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Day 2

Thursday 2nd November 2006.

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Werribee Open Range Zoo, an enriching environment!

Kathy Scanlon
Werribee Open Range Zoo

Abstract

The variety of environmental stimuli for animals are utilised at Werribee Open Range Zoo, ranging from enclosure based enrichment through to more common styles of enrichment. Being an open range zoo, many enclosures are large and visitors transverse them in a safari vehicle. The features of these large enclosures are designed to provide maximum environmental stimuli for the animals. Design features such as changing topography, access to water bodies, and varied use of vegetation areas provide opportunities for animals in large enclosures to best utilise their environment. This can be further enhanced by the use of simple enrichment options, such as changes of access to vegetation and water areas, addition of logs and branches, mounded earth, and sand piles. Carefully managed interspecies interactions and relatively natural social groupings of species encourage displays of natural behaviour. On the other hand Werribee Open Range Zoo also has primates, small mammals and big cats, who benefit from some of the more common enrichment options available. We utilise toy style, food based and olfactory based enrichment throughout the zoo. Our environmental enrichment program and therefore our animals benefit from the assistance of our Friends of the Zoo volunteers and school groups who make up a range of enrichment items. The variety of environmental stimuli for animals at Werribee's Open Range Zoo (WORZ) ranges from enclosure based enrichment through to the more common styles. Being an open range zoo, many of our animals have different enrichment needs to those in a metropolitan style zoo. Animals in smaller enclosures benefit from more common enrichment options, such as toy, food and olfactory style enrichment options.

Many of our enclosures are large and the features designed to best optimise the environment, for example, changing topography, access to water bodies and varied use of vegetation areas. Our Lower Savanna exhibit is 40 hectares. This mixed species exhibit enables inter species interactions and encourages displays of natural behaviour. Even the ability to house natural group structures, composition and sizes of social species such as Zebra and Rhino, is a source of infinite stimulation. For example, our 15 Zebra have the opportunity to behave as wild family groups. Vasectomised males and their mares face the challenges of changing group dynamics, as mares swap between families. Established males challenge for the right of gaining new females and young males form bachelor groups.

The ability to house many of our animals in an open range environment can further be enhanced by the use of simple enrichment options. These include, changes of access to vegetation and water bodies/ mud wallows and the addition of logs, branches, earth mounds and sand piles. The ability to introduce individuals such as moving Bulls through herds also provides stimulation to social animals.

Planting lots of vegetated areas in the exhibits of more flighty species such as antelope and deer, is another form of enrichment. This allows the animals opportunities to express hiding behaviour and may reduce fear responses from more subordinate animals.

Some of the rounds worked by keepers at Werribee are;

- The Safari route. (Manage much of our hoofstock incl. Rhino and Hippo)
- Carnivores. (Lion, Serval, Cheetah)
- Monkeys and Meerkats.

The Safari route is the open range section of the zoo, which in its size and general design is enriching in itself. The other rounds such as Carnivores and Monkeys can be more challenging and require more enrichment due to being more metropolitan style exhibits.

The following lists some of the ways we stimulate animals on the safari route:

Southern White Rhino

- Fill the holes of bowling balls with faeces from other bulls or cows and roll them in their enclosures.
- Drive our utility vehicles through the Rhino dung piles and then into other Rhino territories. (This has also been used as a handy way to encourage the Rhino to present us with an instant faecal!)
- Rotate the bulls through the females enclosure which presents the keeping staff with opportunities to breed Rhino and gives the bulls opportunities to chase our safari vehicles. They can also mix with animals they would naturally encounter in the wild, such as Eland, Giraffe and Zebra.
- Provide water bodies in which Rhino can come together as they would in the wild. They share a communal meeting place and wallow the warm days away.

Bison

- Harrowing. (Harrows are a group of chains joined together, which we drag behind the utility vehicles. They not only disperse the faeces but also fertilise the pasture.) This provides the herd with an endless supply of amusement. The bison also become excited if we drive machinery through their exhibit.
- Provide an earth mound.
- Sand plots for dust baths.
- Changing enclosure furniture such as large logs or altering their position.

Preswalski Horses

- Water body or running trough for playing and wallowing.
- Sand plot for dust baths and rolling.
- Apples! A change from their regular diet.

Off-display breeding pens (Mainly antelope species)

Stimulating the animals in the off-display breeding pens is a challenging task. One of the greatest ways to stimulate the bull antelope is to provide them with reasonable quantities of browse. Each enclosure has an upright forked tree from which we are able to hang browse. These animals become highly excited as they attack or spar with the browse. Hanging the browse also promotes the natural behaviour of the animals browsing from

low trees as they would in the wilds of Africa! The addax are also particularly fond of using the branches as a fashion statement (on their heads.) As mentioned previously, Werribee Open Range Zoo is also home to primates, small mammals and big cats. These animals benefit from the more common enrichment options. We use toy, food style enrichment and olfactory based enrichment in these areas.

Meerkats
Our Meerkat exhibit at WORZ has been designed to provide optimal enrichment with sand for digging, a tunnel system and large boulders positioned at varying heights for a range of views. Other enrichment tools used include Ostrich eggs filled with mealworms, rotten logs filled with insects, buried poa grasses, access to infrequently used areas and the odd low flying sparrow!

Vervet Monkeys
Our Vervet troop share a fairly large island with both living shrubs and large dead trees that have been concreted into an upright position across the exhibit. We promote natural foraging behaviour on the ground with the use of a scatter feed with seeds and pellets hidden amongst the mulch. The Vervets are encouraged to use their arboreal behaviours to pick their own breakfast. This is made possible through the keepers spiking fruit and vegetables up in the dead trees. Pinecones filled with goodies are also given to the monkeys. Providing hammocks and changing the furniture in the Vervets night yard is especially stimulating for young Monkeys as they chase and play.

Lions
We commonly use olfactory and food based enrichment with our big cats. The Lions are predominantly fed beef or horse muscle meat, with separate bone feeds. So the odd occasion they are given a carcass feed of goat or venison (which obviously includes meat, hide and bone) provides great enrichment in itself.
The exhibit design provides enrichment with views to herds of Addax, Kudu, Donkeys and Goats.
In utilising olfactory enrichment we use a variety of perfumes, aftershaves, fresh and dried herbs and herbivore faeces. The Lions enjoy rolling and head rubbing in these scents. They become particularly territorial as they roll in piles of old giraffe mulch from the Giraffe house. Our youngest Lioness Jarrah finds great amusement in toy style enrichment in the form oflogs. We hide a selection of small logs on her display high in the trees and buried in the mulch. She will retrieve these and leave them in an obvious place for us to find. The interesting factor here is that she sets the rules. Jarrah has initiated this game, as if to engage us!

The keepers at Werribee have also found positive reinforcement training to be a form of enrichment, particularly with the female Lions. We only train with the intention of improving the animals' welfare especially when it comes to veterinary care. The lionesses wait eagerly for the keepers in the morning hoping for a training session. We have also found training helps stop unwanted behaviours both with our Lioness and Vervet Monkeys.

Werribee Open Range Zoo's enrichment program is fully supported by our Friends Of The Zoo volunteers and school groups who make up a range of enrichment items. This also helps to educate the public of the abilities of different animals and their requirements in captivity.

In summary, we are fortunate that creating an enriching environment in an open range zoo is often largely accomplished from as early as the design phase. The open range exhibits we strive to create are inherently naturally stimulating places. Where they are lacking, the opportunity for greater input exists. The provision of discrete enrichment items as well as manipulating situational and social elements are all methods employed in achieving our enrichment objectives.

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A Devil's Occupation

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Abstract

The Tasmanian devil (Sarcophilus harrisii), the world's largest surviving carnivorous marsupial, was first photographed with the Tasmanian Devil Facial Tumour Disease (DFTD) in 1996. A multi-faceted research and monitoring program was started as this devastating cancer continued to spread across Tasmania. As part of this program, the Tasmanian Devil Disease Team removed a number of Tasmanian devils from the wild to form the basis of a captive insurance population of devils, and to facilitate research into the disease itself.

The maintenance of these wild animals in captivity provides a number of unique husbandry challenges. The mode of transmission of the disease is as yet unconfirmed, and with no pre-clinical diagnostic tests available, bio-security protocols are necessarily strict. Environmental and behavioural enrichment strategies are developed to ensure the health and wellbeing of these captive devils. The pro-active and varied program is essential for the maintenance of the psychological and physiological health of these iconic animals, at a time when they are already under considerable stress.

Introduction

The Tasmanian devil (*Sarcophilus harrisii*) is under threat. Disfiguring tumours are decimating populations of the world's largest surviving carnivorous marsupial. In 1996 Christo Baars photographed devils at Mt William National Park in the north east of Tasmania with large facial masses. Subsequent investigation showed that the disease termed the Tasmanian Devil Facial Tumour Disease (DFTD) caused death between four and six months after the initial lesions are seen. Animals can become emaciated as the tumours interfere with their ability to feed. Recent research has shown that there has been a 41 % decline in mean devil sightings from 1992-1995 to 2002–2005 (Hawkins et al,

2006). The disease currently covers over 50% of the state, which is more that half of the extent of the occurrence of the world's population (Hawkins et al, 2006).

A funding package was provided by the State Government in 2003, which was later supplemented by the Federal Government. The DFTD Team has a multi faceted approach. Diagnostic research has provided a case definition and involves cytogenetics, immunology and pathological investigations. Other epidemiological investigations have concentrated on mapping and monitoring the wild devil population. Management strategies have been developed designed to mitigate effects of the disease on wild devil populations. As part of this program a number of devils have been sourced from the wild. These devils have been placed into quarantine, either as part of the national insurance program, or to assist with diagnostic research into DFTD progression and mode of transmission.

Pearce and Swift (2006) showed the chromosomal rearrangement of the tumours were identical in every animal and proposed that the disease is transmitted by allograft, whereby an infectious cell line is passed directly between animals through contact. Research by the diagnostic branch is continuing. At present histological or cytogenetic examination of the tumours is necessary to diagnose DFTD (Loh et al, 2005, Kate Swift, personal communication). Without a pre-clinical diagnostic test it can not be assumed that animals that do not possess the tumours are free of this infectious and fatal disease. A viral component to the disease is yet to be ruled out. As a consequence, the bio-security protocols in use are based on risk reduction principles, following the best current knowledge of the disease. The background surrounding the disease and the history of the individual devils themselves present a number of husbandry challenges.

Bio-security

The captive devils have a varying disease status and purpose:
Animals confirmed to be DFTD positive via histological examination of the tumours, (diagnostic animals).
Animals sourced from areas where DFTD is known to be present, (diagnostic animals).
Animals sourced from an area, which is considered to be disease free. Disease absence can not be definitively confirmed, therefore animals from different areas, which are disease free, are considered to have a different disease status, (insurance animals).
The animals with the least disease risk are thought to be those that came into captivity from a disease free area, with their mother as pouch young.

The Tasmanian devils are held in six separate government centres located throughout Tasmania. Protocols when working with the Tasmanian devils are specific to the disease status of the animals and are detailed to ensure that the potential to spread the disease to another area or animal is minimised. Whilst no other species has been identified with the disease, we can not be complacent. DFTD is an infectious cancer. Until further research is completed, all food and pen furniture must be sourced from disease free locations or areas where there are no devils present, for example the far North West of Tasmania, offshore islands or inner urban areas. Any item removed from an enclosure is treated as bio-hazardous waste and disposed of accordingly. Currently the disinfectant used is

Virkon, which is cytolytic and effective against viruses, bacteria and fungal pathogens. This is used as a footbath prior to entering an enclosure and as a disinfectant for boots or other non disposable items in contact with the devils or their environment. Many diagnostic animals are kept singularly and all are off public display.

