implemented for targeting different species to feed at different stations. This initially will incorporate and examine colour distinction and in turn a conditioned stimulus, developing a recall and a bridge to desired behaviours. Desired behaviours to train such as capture and transport would be highly beneficial as specimens are often moved to different areas of the exhibit for various reasons (change in

size, maturity and therefore a natural change in the natural habitat the animal would inhabit in the wild and also for research projects).

This training program will be a second phase to this initial enrichment plan and will follow as Appendix F when constructed.

Implementing Enrichment

Approvals: An enrichment approval form must be submitted for all new enrichment ideas; this can be found at Appendix C.

Exhibit changes:

All exhibit changes would be relatively minor. Small additions or removal of rocks, minor creations of caves or covering of holes. All exhibit changes however would have to be done by divers by hand so movements of large amounts of materials are not really viable.

Changes in routine:

This needs to be discussed as to options as there are many events in the daily routine that are set occurrences, particularly with guest animal adventure programs and the large shark feed that is a public favourite to watch.

Conditioning program with training goals:

A training program is to be constructed and implemented for targeting different species of elasmobranchs to feed at different stations within the Reef Pool, in particular, and study the abilities of different species to learn and distinguish between shapes, colours and different materials of proposed targets. To be constructed and attached at Appendix F.

Introductions:

Changes in the population, births and additions of new animals from the wild or other aquaria are events that are often unable to be determined at a set time or date.

Ongoing supply of suggested new enrichment items:

With 15 full time divers (keepers) as well as 5 casuals and management all with an interest in the well being of the inhabitants of Shark Bay, all staff will be given the opportunity to suggest new enrichment ideas and to fill out a “Enrichment Approval Form” (Appendix C.) This should ensure the ongoing projection of new enrichment items into the exhibit.

Timetable:

Immediate: Implement the suggested enrichment ideas and gain feedback as to their effectiveness.

Short term: To establish a schedule of successful enrichment usage and ensure its implementation. The use of a table (Appendix E.) to utilise the various enrichment items effectively.

Long term: To develop and implement the abovementioned training schedule.

Schedule:

A table will be produced (e.g. Appendix E.) listing all the enrichment items and the keepers will be given the opportunity to utilise one or many of the enrichment items on various days. Choosing the enrichment they want to use and marking it down on the table. The large number of keepers ensures the randomness of enrichment use. Even if some have favourites, their input would most likely be weekly. If an enrichment item has not been used in a while, this can be easily seen by the schedule table and keepers given the opportunity to use that item or even repeat yesterday's enrichment. The large variety of keepers personalities and abilities will ensure a vast range and randomness to the Environmental Enrichment Program.

Evaluation

An evaluation data sheet can be found at Appendix D.

Conclusion:

With what appears to be a blank slate to develop enrichment in a relatively new exhibit prior to behaviour problems developing, this Environmental Enrichment Program should be highly successful and beneficial to both the staff and animals of Shark Bay.

Acknowledgments:

Mitchell Leroy, Animal Care Supervisor, Sea World, Australia ☺

Appendix A: Shark Bay exhibit**Appendix B:**Pre-enrichment studies

Date:

Time of study:

Individual observed:

Behaviours observed (circle):

- Exploratory
- Playful
- Aggressive
- Repetitive Patrolling
- Resting
- Feeding

Describe the behaviour observed (e.g. exploratory behaviour: digging):

How long was each behaviour observed for?

Behaviour:

Time:

Comments (e.g. did one behaviour always follow another?):

Keeper Name: _____ Signature: _____

Appendix C:

Shark Bay Enrichment Approval form

Date:

Submitted By:

This enrichment refers to:

Specific individual/ Species: _____

Or

All animals at Shark Bay

Enrichment to be given during or outside park hours: DURING/ OUTSIDE

What behavior is this enrichment meant to encourage?

Describe enrichment idea: (give specifics of materials used, frequency and duration of presentation, potential safety concerns, estimated set-up time and estimated cost)

Where can materials for this enrichment be sourced and reordered from?

Where will these materials be stored when not in use?