Devil's evolutionary adaptations

Devils occupy overlapping home ranges of 13.3 square km on average and travel at an average speed of 1.1 km/hr covering 8.6 km from sunset to sunrise (Pemberton, 1990). Tasmanian devils can exist in a variety of habitats but are most abundant in dry sclerophyll forest and coastal woodland adjacent to open grassland (Jones, 2001). Tasmanian devils are opportunist; they will scavenge but also hunt and kill live prey. Small mammals are their dominant food source. A nocturnal predator on vertebrates, a wide variety of food is eaten including insects, beached fish and birds (Jones, 2003). In studies at Mount William National Park in the late 1980s David Pemberton showed that devils use on average 3.8 dens one of which is the primary den, burrows are the most common type and the only ones identified as maternity dens. Devils, despite a fearsome reputation are shy and wary of humans. They maintain a solitary existence but will congregate in large numbers at a carcass. Latrines are distributed through out the home ranges and are usually situated at breaks in ecotones. They remain in use for a long period of time and it is hypothesised that they are instrumental in facilitating interactions between members of this otherwise solitary species (Pemberton, 1990). Devils have a good olfactory system; their hearing is acute although their eyesight is poor during the daytime.

Enrichment

An effective environmental and behavioural enrichment strategy should be based upon an individual species and indeed an individual animal's history, biological, social and cognitive requirements. An understanding of the devil's evolutionary adaptations is therefore an essential pre-requisite to the development of an enrichment program. The ability to make choices is important for captive animals along with the provision of the opportunities and the motivation to display natural behaviours. Tasmanian devil's natural behaviours include, foraging, climbing, digging, and scent marking via an ano-genital drag. Enrichment endeavours to satisfy physical and psychological needs of captive animals. The requirement for sensory stimulation is now well understood by the zoological industry. Enrichment can provide a controlled method of exposing animals to stress and maintaining their ability to adapt to new situations (AAZK, Enrichment Committee). Environmental strategies were developed to facilitate the transfer of wild devils into captivity. In conjunction with the behavioural enrichment program it continues to evolve, remaining adaptive, responsive and innovative.

Environmental

Enclosures

It is difficult to provide the area utilised by the Tasmanian devil in the wild, within a captive context. The enclosures for the diagnostic devils are small, 12 metres by 6 metres or 6 metres by 6 metres, 36 m2 is the minimum standard for zoos. They are constructed from colourbond attached to posts concreted into the ground. The base is weld mesh

secured via a skirting to the colourbond walls. Irrespective of the enclosure size good planning can still provide an animal with the opportunity to make choices and ensure a stimulating environment.

Enclosure structures

Substrate: The base of the enclosure is covered in varying substrates providing different textures and smells; sand, soil, grass, woodchip and leaf litter. The sand and soil are favoured spots for sun basking. The seed heads require removing in summer due to dangers of grass seed infection.

Crates: Large untreated wood crates are turned upside down with access and exit points cut into the slats. The solid crates are donated by a local large machinery manufacturer, the employees of which were happy to help when approached. The crates break up space within the enclosure and make optimal use of horizontal and vertical layers.

Tree limbs: Juvenile and sub adult devils climb well. They have been known to shimmy up a vertical star picket. Adults require wider perching and tend to avoid structures with any give or seemingly unstable logs. The limbs are placed onto of the top of the crates and manipulated to create height within the enclosure. This allows the devils to climb and gain access to smells wafting by. It is not unusual to see captive devils standing on their hind legs to place their noses in a more advantageous position.

Leafy branches: Short pieces of poly tubing are buried into the ground and used to hold leafy branches to further break up the enclosure area. It has the added advantage of varying the pattern of light, shade and providing auditory stimulation. The leaf is cut by the local council on a weekly basis. Eucalyptus is used by preference, when the leaves are stripped and added to the substrate they continue to produce interesting odours, but other native species such as acacia sp. are also used.

Nest box/dens: Each enclosure has a nest box constructed from plywood and a den, which is made from logs or rocks. They are placed away from the enclosure door. Den and nest box entrances are covered in hessian sacks and leafy branches, ensuring an enhanced feeling of privacy and security for the animals. The nest boxes are covered in a shade cloth 'A' frame structure and shrouded in branches. The devils wild caught, as adults are extremely timid. Even after an extended time in captivity it is rare to see sun basking activity, when seen, they quickly retreat to the security of the den. The devils reared in captivity are more often seen sun basking and some individuals are settled enough to interact directly with the keeper.

Digging box: A digging box is provided, ranging in size from a cupboard drawers, often to be found in local skips, to one of the smaller upright crates. A structure with a solid base is preferable. The base improves the ability of the structure to hold the contents and allows the devils to dig without catching the weldmesh on the enclosure base. Sand and soil are sourced curtesy of the Agricultural and Soil Research Departments, who had previously been discarding it.

Hanging post: A 2.4 metre star picket is driven between the wire mesh of the enclosure. This is fitted with an L shaped bracket, the height of which can be altered and an eye hook which allows food and sensory items to be suspended above the ground.

Behavioural

Tasmanian devils of both sexes exhibit a physiological stress response when transferred from the wild to a captive environment. They experience elevated plasma cortisol concentrations; these high concentrations were maintained for 4 weeks in female devils, in male devils a decline was recorded after 46 hours in captivity. (Jones et al, 2005). As a consequence in the initial period of captivity, interference and activity in and around the enclosure are kept to a minimum. The wild devils are disturbed by noise, particularly 'man made' noises such as those made by plastic bags or metallic sounds. The simple action of pulling back the metal bolts on the enclosure door too harshly will illicit a behavioural stress response in a newly captive devil, flinching. It is easy to accidentally knock the tin enclosure walls with branches or perching. During this initial settling in period, the animals become acclimatised to the cleaning routine. Behavioural enrichment is later introduced as part of the daily husbandry routine. No training or conditioning techniques are implemented. The aim of this enrichment is to provide 'activities' for physical and mental stimulation presenting novel situations within the captive environment. The classic animal signs of inadequate exhibit environments in zoos are behaviour aberrations (Robinson, 2004). Enrichment should prevent such aberrations with a pro-active approach to these potential problems. Most species of dasyurids can suffer from stereotypic behaviour that can be very difficult to stop once established (Jackson, 2003). Examples include pacing circles, figure of eights or walking repetitively back and forth alongside an enclosure wall.

The enrichment strategy developed divides the enrichments into a number of categories: food related, sensory and physical. Many of the enrichment ideas cross categories but are only recorded as falling into one. The devils are provided with a minimum of one 'item' five days a week and preferably one from two of the categories. For example on one day furniture may be moved around within the enclosure and an aromatic herb provided. Care is taken not to repeat individual items or style of items too frequently. In addition to enrichment items, the mode of feeding is constantly varied.

Feeding strategies

Whilst they may feed infrequently in the wild, Pemberton and Reouf (1993) found that at a carcass, one devil may eat an average of 2.4 kg per night which equates to 39 % of the body mass of the average devil. This has been translated into a captive context via the provision of a carcass feed; this may take the devil a number of days to consume completely. 'Fast' days proceed and follow this gorge feed, when small 3g pieces of meat are hidden around the enclosure. The carcasses are small, 1.5- 4 kg and enable the consumption of whole prey including the fur, tail and viscera. At times devils in captivity will consume the stomach lining and intestines. The contents of the stomach and intestines are generally rejected as the devils manipulate the food with their forepaws pushing out much of the faecal matter.

Food is presented in a number of other ways; 3g pieces of meat to a total of 50 -100g is hidden around the enclosure by the keeper, placed into paper potato sacks, cardboard boxes or hessian sacks. Meat is cut into small pieces 10 – 50 g pieces and hidden amongst

leaf litter, bark/log piles, in buried toilet rolls, on perching, in long grass or holes in branches. Animal tails or meat pieces are attached via natural fibre string to a rubber bungee which it then attached to the eye hook on the hanging post. The devils are required to use considerable strength pulling against the bungee. A cognitive approach is required, after pulling they are often seen manipulating the food with their dextrous paws, enabling them to eat in situ. The bungee is found in auto shops and requires just a small amount to modification so they do not bounce out of the eyehook. This greatly increases the amount of time spent finding and consuming the food and decreases inactivity. The type of food is also varied to as much as possible to mimic items that devils would consume in the wild; Brush tail possum (*Trichosurus vulpecula*), pademelon (T*hylogale billardieri*), Bennett's wallaby (*Macropus rufogriseus*) and European hare (*Lepus europaeus*) are the main staples. These are supplemented by the occasional rabbit (*Oryctolagus cuniculus*), domestic ducks, chickens, chicken feet, eggs, beef bones, lamb rib and dried liver which is used within the food related enrichment items. The wild caught devils spend long periods of time in the nest box or den. They have retained their nocturnal habits and are seldom active in daylight hours, except for the occasional sun bask. The enrichment strategy is designed to increase complexity in feeding thereby promoting activity, exercise and prevent obesity. A useful way to do this is to maximise the time taken interacting with food. Obesity is well documented in captive dasyurids.

Food based enrichment items

These are extremely popular, devils are food motivated being an opportunistic carnivore. The food based enrichment is taken from an individual devil's daily dietary allowance, to prevent obesity.

Bags or boxes: heavy duty paper bags are filled with items such as leaf litter, wood shavings and a small amount of liver treats. The devils rip into them and then some go onto utilise the cardboard or paper as bedding material. The boxes vary in size, A4 paper boxes work well as they come with a lid, the office put them aside. Apple boxes have no staples or tape and possess a snug fitting lid. This size appears ideal as it takes a while for the devils to grab hold of it effectively enough to gain access. It tends to be pushed around the enclosure as they try first one angle then another. Once destroyed, devils will often exhibit scenting behaviour (ano-genital drag) or rip them to shreds, leaving many tiny pieces.

Molluscs: Collected from a local devil free shore line close to home.

Piñatas: Inspired by Schapp (2002) local Parks and Wildlife Summer Interpretation Rangers were encouraged to support devil conservation and education. They held National Park family activities creating Piñata's. These paper mache shapes work particularly well when they are suspended. The devil finds a rounded shape difficult to grip with their teeth. Once they do gain a hold they easily break open the piñata, eat the treat inside and then proceed to completely destroy the pinata. They are fun to make but many volunteers are required as they are time consuming. A quicker version is to utilise sections of thick cardboard tubes from rolls of vinyl etc as the basis of the piñata and then using flour, paper and water mixed to seal off the ends.

Blood Popsicle: Blood frozen onto a stick and suspended is tricky to pull down, the devils spend a long time licking the frozen, dripping lump. Frozen bouillon or stock has

been trialed in an attempt to limit calorific input however the devils exhibited no interest. Frozen treats are limited to use with the captive reared devils which are active during the day. Freezing larger blocks containing small treats and items such as feathers encourages sustained interaction until they have obtained each individual treat.
Blood jelly: placed into the middle of thick cardboard tubes or dog 'Tuff Tyre' toys created a good response. The devils spent considerable time trying to extract all of the jelly from the item using teeth and paws.
Vegetable feeder: Food or blood jelly is hidden inside hollowed out potatoes or pumpkins.
Scatter feed: A small handful of treats is scattered around the enclosure so that the devils spend some time sniffing them out. Cat biscuits are not universally consumed except by the captive bred devils, although they are extremely easy to scatter. All devils respond to dried liver treats and most will eat dried sprats and dried raw hide.
Insects: The devils love crickets which can be fed via a feeder (modified milk cartons), on the ground or in leaf litter. Meal worms have met with limited success but the challenge is to devise an alternative feeding method which will illicit an improved response. Whilst the insect breeding takes off, winged insects are encouraged to the enclosures via a florescent light powered with a 12 v car battery. A camping light is suspended above each enclosure, in rotation, attached horizontally to a star picket.

Sensory items
Many of these sensory items cause a good deal of interest. The devils will smell the item often scent mark via an ano-genital drag or move it about the enclosure. Some popular items are revisited a number of times.
Blood trails: Blood is dripped or sprayed around the enclosure or items such as pinecones soaked in blood. The devils will return to sniff these trails out. You may return to a scene of destruction in the morning as they will lick or chew the surface it is applied to.
Fresh herbs: Rosemary, mint, oregano, fennel or whatever is growing well in the garden. These are usually suspended one day and then, if not already ripped down by the devils are placed on the
ground for the second, prior to removal.
Seaweed: Freshly collected seaweed is full of micro invertebrates and the devils will thoroughly investigate the seaweed and proceed to scent mark.
Tuna oil: This pungent oil is sold in fishing shops as burley and used diluted with water and sprayed in a trail around the enclosure.
Spices: Spices such as ginger, all spice, cinnamon. They are easier to apply if mixed with a small amount of water and a binding agent such as oil or egg and smeared onto items of furniture.
Scents: Non toxic scents such as vanilla, peppermint, aniseed etc mixed with water and sprayed onto furniture items.
Cuttlefish: Cuttlefish are collected locally and keeper observations suggest they arouse some level of interest since they show signs of manipulation.
Animal hides or off cuts from the fleece of sheep;
Prey scats: The devils show great interest in prey scats and bedding material utilised by prey species including bird nests.

Shells: Empty mussel shell were floated in water which the less secretive devils were seen to bat with their paws. The next day when they were retrieved from the water and placed onto the ground, some crunched them into small pieces.
Feathers: These can be presented either in bags or loose around the enclosure. A local free range farmer is happy for keepers to collect chicken, feet, heads and feathers on their plucking days.

Physical
Cork or apple birds: Feathers are stuck into apples or corks and then suspended in the enclosure. The feathers cause them to act as a propeller, spinning around. It is the feathers which stimulate the interest and devils will utilise fore paws to manipulate and attempt to hold the apple still, whilst they taste test.
Digging box: The box is emptied periodically with the contents forming part of the substrate then a bucket of fresh soil, wood shavings or sand is added.
Leaf litter: Leaves are added to digging box or crate. The devils will rout around in the litter for treats and is often utilised along with other natural materials such as bracken for bedding. One of the devils nightly chooses to retrieves material from one area and carries it back to his den.
Native grasses and exotic grasses or grains grown in pots: These are grown as part of the agricultural research and once measured were previously discarded. When placed into enclosures, devils will dig and break up the soils and roots with great enthusiasm.
Leafy branches: Fresh branches are added to the enclosures weekly, the leaf works as shade and a sensory (olfactory and auditory) item. The devils have chewed some of the wattle branches to retrieve wattle grubs.
Rearrangement: The furniture in the enclosure is moved around on a regular basis to create new exploratory opportunities. Logs are added to or changed periodically.
Ponds: In summer some enclosures have a water trough large enough for a devil to lie in. This is more important for the animals which have taken on a more diurnal habit. There is little indirect evidence of the wild caught devils utilising such ponds. They tend to remain clean and unused.
Co-specifics: Animals are housed communally where there are animals of compatible age, sex and disease risk. The activity levels of these animals are greatly improved and the opportunities to display species specific behaviours are enhanced. However, quarantine procedures for the diagnostic animals require that many devils are the sole occupant of an enclosure. Animals in the south of the state that have been housed together past sexual maturity will choose to share nest boxes (Ingrid Albion, personal communication). Social groupings make the maximum use of any enrichment. The animals compete for the use of the particular item, which increases the intensity and duration of activity stimulated by it.

Toys
A small number of commercial style toys are utilised as part of the enrichment program. It can prove expensive when items can not be moved from one enclosure to another for bio security reasons. Nor are many strong enough to withstand the attention of the devil's formidable jaws, causing ingestion and safety concerns.

'Tuff tyres': A rubber tyre toy for dogs, which are good when, blood jelly is placed inside. It is not easy for the devils to extract it. The utilisation of teeth, tongue and forepaws is required.
Treat balls: Treats are inserted into the centre of the ball, the animal is then required to roll the ball around to obtain the treats. They work but are prone to breaking at the area where you insert the treats, they are no longer used.
'Indestructible ball': A rubber ball toy that contains a hardened liver treat. One devil will carry his around when presented with it and keep it in his den, another has shown little interest, perhaps it is too indestructible.
Rope toys: These are a cheap option. They are sometimes tied to a bungee or sprayed/soaked in scents to stimulate interest. These toys have the best response in social situations.

Safety
Devils are renowned for their considerable jaw strength. Since their primary sense is smell, they have a tendency to taste test. It is vital not only to ensure that items given to the devils pose no disease risk but also do not constitute a potential danger. It is only a matter of basic safety considerations; research the plants placed into the enclosure to ensure they are not poisonous, for example rhododendrons. The keepers use only native branches, they are easier to identify and are deliberately chosen to stay as close as possible to the devil's natural habitat. Remove all tape, plastic and staples from boxes or bags. Use non-toxic substances, such as untreated wood. Avoid plastics and items with sharp edges, such as protruding nails, wire or metal edges. Furniture should be secure to ensure it does not cause injury or provide an escape route. Where possible use natural items for example sisal string or hessian. Think whether there is a possibility that the animal may ingest an unsuitable item. If in any doubt over the suitability of an item contact your veterinary team.

Records
Daily records are kept so keepers know not only what item has been utilised recently but also what worked and what did not. Much of this evaluation relies on direct keeper observations for the captive reared devils. For wild caught devils the assessment of success utilises indirect evidence. Keepers must evaluate whether an item has been used and document the estimated level of interaction with that item. This is not fool proof, there is a distinct difference between the preferences of wild and captive reared animals. In the future there is a plan to set up an infra red video camera which will enable keepers to track and record activity overnight. This will greatly enhance the evaluation of the behavioural and environmental enrichment program and thereby provide further opportunities to augment it.

Conclusion
The efficient and easy recording system has distinct advantages. It safeguards against the over use of one item or type of enrichment and ensures that a wide variety of stimuli are provided. Results of the enrichment provided are analysed and the strategy modified accordingly. Not all animals are motivated by the same enrichment incentives. Initially the environmental enrichment strategy for the wild caught devils was designed to assist

their adaptation to life in captivity. This moved to a program developed to assist with their longer term stress responses. Other considerations such as aesthetics or increasing display opportunities have never been part of the equation for the diagnostic devils. The behavioural and environmental strategy continues to evolve, guaranteeing that the animals remain active at least during the hours of darkness. Lethargy is becoming an increasing problem with some of the captive devils and daily stimulation via enrichment is vital to prevent animals becoming overweight. This lethargy can itself be considered a coping response. The wild caught devils had previously expended considerable energy attempting to escape. This is particularly noticeable on the initial transfer from the wild, evidence such as digging or scratches on enclosure walls. Similar behaviour is observed after the transfer of a devil to a new enclosure. The devils will often 'test' the integrity of the pen.

The bio-security issues surrounding DFTD means that sourcing natural material can be difficult but good keepers are inventive. Others have attempted a variety of activities for their taxon group, these can be utilised, assess what modifications may be required for it to work with another target species. Auckland Zoo Elephant Management Programme combines enrichment by employing their Asian elephants to redesign other species exhibits (Gardiner, 2001). The bio-security protocols would prohibit such cross species activity with the devils and there are no elephants in Tasmania. However, utilise what is close to hand. After a big bonfire at home make use of the charcoal and ash, live close to the sea so, use seaweed once in a while. Look around for what is accessible, reuse and recycle. Use your own senses and assess items, as would the animal you are trying to enrich, what are their main sensory perceptions. Humans and primates are visually dominant, but most other animals reply on olfaction, hearing and taste experiences to interact and interpret their environment. Do not rely on one style or one favoured enrichment item; the devils are not given the same item again for at least two weeks. The enrichment program framework remains formalised butfacilitates the use of initiative and novel ideas enabling keepers to utilise what is locally available. The Tasmanian devil is an inspiration, be resourceful, an opportunistic scavenger.

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Devil enrichment paper – Crikey who moved that branch?

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Abstract

In the past, most Tasmanian devils that live in Wildlife Parks or Zoos were either born in captivity or have come into the Park or Zoo as hand-raised orphans. In both cases the devils are very familiar with people and being in captivity. However as a result of the apparently highly contagious and 100% fatal Devil Facial Tumour Disease (DFTD) a number of devils have been brought into captivity over the past two years in an effort to learn more about the disease and also as insurance animals for the future. This has resulted in a number of animals of different ages and life experiences being cared for by keepers and it is clear that different groups require different care and enrichment.

What is clear is that all captive devils require intensive enrichment and the best practices include:

Variation on a daily basis: Every day the pen needs to be different. This might be adding or moving a number of things such as: food, furniture, treats, toys, habitat, ground cover, nesting sites and shading areas. Even just moving branches across tracks that a devil has started to form can force them to investigate new areas and stop repetitive behaviours building up.

Pen complexity: Size is important but it is the complexity of the pen that makes the devil's existence more enjoyable. Provide areas with different ground covers and substrates such as sandpits, mounds, gum mulch, seaweed, growing trees, shade plants and dens. Provide opportunities for choice such as a range of den sites and nest boxes. Provide a range of pen furniture such as logs for running through, trees for climbing up, vantage points from which to see out of the pen, rocks for climbing on, nooks and crannies to investigate, reduction of mind numbingly straight runways, ponds for playing in, dens for hiding in and an environment that will attract birds or lizards – provided this doesn't compromise bio security of course.

Social Contact or Groupings: Where possible group devils – the best enrichment is contact with other devils. Where physical contact is not possible, for example when devils don't get on or for reasons of bio security, provide other sensory contact (olfactory, visual and auditory). Branches, platforms and mounds that allow them to climb up and watch devils in other pens are perfect. When we first brought all the eastern boys together to one location and separate pens, they all spent a large amount of time perched on top of branches and structures watching the other devils. This has happened each time new devils are added to a site and also when juveniles are separated from their mothers. For several weeks Christine watched her first litter frolic from a high structure in her new pen. During the breeding season this type of behaviour becomes more common also. If they cannot share a pen but have the same bio security status then share items between pens or if possible let them swap pens on occasion.

The different groups of devils held in captivity as part of the Devil Disease Management Program:

Since July 2004 the DFTD team have brought a number of wild devils into captivity. They can be broadly categorized into three groups that have been held in three completely separate facilities and managed separately.

Mt Pleasant experimental group – this group is managed by Lisa Edwards (see paper A Devil's Occupation). Most of these devils were wild-caught during 2005 as mature adults of about two years of age (males and females). At present there are nine relatively small pens each holding a single adult devil. Lisa also manages a newer site with five pens at Cressy; a couple of which have two or more animals sharing.

Disease Area - Vertical Transmission Trial animals – This group is cared for at two sites near Richmond by Ginny Ralph. In August 2004 six females with pouch young from Diseased Areas were brought into captivity to see if the disease was passed from mother to young. Three of the females already had signs of the disease and by Boxing Day 2004 all had died. Subsequently two of the mothers developed the disease. The babies were mostly orphaned within a few months of detaching and so have had quite a long association with their keeper, particularly those at Richmond. They behave in a similar way to other captive-raised devils, being more diurnal and relatively unafraid of people. The group at Daisybank which have less keeper contact have become quite cryptic. One litter of four young remained with their mother until she was euthanased in August 2005 as she did not show signs of the disease until 10 months into captivity. Fantastically, all the pouch young are now over 2 years of age and so far none show any signs of the disease.

Insurance animals at Pre Export Quarantine Sites – The third group are the devils which I have been involved with and mostly come under the banner of Pre Export Quarantine animals a program managed by Heather Hesterman. We have a range of different animals within these sites. All were collected from Disease Free areas and all are Disease Free. From the beginning, our biosecurity has been the highest of all the sites. I have divided them into five groups according to their capture/captivity status:

West Coast adult females - A, B, C mums – these devils were brought into captivity as part of the Control females for the vertical transmission trials so all were mature adults over two years old. As they were all disease-free, they remained in captivity and all successfully raised their young. Initially they were very frightened of people and highly nocturnal. However, once their pouch young detached they showed greater levels of intolerance towards keepers. As their young became more diurnal and began playing outside, two of the females spent quite a bit of time sitting under shelters watching them. One female became quite aggressive towards keepers during this time. All the females stayed with their pouch young until they were well over a year old and it was common to find them all still nesting together. Once separated from their pouch young, two of the females returned to a mostly nocturnal pattern of behaviour and disregarded toys and ponds as a form of enrichment.