Other Comments:

Approvals:

Shark Bay Supervisor:

Approved: Yes/No

Changes suggested:

Marine Sciences Manager:

Approved: Yes/No

Changes suggested:

Veterinarian:

Approved: Yes/No

Changes suggested:

Appendix D:

Evaluation of enrichment

Enrichment item:

Time enrichment given:

Area enrichment given:

Time since last given:

Animal studied (species/ name): _____

Reaction to enrichment (explain): _____

Time since enrichment offered that a reaction was noted

0-5 min 5-30 min 30-60 min 60-120 min 120min + did not react

Time spent with enrichment:

0-5 min 5-30 min 30-60 min 60-120 min 120min + did not react

Intensity of interaction to enrichment:

None				Significant					Intense
1	2	3	4	5	6	7	8	9	10

Type of interaction, did it have the desired effect?

None				bad interaction				Good interaction	
1	2	3	4	5	6	7	8	9	10

Comments:

Keeper Name: _____ Signature: _____

Appendix E:

Schedule of enrichment in Shark Bay

<i>Week commencing:</i>	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Enrichment Item	Spp Rxn	Spp Rxn	Spp Rxn	Spp Rxn	Spp Rxn	Spp Rxn	Spp Rxn
Live food (list food)							
Suspended fish (where and what)							
Ice Blocks (how many, what in them)							
Floating meat (where and what)							
Bucket dispenser (what food)							
Crate cave for food (what food, where)							
Hiding food (where and what)							
Puzzle Ball (what food)							
Food in container (what food)							
Mirror (where, how long in water)							
Population change (what species)							
Substrate change (how much, where)							
Change rockwork (how much, where)							
Blood, burley ball (how many)							
Electro Devices (what device used)							
Live Rock (how much, where)							
Bubbles (where, how long)							
Fresh water hose (where, how long)							
Coral Bommie (where, how long)							
Reaction recorded:							
Species involved: Type of reaction:							
E = Eagle ray I = Instant Reaction π = Positive reaction							
R = Ray spp. (not eagle ray) D = Delayed reaction X = Negative reaction							
B = Benthic Shark N = No reaction							
P = Pelagic Shark							
S = Shovelnose ray S = Short term interest							
F = Bony Fish P = Prolonged interest							

WORZ ANIMAL TRANSPORT SLING
Werribee's Immobilisation Sling- Enrichment for all

Bev Drake and Joe Parsons
Werribee Open Range Zoo

Abstract

This paper is not the NORM when it comes to animal enrichment, but benefits through good husbandry practises and safety for all concerned. This in itself can be enriching. WORZ has many species of large animals. Our veterinary department maintains a preventative management program; therefore there are many large animal immobilizations. Our husbandry procedures are out in either "open range" areas or in one of our immobilization yards. These are high, solid walled yards. When a procedure is carried out, we use a rubber sling, attached to an apparatus, which is locked into our tractor forklift tines. Using this method, we can weigh the animal or transfer it to either our transport trailer or to another yard. This sling is made from 15 mm thick rubber matting which is 2m long x 1.5m wide, weighing 52 kilograms. This is very heavy for 1 or 2 keepers to manually handle. There is strong webbing material for the straps which attach to the lifting mechanism. Thus using this sling, when placing an animal into a trailer or transport truck, it is very difficult to remove the sling from under the animal whilst it is still immobilised. In this situation, you cannot remove it when the animal has been revived, for the obvious reasons. WE VALUE OUR KEEPERS.

This being unsatisfactory for all concerned, we then thought of a sling that has the same durability, but could separate into two halves. This would allow for the safe release of the animal with little effect from the keepers.

We knew what we wanted, but to make it and make it work, we thought of Joe Parsons from Aussiedog. I rang Joe and explained our idea. As this phone conversation continued, there was a considerable amount of silence from the other end. I asked Joe if he was still there. His reply was, "Yeah I'm thinking. Gee girl! you give me some good job challenges to think about!!!!!!!!!! Yeah, I'll get onto it. Give me some time and I'll get back to you!!"

Well after a few more conversations, Joe brought out a prototype and the rest I will leave to Joe.

It was actually several conversations not only with Bev who sowed the seed, but Lorraine and Davin as well and several trips to Werribee before I was satisfied that we could build a prototype and make it work. These conversations were mainly questions regarding size and weight of the animals. How they wish to position it, for lifting. Simple things like do they fold the legs under, length of hair etc.