A, B, C babies – these are the offspring of A, B, C mums and act rather like captive born devils. They make great display animals as they are highly diurnal and have no real fear of people. This makes them difficult to handle when they need to be orally wormed! Keepers are one of the most interesting things in their pens and from an early age they follow keepers around hoping for food, treats or just some fun. They will muddy up the ponds and water bowls the moment you fill them. Due to the quarantine protocols we raised these in pens within their litters until nearly two years old and sexually mature. These devils have a propensity to over-eat, love paddling in the pools and playing with any new toys. They are highly food orientated and will run up for a liver treat or dry cat biscuit. Over Christmas a local primary school had a Giving Tree for devils donating special devil toys and gold coins to make sure every devil had a new toy for Christmas. Rope toys, bungee balls, strong rubber toys and other non food objects are treated with glee and the devils will chase each other around the pen playing tug of war and other games. It is important any such toys are carefully chosen to ensure they do not cause any health risks to the animals. As very young babies tunnels made from big rolls and pipes can be a great source of entertainment and easily moved around the pen.

D and E males – these were wild caught on the West Coast in January 2005 as adult males at around three years of age. These males remained firmly nocturnal and very shy of keepers and so were much easier to handle that some of the A, B, C females. They rarely use their ponds and do not touch toys. For them, enrichment needs to be all those things mentioned earlier which includes adding new things with new smells, new types of food and wherever possible company. Both males lived quite agreeably in shared accommodation with non-breeding adult females. One regularly shared a nest box with one female. Regular movement of structures and runways within pens is also very important for these animals to prevent boredom.

Eastern and West Coast insurance animals – Most of our devils come from wild caught newly-independent juveniles. Ten were captured in May 2005 from three different sites on the West Coast (named our F, G and GA babies) and thirteen others from Disease Free areas in Eastern Tasmania (known as the Southport and Narawntapu babies in January/February 2005). Because of their different quarantine status they were held in different quarantine centres – eastern animals are kept on my property at Lauderdale and also in pens on Maria Island and the western animals at Taroona.

Both groups of animals have remained relatively nocturnal and would make terrible display animals as they are still frightened of people. They spend all day hidden in their nest boxes. This behaviour as big implications for the type of enrichment that is provided and their pen design. For example, although mounds are great places for devils to tunnel into, these devils would move into such areas and be impossible to check on daily to determine presence and well being. They are very easy to handle, even females with pouch young. They act much like newly-caught wild devils even after 18 months in captivity. Most of them enjoy the swimming pools which are often muddied overnight. However, they are all individuals with individual likes and dislikes.

They are virtually all uninterested in toys unless they involve food and will not eat dry cat biscuits. Interestingly, none of the Southport devils would eat chickens whereas many of the other devils considered this a nice change. One thing they will all search for is cardboard rolls with special food treats inside. Treats are made from pre-soaked cat biscuits mixed with sardines or a high quality fish-based cat-food with vitamins or using blood soaked biscuits and dried fish. The next morning the pens look like they have had a bunch of vandals spreading bits of cardboard throughout. One of the females with pouch young made herself a devil drey out of hay from all the nest boxes. Industriously over several nights, she built herself a huge hay igloo, made from hay stuffed between a mound of branches. Each day she would lie in there with her four playful young and watch us move around the enclosure through the tiniest peephole. In one night she could move a whole biscuit of hay from one end of the enclosure to the other. The scattered traces of hay showed us her pathways. Regularly refilling the nest boxes provided her with a fulltime occupation for many nights until it finally rained and the drey collapsed.

The eastern males were kept separate from the females in individual pens from May 2005 until the breeding season in 2006. For these animals, enrichment is critical. One devil developed serious pacing problems before his arrival at Lauderdale in September 2005. By providing daily enrichment, within a few weeks much of his stereotypical behaviour had reduced. Food was hidden in tiny bits under terracotta pots; tracks were broken up with vegetation and every day his pen furniture was moved. Branches are regularly moved across any marked trails to circumvent pacing or to force devils to follow a new path. However the highlight for Neil was obviously the arrival of his three females from Maria Island for breeding.

One of the things I found most interesting about the devils was their social interactions. Devils are often described as solitary animals which are social feeders. However there is anecdotal evidence that two mature females in the wild with at least five detached pouch young shared a communal or very close den sites under a single dwelling. They have a range of utterances that start with a sniff seeming to say – “I am in here” to an outright roar – “I want that meat” or a long drawn out wail or series of guttural “arfs”– “I am not happy”. Their poses, gapes, scent marking and vocabulary seems to point to a social animal as does their long suckling period of easily ten months if allowed to remain with their mothers.

I was surprised when many of the littermates up to and over two years of age, consistently chose to sleep together in one tiny nest box or continued to share with mum to well past 18 months in age. But I assumed it was an extension of the natural bond between relatives who were forced to remain together in an enclosure. However, when we caught the juveniles from the west coast who should all have been around 12 months of age and from different areas and litters and put them in pens, all of them chose to pile into a single nest box virtually from day one. Every day for months we would find five or six animals huddled into one box! They continued to do this until well over 2 years of age!

The eastern girls spent a long time together in their quarantine groups first in the location where they were caught, then on Maria Island and now at Lauderdale for their breeding program. In almost all cases the females will still sleep together in one tiny box. Even if separated into different pens and mixed with males and then put back in one pen they will quickly pair up into one nest box. The animals with another devil as a friend have the best enrichment – company. For those on their own it is much more important to ensure their enrichment is of the highest quality and variation possible.

From my experience of these animals it seems to me that when we can group compatible animals we should and maybe pouch young should be left as long as possible with their siblings and their mothers, provided of course this doesn't interfere with their breeding cycle. Different enrichment is needed for different animals and the wealth of experience on enrichment in Wildlife Parks and Zoos bodes well for our special little devils.

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Effectiveness of environmental enrichment in reducing stereotypic behaviour in captive Australian Sea Lions *(Neophoca cinerea)*

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Abstract

Marine mammals are often housed in the most 'sterile' captive environments and seem to exhibit high levels of stereotypic behaviour (such as pattern swimming). Most studies however, have only focused on species of pinnipeds from the northern hemisphere and have thus far overlooked the Australian Sea Lion (Neophoca cinerea). Consequently, this study examines the relationship between captivity and the behaviour of Australian Sea Lions. Specifically, it aims to identify the behaviour of captive sea lions, and to measure the effectiveness of environmental enrichment as a tool in reducing 'abnormal' behaviours. It was predicted that stereotypic behaviour would be evident, and that enrichment would be effective in increasing active behaviours and decreasing stereotypic behaviours. It was also expected that objects which are extrinsically reinforcing would be more effective than objects that are intrinsically reinforcing. Two sea lions (a male and female) housed at the Adelaide Zoo were used in this study. An ABABA (withdrawal) experimental design was conducted over a 30-day period (180 hours) using non-food related (intrinsic) and food related (extrinsic) enrichment devices (present during B conditions). Results showed that only the male exhibited signs of stereotypy, suggesting there may be individual differences in the prevalence of stereotypies. The non-food related items elicited a large number of object related behaviours in both animals, which significantly reduced pattern swimming in the male and increased active behaviours in the female. Even though the non-food related item elicited greater response, the food related items produced a larger reduction in pattern swimming. Little behaviour was directed at the food object once it was emptied of fish (i.e. extinction took place), whereas habituation to the non-food related object did not occur as rapidly as was expected. The results demonstrate that the use of simple enrichment can dramatically reduce stereotypic behaviour in Australian Sea Lions, and contrary to previous findings, the use of non-food related objects was just as effective as food-related objects in reducing pattern swimming. Enrichment therefore offers a cheap, practical, simple and effective method of adding complexity to the environment which is likely to benefit the animal's welfare, and enhance the zoo visitor experience.

Introduction

It is impossible for any captive setting to replicate the diversity and variability of natural sea lion environments. In captivity sea lions tend to be housed in artificial environments, with high levels of contact with humans, limited access to large areas of water, lack of opportunity for social interaction, and receive 'controlled' diets at scheduled feeding times. Consequently, placing a sea lion in captivity inevitably reduces opportunity for behavioural diversity, social interaction and foraging- since little time and effort is needed to obtain food, and naturalistic foraging is rarely possible within typical enclosures. The extra time available is replaced with other (perhaps new or 'abnormal') behaviours. Marine mammals are often housed in 'sterile' captive environments and exhibit high levels of stereotypic behaviour (Goldblatt, 1993), particularly swimming in a

circular pattern (Kastelein & Wiepkema, 1989). In their review of effects of captivity, Swaisgood and Shepherdson (2005) found that captivity causes more pronounced negative effects on seals and sea lions than for any other mammal. In addition, Harbour Seals and Gray Seals (Family Phocidae) showed more stereotypic behaviour than any other taxonomic family, with 50% of their time spent performing stereotypic behaviour, which typically involved locomotor stereotypies (Swaisgood & Shepherdson, 2005). Hunter, Bay, Martin and Hatfield, (2002), Grindrod and Cleaver (2001), and Corson, Michel and Zaks (2004) found stereotypic swimming to varying degrees in a number of species of seals and sea lions (Harbor Seals, Gray Seals, Common Seals and Californian Sea Lions). The lowest level of stereotypic behaviour observed was 5% in the Southern Fur Seal (Day, Bode, Lailey, Gibbs and Jenkins, 2001).

Since sea lions are known to be significantly affected by captivity they are suitable benefactors of enrichment. Providing captive sea lions with objects which elicit exploratory behaviour, increase play behaviour and social interactions, and which offer a reward for use (either implicit or explicit) should provide opportunities for goal-directed behaviour and therefore reduce the occurrence of problem behaviours.

Marine mammals, specifically seals and sea lions, have received a relatively diverse range of enrichment, including natural enrichment items (e.g., driftwood, kelp, exhibits with large pools and beaches), artificial enrichment items (e.g., balls, food treat balls, Frisbees) & training (see *The Shape of Enrichment* for further ideas on enrichment with seals and sea lions). However, evidence for the success of most enrichment items and techniques is largely anecdotal, often through keeper observation alone. The need for an in-depth systematic analysis of behavioural effectiveness of enrichment has become critical. Currently limited research exists concerning captive behaviour of, and enrichment for, pinnipeds and none based on the Australian Sea Lion. Success of enrichment devices if often assumed but not verified scientifically. Systematic studies of behaviour modification are extremely time-consuming, and many zoos do not have the necessary resources.

For those studies that do exist, captive marine mammals have shown increases in behavioural diversity and decreases in stereotypic behaviour in response to introduction of manipulable objects, training, and other enrichment devices. For example, Swaisgood and Shepherdson (2005) found that stereotypies among seals are high, but along with other carnivores, stereotypies were reduced by approximately 50% by provision of enrichment devices. Early studies found positive effects of enrichment for Harbor Porpoises (Amundun, 1974), and Pacific Walruses (Kastelein and Wiepkema, 1989).

Kastelein and Wiepkema (1988) investigated whether training could reduce ‘routine-like’ swimming. Over a six-week period, Stellar Sea Lions were alternatively trained and not trained for a week at a time. During non-training weeks the animals spent 7.2% of the observation time engaged in stereotypic swimming. This was reduced to 0.5% during training weeks, indicating that training may have a positive influence on the behaviour sea lions (Kastelein & Wiepkema, 1988).

More recently, Corson et al. (2004) set out to determine the effectiveness of enrichment, in terms of interaction with items, in a captive pinniped population (six Californian Sea Lion's and one Atlantic harbor seal). They compared three types of enrichment typically offered to captive sea lions, including novel objects (ball or frisbee), food enrichment (fish frozen in blocks of ice) and sensory enrichment (audio whale songs). Using only simple categories of interaction (1= undetected, 2= inspected then ignored, 3= continued curiosity and 4= very enriching) they determined using metaanalysis, that there was a significant difference between types of enrichment, with foodrelated items interacted with the most, and non-food items (sensory and novel objects) were simply inspected then ignored. Apart from practical information about types of items effective in gaining attention, the behavioural effects of these items were not measured and therefore no claim of effectiveness could be made.

Hunter et al. (2002) have conducted the most comprehensive study to date of environmental enrichment in pinnipeds, investigating behavioural responses of seven captive Harbor Seals, two Grey Seals and one Harp Seal. Their study used five different enrichment devices, designed to engage all of the seals' senses (e.g., sound, smell, taste, tactile and visual movements). Compared to the baseline phase (prior to introduction of items), during enrichment, time spent in pattern swimming and out-of-sight (assumed to be a form of stereotypic behaviour) decreased, and random swimming and exploration (assumed to be healthy active behaviours) increased.

Grindrod and Cleaver (2001) took a rather different approach and instead of offering a few enrichment devices, provided a complex range of devices and randomly presented them. This study more accurately reflects how 'real life' enrichment programs work than other studies. Enrichment techniques used included feeding (variation, simulated predator-prey chase, novel food-related objects), non-feeding (mirrors, house pipes, buoys, plastic drink bottles, balls), auditory (playing a variety of music), and others (floating haul out mats, buoys tied to chains attached to floor). Their environmental enrichment program significantly reduced circular (stereotypic) swimming in the three Common Seals. Unfortunately their study did not determine which item or set of items was most effective.

The studies by Corson et al. (2004), Hunter et al. (2002) and Grindrod and Cleaver (2001) have helped establish which enrichment items are likely to be most effective for sea lions, showing that their introduction helps to maintain or encourage behaviours that are more similar to their wild counterparts, and that the use of a diverse enrichment program is highly effective.

Both studies by Corson et al. (2004) and Hunter et al. (2002) however are by no means comprehensive. Firstly, neither established an appropriate baseline analysis of behaviour and the researchers are therefore not able to accurately demonstrate the effectiveness of the objects introduced. Secondly, both interventions were conducted over long periods of time (over one year duration), which allows many possibilities for extraneous variables to intervene, thereby distorting findings (e.g., seasonal effects, size of visitor crowds, breeding seasons, health of animals, introduction of different species to the environment,

different keepers and changes to routine). Grindrod and Cleaver's (2001) was carried out during breeding season, alterations were made to the enclosure and the sanctuary also housed sick and injured rescued seal pups.

Apart from many observers being used without undergoing inter-observer reliability testing (for Hunter et al.,2002 & Corson et al.,2004), the observation periods were often very short (between 15 and 30 minutes duration and at random times throughout the day), and accordingly, not long or consistent enough to make claims ofabsolute effect. The longer the observation period, the more likely it is that patterns of behaviour related to effects such as habituation to objects will be observed. Although researchers face time constraints, further research in this field needs to offer an in-depth analysis of behaviour over multiple sessions, over many days, and over many weeks, to be able to make any sustainable claim of change in behaviour. Therefore, a study which observes behaviour over entire days and over consecutive days, as well as allowing for longer periods of enrichment availability is required. Longer availability of enrichment items will allow for full effects of habituation to be determined.

Previous studies have focused on seals and sea lions held in large multi-species exhibits. It is assumed that larger more complex environments and the provision of opportunities for complex social interactions (as would be the case in the wild) is enriching. A study observing sea lions housed in a small enclosure with little opportunity for inter- and intra-species interaction would illustrate a 'true' or 'worst case' effect of captivity on behaviour that could be used for future comparisons.

Previous studies have not investigated behaviour Australian Sea Lions *(Neophoca cinerea),* but on behaviour of Harbor Seals, Grey Seals, Common Seals and California Sea Lions). Lastly, previous studies fail to provide any detail regarding the daily routines of either wild or captive sea lions, so it is not possible to compare behaviour seen in captivity with behaviour observed in natural environments, or to conduct a comparative analysis of daily activity budgets.

Aims of this study

The current study attempts to address shortcomings of previous research in order to further the scientific knowledge regarding the relationship between captivity and sea lions. It will also be the first such study to use Australian Sea Lions. This study aims to provide empirical evidence for the effectiveness of readily available enrichment devices in reducing negative effects of captivity. The results from this study can then act as a guide for managers of captive seals and sea lions for use in developing further enrichment programs and basic husbandry management. In order to achieve the aims of the study, captive sea lion behaviour was analysed over a significant period of time, providing comprehensive coverage of days (weekdays and weekends) and times (6 hours per day), incorporating all significant events during a typical day (e.g., feeding time), in order to get an accurate picture of sea lion behaviour in captivity at Adelaide Zoo. Observations were collected by a single researcher, over consecutive days in order to truly gauge behaviour patterns, trends, and changes in behaviour. Simple and practical enrichment items were used, with longer periods of exposure so as to establish optimum items,

exposure times and periods. The research also seeks to determine whether enrichment devices can reduce 'undesirable' behaviour and in the process establish the difference in effectiveness of intrinsic (non-food related) and extrinsically (food related) reinforcing objects.

Methods

Subjects

The behaviour of a breeding pair of Australian Sea Lions *(Neophoca cinerea),* housed at the Adelaide Zoo, was observed. They have successfully raised two pups. The male Birri is nine years of age and weighs 220kg. Birri was rescued from Victor Harbor (on the South Australian coast) at the age of three months and was hand reared at the Adelaide Zoo. The female Shara is nine years of age and weighs 75kg. Shara was born and raised at Adelaide Zoo and receives a daily diet of 5kg of fish per day. The exhibit contains a 60,000-litre pool, haul out sites and a beach area.

Ethogram

Since an ethogram for Australian Sea Lion behaviour did not exist, one was developed in order to record the behaviour of the animals. The ethogram combined categories already used by Hunter et al. (2002) and Gerber (2005) in conjunction with *ad libitum* sampling of this pair (Table 1). Behavioural categories that were considered representative of 'inactivity' were combined for data analysis. Similarly, behavioural categories that were considered examples of 'activity' were combined for analysis. A single category of behaviour was considered 'stereotypic' (Table 2).

Table 1: Ethogram and operational definitions for Australian Sea Lion Behaviour

Behaviour category	Description
Pattern swimming	Swimming in a repetitive circle pattern.
Random swimming	Swimming other than pattern swimming, and also excluding swimming that forms part of the other behavioural categories as listed below.
Interaction with conspecifics	Any contact between the sea lions or any behaviour directed towards another sea lion. Includes holding any part of the other sea lion's body using mouth or fore flippers, nosing (touching other sea lion with the nose), following, mouthing (open-mouth biting or 'gumming' each other simultaneously), and synchronized swimming.
Resting in water	Inactive while in the water; includes lying under rocks, floating/drifting/bobbing and lying on bottom of pool.
Resting hauled out	Any inactivity on land; includes sitting upright on fore flippers with the neck or head pointed vertically, and also includes sitting or lying down on stomach or side while looking around.

Locomotion on land	Walking or running on land.
Maintenance	Grooming activities directed at self (e.g., rubbing on rocks and scratching body with fore flippers).
Exploration/ play	Exploration or investigation of parts of the enclosure (in or out of water), such as the rock wall, under rocks and pool filter. Also includes behaviour (play or exploratory) directed at objects that are not enrichment items, such as bark or small stones.
Interaction with Keeper	Includes looking at keeper, following keeper, being spoken to or touched by keeper, being fed by keeper or eating while keeper is in enclosure, having body inspected by keeper and waiting at enclosure door (prior to door being opened by keeper trying to leave enclosure). This category excludes any behaviour directed at enrichment objects even if keeper is present (see 'enrichment interaction' category).
Enrichment-object directed behaviour	Touching and interacting with object using any part of the body, but in particular, mouth, nose, neck, and flippers. For the non-food related object, this includes tossing or throwing of the ball. For the food-related object, this includes pulling fish out of the object, and Consuming fish taken out of the enrichment ball. Also includes behaviour directed at the objects by both sea lions simultaneously.
Out of site	Sea lion cannot be seen, as it is in the den, hiding under rocks, or cannot be seen as a result of reflection of sunlight off the water or obscured by position in the water.

Table 2: Classification of behaviours

Classification	**Behaviours included**
Active	Random swimming, interaction with conspecific, interaction with keeper, exploration/play and enrichment-object-directed behaviours.
Inactive	Resting in water, resting hauled out, maintenance
Stereotypic	Pattern swimming

Enrichment objects

Enrichment can elicit two types of exploratory behaviour by providing two types of reinforcers, intrinsic and extrinsic. Intrinsic exploration involves exploratory acts that are not instrumental in achieving any particular goal other than performance of the acts themselves (Hughes, 1997). Intrinsic reinforcement occurs when simply performing the

behaviour increases the probability that it will occur again (Tarou & Bashaw, in press). Extrinsic reinforcement occurs when the performance of behaviour results in a consequence that is external to the behaviour itself and therefore increases the likelihood that the behaviour will recur (Tarou & Bashaw, in press). Here the goal of exploration is primarily directed towards an external goal in response to some specific requirement (Hughes, 1997).

Effective enrichment should minimise habituation and extinction effects. Habituation is defined as a decrease in response due to repeated use or stimulation (Tarou & Bashaw, in press). Extinction occurs when reinforcement is no longer provided for a behaviour which results in a decrease in the performance of that behaviour. This occurs with extrinsic reinforcers where a decrease in responding is more likely to result from extinction than habituation. For example, the reinforcer does not last forever (e.g., the food runs out), with behaviour only maintained when the reinforcer is present (see Tarou& Bashaw, in press, for further information).

The enrichment objects used in this study were specifically designed for use with sea lions and are commercially available. The non-food related object or intrinsicreinforcer (*Seal Thong Ball*) was a small spikey ball (150mm diameter) with an attached thong (Figure 1). The food-related object or extrinsic reinforcer (*Seal Tucker Ball),* was a hard plastic hollow ball (250mm diameter) with one hole which is 5cm in diameter (Figure 2). These enrichment objects were purchased from a commercial supplier and known to be safe for sea lions in the zoo environment. A set of two items was placed in the enclosure to prevent competition for the items (and possible aggression).

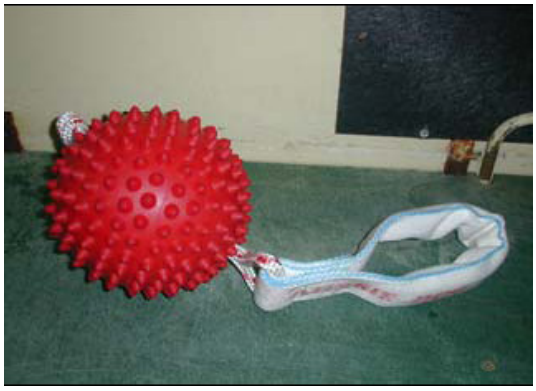

Figure 1: Non-food related item

Figure 2: Food related item

Research design

Both sea lions were observed over a 30-day period using a within-subjects ABABA (reversal) experimental design (Table 3).

Table 3: Summary of the experimental design used and total hours of observation.

Condition	Procedure	Time	Total hours of observation
Initial Baseline (A1)	Observation only; no enrichment objects	14 days	14 x 6 hours per day = 84 hours
Experimental Treatment 1 (B1)	Experimental condition 1; non-food related enrichment objects (2 seal thong balls) present in enclosure	3 days	3 x 6 hours per day = 18 hours
Baseline (A2)	Observation only; no enrichment objects	4 days	4 x 6 hours per day = 24 hours
Experimental Treatment 2 (B2)	Experimental condition 2; food related enrichment objects (2 seal tucker balls) present in enclosure	3 days	3 x 6 hours per day = 18 hours
Baseline (A3)	Observation only; no enrichment objects	6 days	6 x 6 hours per day = 36 hours

Observations were made during three two-hour sessions per day (8:30-1030am, 11:00-1:00pm, 2:30-4:30pm) in order to gain an insight into behaviour over different periods in the day (e.g. feeding time, placing animals in night enclosure). The sea lions' behaviour was recorded using instantaneous-scan-sampling of the behaviour and location of both individuals at two-minute intervals. A total of 180 hours of observations were collected.

Zoo management did not introduce any zoo enrichment devices into the enclosure for the duration of this study. No other change to the animals' routine was made apart from the introduction of experimental enrichment objects by the keepers. Daily food allowance was not altered during the food related treatment condition. The fish needed to fill the food-related object was taken from the daily food allowance. Keepers introduced the *non-food related* items at the beginning of the day and withdrew them when the animals were put into their night areas. *Food-related* objects were placed in the enclosure at the beginning of the day, and refilled again during the main feeding session (11.45am). Both balls were each filled with 1kg of fish (so they were three quarters full) in the morning and again during feeding session. On day one, fish were chopped up into pieces for the ball. However due to the negative effect on the water quality and because Birri did not eat the cut fish, on day two and three, whole fish were placed in the balls. The ratio offish used was three Tommy Roughs to every Trumpeter (3:1) as Tommy Roughs were the preferred food item.