You must realise although I am learning fast, many things in relation to animals that are routine to zoo keepers, are at first sight not obvious to the casual observer, I do get odd looks occasionally! Much to say "is the old guy nuts", but I persevere and 9.9 times out of 10 [there's always a picker!] we come up with the goods to perform the task needed.

Armed with this information we were able to assess the type of materials that were needed, both in strength and durability. The main body of the unit required a large sheet of heavy duty PVC on woven polyester fibre. Similar too the type of material used for side walls of taught liner trucks. Unfortunately the truck type PVC is only there to keep the water out! And no way near the strength we needed. This was over come by using tubing used to line water bores in the outback. It is approx 5mm thick. By splitting the tubing laterally, welding and sewing we were able to make a large enough and strong enough sheet of the desired strength and weight.

The hinge mechanism or join, for want of a better word, was devised by us. In the form of a continuous piano type hinge with thick walled tubing inserted in each loop of the hinge. A removable pin of 16mm fibber glass rod. With a steel tread attached to each end was then inserted thru the web of the hinge and held in place with 2 x 16mm 'eye nuts'.

To be able to lift the required weight, it was easy to source webbing capable of carrying several tonnes but difficult to source webbing that would not roll up when pressure was applied. So we used a 3 tonne 50mm webbing, first of all drawn through a heavy duty fire hose and then sewn into place to prevent any rolling that would cause unnecessary discomfort to the animal.

To prevent the "side walls" from bulging and placing undue stress and wear on the laminations and stitching an extra layer of woven P E T fabric was added at this point to support the "side walls" and although some bulging is evident, it is not detrimental to either the function or to the sling and the operation.

To firm up the outer edge of the sling, we added 38 mm polyester reinforced fire hose to the edges and double thickness to the top edges to prevent unnecessary flexing of the sling.

First trial

To check that the sling would performing the manner requested Bev organised a trial and as many keepers that could be available to see it in operation and to provide further input as to final modifications if required.

With to bales of hay as dead weight the sling was picked up, raised and transported to the enclosed trailer nearby.

Michael carefully positioned the sling right inside and lowered it to the floor, Lorraine then unscrewed the "eye nut" at the far end and Lance withdrew the rod on the outside of the trailer separating the two halves.

The sling was then easily lifted clear of the bales and removed from the trailer.

Smiles all round!

I asked if any thing else the keepers could think of that would improve the field use of the sling,

1/ a flap to cover the hinge to prevent hair being caught in the gaps

2/ use a thicker fibreglass rod from 12 to 16 mm to reduce the likelihood of it fracturing under larger weights.

3/ add two strong handles to each side to assist in removing the sling enabling the keepers to pull in a sideways direction.

These were very positive suggestions and frankly I was impressed by the keepers positive thinking and the fact that they wanted to be part of it.

All the modifications were made and the sling was delivered a few weeks later in May 2006, and has now been used successfully for five months.

Specifications

Two part sling for the lifting of animals undergoing procedures or injured animals

Size

2 meters x 3 meters [two side walls of 1.5 meters with lifting webbing straps .65 meter

Weight

30 kilo in two parts of 15 kilo each

Safe working load 750 kilo based on method of construction and specifications of materials used.

I would like to express my thanks to Bev for entrusting such an interesting project to aussiedog and to the keepers at Werribee zoo for their help and enthusiasm.

Without Keepers there would be no ZOO'S, You gotta love them!.

Bev Drake

Curator Animal Division

Werribee Open Range Zoo

Joe Parsons

Owner Aussiedog.

Animal & Keeper Friendly Enrichment Toys

Joe Parsons

Aussie Dog

Abstract

Animal & Keeper Friendly Enrichment Toys:

- *How and Why Aussie dog Started*
- *Introduction to the Zoo circuit*
- *Progression from one species to another & diversification therein*
- *Interpretation and observation of target animals, information, history, the type of enrichment devices being used and or habitat at the time.*
- *Transforming this information into an enrichment device which will intrigue the animal enough to want to use it, and to make the end product durable and safe, not only for the animal but also to make the product keeper friendly e.g. Less time, less frustration to prepare the device for usage.*
- *Working with food, colour, noise and instincts.*
- *Future development, some in proto type stage, includes devices that move and stimulation of environment by electronic devices either sound, olfactory or sight. Both random and keeper controlled.*