Statistical procedure/ techniques

Due to the issues involved in single case designs (e.g., low power, low degrees of freedom, possibility of making type II error), this study relied upon frequencies and proportions of time (percentages) of the behaviours as the main means of identifying change in behaviour (Kuhar, 2006; Saudargas & Drummer, 1996). Analysis was made primarily by visual inspection of graphs, which is recognised as the standard way in which data from behavioural interventions are analysed and constitutes the criterion used most frequently to evaluate data from single-case experiments (see Brossart, Parker, Olson & Mahadevan, 2006; Kazdin, 1982; Saudargas & Drummer, 1996; Martin & Pear, 2003).

Results

As predicted, *pattern swimming* (stereotypic in nature) was identified in Birri's behavioural repertoire, and contributed to the majority of behaviour exhibited in all baseline conditions. As shown in Figure 3, *pattern swimming* accounted for the largest proportion of behaviour. Birri also spent considerable time *interacting with conspecific* and *random swimming*.

FIGURE THREE FITS IN HERE

Figure 3: Birri's behaviour as a percentage of total behaviour during all baseline conditions (A1, A2, A3).

This was not the case for Shara, who exhibited behaviour more similar to wild sea lions. Time was spent random swimming, resting hauled out and interacting with conspecific. Only low levels of stereotypic *pattern swimming* were found (Figure 4).

FIGURE FOUR FITS IN HERE

Figure 4: Shara's behaviour as a percentage of total behaviour during all baseline conditions (A1, A2, A3).

As shown in Figure 5, the introduction of enrichment items for Birri resulted in an increase in *active behaviour* during both the non-food and food related enrichment conditions. *Active behaviour* increased when the non-food related item was presented, and then decreased equally when withdrawn, suggesting that it was the intervention (nonfood related item) alone that caused the increase in Birri's *active behaviour*. The introduction of the enrichment objects also greatly reduced Birri's *stereotypic behaviour* during both the non-food and food related enrichment conditions. Figure 5 shows that when both the non-food and food related enrichment items were introduced, *stereotypic behaviour* decreased, and then increased when the items were withdrawn. This suggests that it was the intervention alone that caused the decrease in *stereotypic behaviour*.

FIGURE FIVE FITS IN HERE

Figure 5: Behaviour classifications (behaviour grouped as *active*, *inactive* & *stereotypic*) for Birri as a percentage of total behaviour during each treatment condition

Although more time was spent interacting with the non-food related item, the food related item was more effective in reducing *pattern swimming* (Figures 6 & 7).

FIGURES SIX AND SEVEN FIT IN HERE

Figure 6: Percentage of time Birri spent in *object directed behaviour* as a total of behaviour during both the non-food and food related condition.

Figure 7: Percentage of stereotypic swimming for Birri during the non-food treatment condition (B1) and the food treatment condition (B2).

For Shara, the results support the hypothesis that enrichment increases natural (*active*) behaviours (Figure 8). Both the non-food and food related enrichment resulted in an increase in *active* behaviour and an equal decrease when withdrawn, suggesting that it was the objects alone that caused the increase. As Shara did not participate in *stereotypic behaviour*, no effect was observed.

FIGURE EIGHT FITS IN HERE

Figure 8: Behaviour classifications (behaviour grouped as *active*, *inactive* & *stereotypic*) for Shara as a percentage of total behaviour during each treatment condition.

Shara did not interact with the food related item to a great extent (Figure 9), however she did use the non-food related object.

FIGURE NINE FITS IN HERE

Figure 9: Percentage of time Shara spent in *object directed behaviour* as a total of behaviour during both the non-food and food related condition.

Habituation towards the objects did occur over the three days of availability. Use of objects was high for both items on day one, followed by a decline in use. The reduction in use was more apparent for the food related item than for the non-food related item (Figure 10 & 11).

FIGURES TEN AND ELEVEN FIT IN HERE

Figure 10: Birri- Non-food and food related object directed behaviour for Birri as a percentage of total behaviour for each day of availability.

Figure 11: Shara- Non-food and food related object directed behaviour for Shara as a percentage of total behaviour for each day of availability.

Discussion

Overall, *stereotypic* behaviour was evident in the male, but not the female sea lion. The introduction of both the non-food (intrinsic reinforcer) and food related (extrinsic reinforcer) enrichment items resulted in a positive impact on behaviour. Stereotypic *pattern swimming* was reduced in the male, and *active* (natural) behaviours were increased in the male and the female.

The activity budgets of the sea lions differed between the male and female sea lion. As expected, the male spent the majority of time *pattern swimming*. Shara, on the other hand, seemed relatively unaffected by captivity, exhibiting an activity budget similar to her wild counterparts (i.e., random swimming, hauled out and interacting with conspecific), with no sign of stereotypic behaviour. Birri's behaviour is consistent with the behaviour of seals observed by Grindrod and Cleaver (2001) and Hunter et al. (2002). Grindrod and Cleaver (2001) observed a captive born male and female Common Seal of similar ages to those used in this study. It appeared that both sexes produced equal amounts of *pattern swimming*. As a result, it remains uncertain if captivity has different effects for male and female sea lions as was the case here, or whether the effect of captivity affects sea lions individually determined by the their ability to cope in a specific environment. The differences in behaviour between captive males and females need to be further investigated.

Birri's *pattern swimming* occurred in the same locations of the pool at generally the same times of the day, lasting for any time up to one and a half hours. *Pattern swimming* always occurred in a circular pattern, always in an anticlockwise direction, and in one instance included two full rotations or twists of his body in the same location. This is consistent with Grindrod and Leaver's (2001) study, which also reported *pattern swimming* in a circular pattern. Wells, Irwin, and Hepper (2006) found that California Sea Lions show *lateralized swimming* behaviour (i.e., they show a preference in their swimming patterns) which differed according to sex. The males in their study swam in a clockwise direction (and females in a counterclockwise direction), which was the opposite of what was observed for Birri. This *pattern* behaviour may be due to brain lateralization and/ or the enclosure design as it is possible that exhibit layout contributes to the directional preferences. Enclosure design and direction of *pattern swimming* need further investigation to determine if any links do exist. For example, some sea lions have been known to perform figure of eight patterns in larger exhibits.

The introduction of enrichment to the enclosure was expected to reduce *stereotypic* behaviour in this sample of sea lions. Overall the hypothesis was supported as both non-food related item (intrinsic reinforcer) and food related item (extrinsic reinforcer) reduced *stereotypic swimming* in the male. Although the female showed no stereotypic behaviour, enrichment still had a positive effect by increasing active behaviours. On several occasions, however, Shara was observed to regurgitate, which may warrant investigation in future research. Enrichment objects provided Birri with something to focus his attention on. Enrichment thus acts as a good 'probe' to disrupt the pattern of *stereotypic swimming* (as suggested in Mason, 1991).

It appears the non-food related object acted as both an intrinsic reinforcer (the motivation being explained by the 'optimal arousal theory' see Hughes, 1997) as well an extrinsic reinforcer (reflected in increased interaction between the two sea lions). Nonfood related objects therefore provide a low cost, low maintenance enrichment device. When considering non-food related objects it may be worth considering an item that promotes interactions.

The food related item as predicted, successfully in reduced Birri's *pattern swimming*, and contributed to an increased Shara's *active* behaviour. However the use of the item was high for Birri but low for Shara. In fact Birri dominated use of the objects when they contained fish, and did not allow or give the opportunity to Shara to use them (even though there were two identical items placed in the enclosure). Two reasons are expected to play a role in this. Firstly the effectiveness of food related objects depends on the food drive of the animal (which Shara lacked), and secondly, the dominance hierarchy came into play (since Birri is the dominant animal). This suggests that even when two items are provided simultaneously, the dominant animal may still monopolise use of both objects. The less dominant animal may need to receive enrichment items separately.

Use of the food item declined rapidly, but remained highly effective over all three days when food was present, not exhibiting typical habituation effects. Use of the item declined rapidly after it was emptied of fish. As soon as there was no food available, the

object was no longer used. However it was highly effective over all three days when food was inside it. This may be explained by extinction, where the object was only seen as a food dispenser, not as a play item itself, with extinction taking place as soon as the ball was emptied of fish (see Tarou & Bashaw, in press for a summary of learning theory and enrichment).

Despite the fact that the non-food related item was used more than the food related item, the results support the hypothesis that extrinsic reinforcers have a greater and longer lasting effect in reducing stereotypy and increasing active behaviours. This is consistent with Neuringer's (1969) prediction that animals, if given the choice, will work for their food. Working for food (or earning it) seems to satisfy the drives in the animal (e.g. they have fulfilled the species-specific need to find and get food).

Future directions

The data from this and previous studies indicate that enrichment is successful in reducing stereotypic behaviour in pinnipeds. However, only relatively small samples of animals and captive environments have been utilised. Similar studies need to be conducted in order to allow for future meta-analysis. Many more enrichment devices, items and techniques must be designed and their effectiveness tested, in order to provide enough items to choose from. Based on the findings of this study, a number of questions to be addressed by future research arise, that can be separated into two categories: enrichment in general, and enrichment specifically for sea lions.

Questions related to enrichment in general:

- Are intrinsic reinforcers effective? Since there is now conflicting evidence as to the effectiveness of intrinsic reinforcers (non-food related items), future studies should address this further.
- How can extrinsic reinforcers be more effective? The use of partial reinforcement food delivery has not yet been trialed in enough species and is predicted to produce better results than continuous food delivery.
- What are the effects of enrichment in the long term? Long term studies will provide some indication as to whether enrichment still remains effective after long periods of exposure, and also whether stereotypies can be completely reduced after an enrichment program has been in place.

Questions related to enrichment for sea lions:

- Daily routines and activities of both wild and captive sea lions need to be established so as to truly gauge differences in behaviour. Studies of sea lions in the wild provide seasonal activity budgets, but do not give daily activity budgets.
- The effects of routine schedules on behaviour need to be researched, and whether it would be of any benefit to alter them (e.g. have random feeding times).
- The true causes of stereotypy in sea lions are still not fully understood. What else apart from anticipation and poor enclosure design contributes to pattern swimming?

- The characteristics that create differences in an individual's level of pattern swimming (e.g. the differences between male and females, captive versus hand raised animals) is still unknown and needs further attention.
- Regurgitation should be investigated further in order to determine whether it fits the requirement of stereotypy and how often it occurs in sea lions.

Conclusions

1. This study provides evidence that stereotypic behaviour exists in captive Australian Sea Lions, and that individual differences in the level of stereotypy may be present (e.g., sex differences, ability to cope with environment, enclosure characteristics).
2. The results indicate that environmental enrichment has the capability of increasing active behaviours (e.g., random swimming, interaction with conspecific) while decreasing stereotypic behaviour (pattern swimming) in captive Australian Sea Lions, therefore providing the opportunity of species specific behaviours to be expressed in captive environments.
3. Evidence gained suggests that enrichment objects that utilise intrinsic (novel objects) and extrinsic reinforcers (food related objects) are both highly effective in reducing stereotypic behaviour and increasing active behaviours. Extrinsic reinforcers being more effective in the long term.
4. Findings indicate that enrichment is a cheap, practical, simple and effective method of adding complexity to the environment. This is not only perceived to be beneficial for the animal's welfare, but also more desirable for the viewing public. Thus, there is no excuse for not providing enrichment to captive sea lions.
5. In order for enrichment to be most effective (i.e., to lessen habituation), enrichment objects must either constantly introduce novelty into the environment or a large number of items be continually rotated.

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Happy Herpetofauna at Melbourne Zoo!

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Abstract

Melbourne Zoo's Herpetofauna Department has various methods to enrich the some 700 individuals within the collection. It is not, however, the standard forms of enrichment and conditioning that you find in other areas of Zoo-Keeping, but rather good husbandry skills used to promote the well being and up keep of the animals within the collection. The Department primarily uses routine husbandry techniques such as regularly changing enclosure furnishings, providing outdoor exercise and natural sunlight when available, allowing the animal to "swim" where possible and scenting enclosures with different scent trails. These facets and others aid in providing reptiles and amphibians with an enriching life in captivity.

Introduction

The Melbourne Zoo Reptile House was opened in 1969 and in that time has seen thousands of reptile and amphibians pass through the collection. Currently there are over 700 animals within the department, including snakes, lizards, turtles, tortoises, crocodiles, frogs and newts. There are over 7000 species of reptiles in the world and Melbourne Zoo Herpetofauna Department is home to approximately 80 of them within 36 displays. The World of Frogs adjoining the Reptile House opened in 1995 and 15 species of amphibians are represented within 8 displays.

Reptiles live in a vast array of habitats and can inhabit a variety of temperature extremes, adapting to different living conditions. Reptiles can been found in marine environments, harsh desert conditions, and semi-aquatic, terrestrial and moist rainforest environments. Reptiles consume a variety of prey items and use different feeding strategies. Species may be herbivores, carnivores, insectivores or omnivores. More than often it is the reptile species that can be both the predator and the prey in the food chain.

Herpetofauna enrichment is not viewed in the same light as other mega fauna enrichment. However, it is still a necessity to allow animals in captivity to behave in a naturalistic manner. Reptile enrichment does not involve smearing blood onto balls, hiding yabbies in PVC tubes in children's swimming pools or making puzzles with food rewards for mental stimulation, but rather correct exhibitry and husbandry to allow for typical species behaviours.

Exhibit/Enclosure Enrichment

There are many ways in which reptiles and amphibians lives can be enriched in captivity. Enclosure design and size is an important part of enrichment for reptiles as too small an enclosure can cause problems such as overgrown claws, muscle deterioration and potential fighting between individuals. Larger enclosures are much more appropriate, and maximising use of space is a key component when deciding on furnishings and substrates. Offering many hides and refuges are also important but spatial familiarity can

occur. We are constantly changing and moving around furnishings within enclosures and this encourages investigation and stimulus for the animals.

Enclosures in the Herpetofauna Department are provided with many different substrates and furnishings. Substrate or soil types include palm peat, river sand, leaf litter, gravel, river rocks and sphagnum moss. These are all changed on a regular basis by the Herpetofauna staff and also a member from the Horticulture staff. Sixteen years ago a relationship was formed with the Horticulture department to encourage one member to be involved with the reptile team and come to the department on a regular basis to change plants and substrates. This is still taking place to this day and is important part of reptile and amphibian enrichment. Constant changeovers of substrates and live plants promote investigative behaviour. The use of different soils and mosses encourages excavating and nest burrowing.

Perching is another vital component in reptile and amphibian husbandry and enrichment. Perching provides ways for animals that are semi or fully arboreal to make use of the whole enclosure space. The positioning of perches and branches within an enclosure is important for reptiles to allow them to access to heat sources enabling them to regulate their preferred body temperature (PBT). This is known as thermoregulation in Herpetofauna. It is also important to place perches in other areas of the enclosures or exhibits, giving the animal a chance to move away from the heat source when required. Perches and branches can be placed either vertically or horizontally, both of which promote exercise and should be regularly changed and positioned differently within an enclosure to avoid spatial familiarity. In some lizard species it is important to offer several perches, as alpha males will assert their dominance over other individuals by perching or sitting above them. The positioning of perches can also act as a visual barrier for some reptile species e.g. Frilled Lizards and arboreal geckos. Less dominant animals can therefore hide on the offside of a branch and therefore overting hostility between individuals and minimising stress.

Misting and spraying is also used on a highly regular basis within exhibits and off limit enclosures. It promotes high levels of activity in many different species, especially in frogs. Many reptile species require fresh water to drink from and misting and spraying of animals promotes this exercise. For example, it is not common practice for Frilled Lizards or Eyelash Vipers to drink from a standing water source, but rather fresh water sprayed onto them by a keeper from either a hose or spray bottle, stimulating drinking behaviour. Misting and spraying also aids in increasing humidity levels and creating a healthier soil and plant environment. Misting can also promote breeding behaviour. In many species of frogs, after misting takes place, male frogs will make advertisements calls to attract females.

Environmental Enrichment

The Herpetofauna Department consistently provides outdoor exercise and natural lighting for many different species during the warmer months of the year. Many species of turtles and tortoises, chameleons and lizards are exposed to many hours of natural sunlight in the sunning boxes and outdoor enclosures. Natural sunlight is vitally important to many

reptiles for the intake of natural UVB. UVB is important in manufacturing Vitamin D3, in turn is vital to assist the body in absorbing calcium and maintain strong and healthy bones. It also provides benefits to skin condition, appetite, immune and reproductive systems.

Swimming some of our snakes is another form of enrichment that we use. We regularly swim our large viper species and this promotes good muscle strength and toning and potentially could aid in improving bowel movements. The swimming of these snakes consists of a large black tub filled with tepid water. The snake is placed into the water for a short period of time and due to the shape of the tub, is unable to catch onto anything along the sides causing consistent swimming motions. Swimming is only done in species of snake that would commonly encounter water in their natural habitats. This practice is also closely supervised.

Scenting exhibits and enclosures is another way of enriching reptiles, and this can cause very high levels of activity in many species. A variety of enclosures can be scented with different forms of prey items. Our Department regularly scents lizard enclosures with snake sloughs, promoting tongue flicking and investigative behaviour. We also scent snake enclosure with other snake sloughs, water with mice gizzard within it and bird feathers. This again encourages snakes to be active and stimulated. Rather than using sloughs in some instances, we occasionally will rotate animals and swap snakes and lizards from different enclosures for periods of time. This again promoting different and potentially stronger scents from live animals within enclosures. At certain times of the year, sexually active males will also be put within enclosures together for brief periods of time, promoting increased hormone levels and combat activity. It is important to note that the health of these animals is all known prior to movements and scenting to avoid the spread of disease or parasites. Many of our displays are also mixed species exhibits. By having Chameleons housed compatibly with snakes, smaller snakes with larger snakes, lizards with tortoises can create a mini eco-system. Mixed species exhibits maximises full usage of an exhibit with a mix of terrestrial or arboreal species and also aids in scenting the enclosures without keeper interference.

Dietary Enrichment

Dietary enrichment can also elicit many types of behaviours in reptiles and amphibians. Feeding live crickets to many of our lizards and frogs species at irregular intervals encourages foraging behaviours and stimulates natural behaviour activity. Other live prey items such as grasshoppers and cockroaches can also encourage activity. One example of stimulated activity from live prey items is fruit flies in Poison Frog exhibits. A culture within a small plastic bottle is made up with fresh fruit and taken to the exhibit. The bottle is left within the exhibit and all frogs are aware of the bottle being a food source. All frogs within five minutes will move down to the bottle and sit on and around it waiting for the flies to leave the bottle. We also on occasions feed our crocodiles live goldfish. This promotes somewhat of a feeding frenzy, and aids in giving the crocodiles plenty of exercise chasing the fish within the exhibit. We regularly feed our Iguanas a wide range of browse. At different times of the year we will feed coprosma, hibiscus, Chinese-lantern and many other brightly coloured aromatic flowers. The browse and

flowers are arranged within the exhibits and enclosures as temporary perches to again promote exercise.

Discussion

The above forms of enrichment that I have discussed are the more interesting scenarios of reptile enrichment within the Herptofauna department. There are also basic requirements for good husbandry and exhibitry for reptiles. Correct temperatures, lighting and providing water sources are essential in the husbandry of these animals to allow all of the above enrichment regimes to occur and be successful. Temperature gradients in reptile and amphibian enclosures are vitally significant to create a healthy environment, breeding regimes and to maintain variation for animals in an exhibit to promote activity. Full spectrum lighting is also important as the provision of UV is vital is maintaining healthy and long lived animals. Both temperatures and lighting is species dependant and without the correct basic requirements of reptile husbandry, enrichment of these animals is unlikely to have a significant effect.

Reptile and amphibian enrichment is extremely different from the other forms of enrichment you see in primates, ungulates and mammals. It stems from good basic husbandry (correct temperatures and lighting requirements), and once that has been successfully achieved, moving onto other forms of enrichment to promote activity and stimulus can be targeted. In the Herpetofauna Department we are constantly changing enclosure furnishings, scenting exhibits, misting consistently and mixing diets all to enrich the lives of our animals to ensure a long and happy life for the Herpetofauna at Melbourne Zoo.

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A multi-sensory enrichment program for ring-tailed lemurs (*Lemur catta*) at Auckland Zoo, including a novel feeding device

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Abstract

In modern zoos, enrichment programs have become a standard part of animal care routines. Although 'higher' primates usually receive complex enrichment programs, encompassing many types of enrichment, these are less common for prosimians. These animals often largely receive food-based enrichment, as was previously the case at Auckland Zoo, where the ring-tailed lemur enrichment schedule contained only three different items, all food-related. Lemurs tend to be considered less curious and quick to learn than other primates, as well as being less manually dextrous, and for these reasons can be overlooked for complex enrichment. However, they have strong sensory abilities, in particular an acute sense of smell (Sauther et al 1999).

This paper describes an enrichment program designed for the lemurs at Auckland Zoo with the aim of stimulating all senses. It includes olfactory, auditory, occupational and feeding enrichment, consisting of 19 different items rotated over a monthly schedule. The lemurs are offered at least one form of enrichment daily, including non-food items at least twice weekly and occasional enrichment-free days. Olfactory enrichment includes browse from other non-primate exhibits, fresh herbs and flavours or spices mixed with water and sprayed in the exhibit. Auditory includes playing music and animal sounds, as well as presenting 'noise maker' devices the animals can manipulate (still in development). Visual enrichment is also in development, in the form of suncatcher devices. The other items encompass feeding and manipulatory behaviour, including water pools, leaf forage pits, stuffed pumpkins and watermelons, Kong toys, smears, pinecones, ice-blocks and dried fruit and nut ropes. The lemurs show the most interest in spice pastes, which they investigate as a group, then roll in and groom off; pinecones with mashed banana and raisins, which require fine manipulation to remove all food from within; and browse scented by other species, which they band together to investigate and which then triggers territorial behaviour such as scent marking.

Included in the program was the introduction of a novel feeding device, a T-Bar on which food is presented, which also proved to be extremely popular with the lemurs. A metal T-Bar is hung upside-down from branches in the exhibit and apples are threaded on to it, each apple pitted with holes in which small treats and honey are buried. This device encourages arboreal feeding, object manipulation and also grooming, when the honey sticks to the fur.

The new enrichment program has provided opportunities for Auckland Zoo's ring-tailed lemurs to explore a variety of new scents, sounds and objects and encourages natural behaviours such as scent marking, grooming and arboreal feeding.

Introduction

Ring-tailed lemurs belong to the prosimians, known also as Strepsirrhines, a line of primates that also includes bushbabies and lorises, which diverged from their monkey and ape relatives around 50 million years ago. They are found only on the island of Madagascar, where they inhabit a variety of habitats, primarily dry, woodland districts. Unlike most lemurs, which are almost exclusively arboreal, ring-tailed lemurs frequently use terrestrial locomotion - however they are still strong climbers and also move through the trees (Mittermeier *et al* 1994).

They live in large multi-sex groups consisting of 3-25 individuals in which, unlike most primates, the females are the dominant sex. Social bonds between individuals are established through reciprocal grooming. The group is highly territorial and will use scent glands located on their feet, rump, wrists and chest to mark their home range (Sauther *et al* 1999).

In modern zoos, enrichment programs have become a standard part of animal care routines. There are many different forms of enrichment, including structural, social, object, sensory, occupational and feeding (Novak & Petto 1991). Although it is common for 'higher' primates (monkeys and in particular, apes) to receive complex enrichment programs, encompassing many types of enrichment, these are less common for prosimians. These animals often largely receive food-based enrichment, as well as passive social and structural enrichment arising from their grouping and enclosure.

Lemurs tend to be considered less curious and quick to learn than other primates, as well as being less manually dextrous (Sauther *et al* 1999), and for these reasons can be overlooked for complex enrichment. However, they are still an intelligent animal and have strong sensory abilities, in particular an acute sense of smell. Prosimians have a large area of their brain dedicated to olfaction (King 1978) and the wet nose of lemurs, similar to that of dogs, allows for improved olfaction. Olfactory investigation is found to appear quite early in the behavioural repertoire of young lemurs (Palagi *et al* 2002) and they are able to recognise individuals by scent alone (Pelagi & Dapporto 2006). There are varying reports as to the effectiveness of olfactory enrichment to elicit a response in ruffed lemurs (Butterfield 2006, Hutchings & Mitchell 2003). Lemurs also hear well, with mobile ears, and have greater aural sensitivity in the high frequency range than anthropoids (Gilette *et al* 1973, King 1978). They have good stereoscopic vision, including night vision, although limited eye movement. They also have more rudimentary trichromatic colour vision than anthropoids and appear to have lower visual acuity (King 1978, Sauther *et al* 1999).

Auckland Zoo's lemur group is made up of one (vasectomised) male and eight females, ranging in age from two to twelve years old. Although there have been problems with female aggression in the past, the current group appears quite harmonious. The animals reside in an open-air exhibit measuring 32 x 9 metres, connected by raceway to an indoor holding yard. Their exhibit is highly vegetated, planted with trees, shrubs and grasses; also containing added branching and ropes. Itoffers many varied travel routes, both

arboreal and terrestrial. The thick vegetation also provides the opportunity for the animals to escape public eye when they desire.

Previously at Auckland Zoo, the ring-tailed lemur enrichment schedule contained only three different items, all food-related – pinecones, dried fruit/nut ropes and hanging browse baskets. In comparison, the orang-utans' schedule consists of over 20 items rotated over six months, encompassing feeding, sensory and occupational enrichment; as well as daily keeper choice of object, social and structural enrichment.

Multisensory Enrichment Program

This paper describes an enrichment program designed for the lemurs at Auckland Zoo with the aim of stimulating all senses, as it was thought that their current enrichment schedule was not providing much variety or sensory stimulation. The program was designed using ideas from the keepers and from those used for other species elsewhere, and includes olfactory, auditory, visual, feeding and occupational enrichment, consisting of 19 different items rotated over a monthly schedule. The lemurs are offered at least one form of enrichment daily, including non-food items at least twice weekly, presented at varying times of day. They also have enrichment-free days throughout the month.

Olfactory

Olfactory enrichment includes browse from other non-primate exhibits, fresh herbs and flowers, and flavours or spices mixed with water and sprayed in the exhibit. Branches and nesting material are brought in from other exhibits, containing the scents of other species. Fresh herbs and flowers are picked from the garden and either scattered in the exhibit or placed in hanging baskets. Sacks are filled with hay and dabbed with essential oil, then tied up and hung in the exhibit. Liquid scents and flavours are diluted in water, then sprayed around the exhibit and on the furniture. Spices (such as nutmeg, cloves, allspice, paprika) are mixed with water to form a paste, then smeared throughout the exhibit.

Browse scented by other species causes the group to band together to investigate, as an intrusion into their territory. They then start territorial behaviour, such as scent marking, which increases bonding within the group. This also increases exhibit use, causing the lemurs to use the entire exhibit, rather than just the one end they usually prefer. Due to the potential risk of intra-group aggression arising from this heightened territorial state, this enrichment is only used once a month.Fresh herbs and flowers were one of the first items introduced and are one of the favourite non-food items - the lemurs foraging through, experiencing different scents and textures, and eating parts they like. Sacks with essential oils were trialled a few times but elicited no response and so were eventually removed from the schedule, to be replaced with items that will stimulate behaviours. Spice pastes are very popular (in particular nutmeg); they generate group investigation, rolling and grooming. Liquid flavours have a similar but lesser effect, but can be sprayed up higher to encourage arboreal behaviour and the lemurs will rub the scent onto their fur.

Auditory

Auditory enrichment includes playing music and animal sounds, as well as presenting 'noise maker' devices the animals can manipulate (still in development). There are

multiple sets of sounds used, and these are played softly from a speaker system set up behind the exhibit. The 'noise makers' will be sealed tubes containing small rocks or similar, and are intended to be hung throughout the exhibit, allowing the lemurs to manipulate them to generate sound.
In the beginning, lemur calls were played as audio enrichment, but this was stopped as it caused stress in the lemurs and given the history of aggression in the group it was considered that continuing may pose a risk of this recurring. They now get natural habitat sounds like running water or rainforest sounds, as well as soft classical music. Depending on the sounds and other stimuli present on the day, the lemurs may move to the far end of the exhibit away from the sounds (an area they do not commonly use), vocalise or group together and move forwards to investigate the sounds.

Visual
Visual enrichment in the form of suncatcher devices is also still in development. Reflective items will be hung in the exhibit, out of public view, where they will reflect the sunlight into the exhibit, creating multiple shifting light spots throughout the enclosure, which the lemurs will have the opportunity to watch and even stalk or chase.

Feeding/Occupational
The other items encompass feeding and manipulatory behaviour, including water pools, leaf forage pits, stuffed pumpkins and watermelons, kong toys, sticky logs/balls, pinecones, ice-blocks and dried fruit and nut ropes.

Water pools are small children's paddling pools filled with water and a small amount of floating leaves, grass or woodchip with some food treats, which the lemurs have to fish for. A leaf pit is a small pit dug in the exhibit then filled with leaf litter mixed through with treats such as dried fruit. Stuffed watermelons are whole watermelons with small holes cut into them, which are filled with dried fruit treats and then hung in the exhibit. Stuffed pumpkins are similar, except the pumpkin is hollowed out a little and refilled with an oat and fruit mix that the lemurs can access through holes. Kong toys are smeared with a little jam, honey or mashed banana inside and out, and rolled in coconut; then hung in the exhibit. Sticky logs/balls are exhibit logs or boomer balls smeared with syrup or similar, which has food stuck into it for the lemurs to pick out. Pinecones are smeared with mashed banana and raisins and hung throughout the exhibit. Ice-blocks are made up of multiple layers of different flavours and textures (yoghurt, juice, chopped fruit) and hung in the exhibit. Dried fruit and nut ropes are ropes strung with dried fruit or nuts and hung through the exhibit.

Most of the food items encourage investigation and object manipulation. The hanging ones also require balance and hand-eye coordination, and can be placed in more difficult to access areas of the exhibit to increase exhibit use. Items with syrup or honey increase grooming, as the sticky substances are transferred to the fur and need to be groomed off.
The stuffed pumpkin and watermelon were mostly ignored when first introduced, and had to be altered slightly to encourage use - the size of holes was increased, as the lemurs had trouble extracting food from the smaller holes. The pumpkin will occupy the group over an entire day, with the dominant females guarding it and the subordinates sneaking in

when they can. The watermelon has a scent the lemurs seem to like and they will lick the melon, something they do not do with the pumpkin.

The water and leaf pits encourage investigative and foraging behaviour. The water also provides a new sensation for them to experience, for although they have a moat at the front of their enclosure, they have not had reason to use their hands in the water before.

T-Bar Feeder

Included in this enrichment program was the introduction of a novel-feeding device, a T-Bar on which food is presented, which also proved to be extremely popular with the lemurs. A metal T-Bar is hung upside-down from branches in the exhibit and apples are threaded on to it, each apple pitted with holes of varying depths in which small treats and honey are buried.

The T-bar feeder was designed with the idea of encouraging a range of behaviours. As it is a new item, it leads to exploration and investigation. Hanging it on ropes or in trees increases arboreal feeding, in contrast to their usual feeds on the ground, and requires balance. The device can also be placed throughout the exhibit to encourage wider exhibit use and vary the difficulty of obtaining food. Extracting the food requires object manipulation and hand-eye coordination. After the food is consumed, the honey stuck to the fur leads to mutual grooming activity, which may help develop social bonds. It is also a device that can be used by the whole group at one time, as some of the raisins fall to the ground and the less dominant animals can forage down below while the moredominant animals work with the feeder.

The T-bar was deemed appropriate to introduce to the lemurs straight away, as it did not seem likely to cause risk to them. In the beginning, the ribbons tying up the device were kept short, to allow the lemurs a chance to grasp the concept of using it. Now they are aware of the rewards offered, the lengths of the ribbon are varied to increase difficulty and the lemurs will still work for the food when it is more difficult to do so.

On the first introduction, the group was monitored to ensure there were no problems with the device, particularly with group aggression. They were watched both before and after the introduction of the device, with no problems observed. The data collected indicates that the lemurs spent about 20 minutes interacting with the T-bars initially and returned to them continually throughout the watch. After finishing with the treats, they groomed one another sporadically for about 40 minutes. They were also observed to return to the T-Bars throughout the day and interact with them.

The T-bar is constructed from 10mm steel rod. They are cheap to make, only costing around NZ$10 each. They are hardwearing and easy to clean, and take up very little space in storage. The T-Bar device can also be used as a different way of presenting items from the daily diet, encouraging increased arboreal feeding and discouraging rodent activity.

Conclusion

The new enrichment program has provided opportunities for Auckland Zoo's ring-tailed lemurs to explore a variety of new scents, sounds and objects, which were missing in their previous schedule. Although some devices are more popular than others in terms of the amount of interest shown in them, all are valuable in terms of providing variety and stimulating different behaviours. In particular, natural behaviours such as scent marking, social grooming and arboreal feeding were observed to occur in conjunction with the provision of this enrichment. Future studies comparing the frequency of behaviours occurring both with and without the enrichment may help to further reveal the exact effects of the enrichment program on the lemurs' behaviour.

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My Boss is a Silverback

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Abstract

21st century zoo keeping practises have embraced and are developing the notion of animal enrichment as a means of enhancing the well-being and heath of all zoo animals. Successful integration of Enrichment programs requires changes to operational plans daily timetabling and departmental structures with support and input from a wide range of staff members. Unfortunately Maintenance workers are often neglected in restructures and still viewed in isolation from keeper teams and animal welfare initiates such as enrichment. The daily experience of maintenance staff can and does vary, from time in the primates to demands from reptiles through to working on the carousel. This allows for the development of extensive and varied knowledge on a wide range of areas within the zoo environment. As experienced professionals, maintenance staff can offer exciting and innovative developments to assist with the development of initiatives to improve the outcome for animal welfare, conservation, and keeping staff. Curatorial and keeping staff may be aware of animal needs however have little knowledge of the practicalities or possibilities of maintenance and construction. Development of facilities such as the blood sleeve for Primates at Melbourne Zoo, clearly demonstrates the benefit of close discussion and consultation between maintenance and keeping staff. It had become increasingly evident through my time at the zoo that the closer the two disciplines work-works department and keeping staff- the better the outcome for animal welfare, conservation, and keeping staff.

The effectiveness and logistical limitations of an enrichment programme for two Syrian Brown Bears (*Ursidae arctus*) implemented at a small zoological institution.

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Abstract

An enrichment programme to facilitate the reduction of stereotypic behaviour patterns in the Syrian Brown Bears, Huggie and Pooh at a small zoo was established to help increase the display of a relatively diverse array of species-normal behaviour patterns. The aim of this study was to assess the effectiveness of the early development of the programme using systematic observation of the bears' behaviour. Observations were taken over 20 days, adding one additional activity to the bears' day after ten days of observation. Simple analysis, using pie and line graphs was carried out to find trends in the reduction of stereotypical behaviours. A definite trend was seen in Pooh's behaviour towards less stereotypic behaviour over the course of the study. This study also aims to address the logistical and practical limitations that the programme revealed in relation to small zoological institutions.

Introduction

Over the past century there has been a considerable shift in how people perceive the role of zoos in our society. The modern zoo is no longer merely for the exhibition of a newfound species or the provision of a space to breed those becoming extinct it is now more than ever intended to be a snapshot of the wild. (Chamove, 1996). This has made way for the rise in importance of environmental enrichment for the improvement of the psychological well being of the species that are housed in zoos and in turn those in research laboratories and those used for consumption (Renner, 2002; Swaisgood *et al.*, 2001). Considering an ever decreasing population of fauna on our planet it is with mounting importance that we not only aim to save species from extinction but also to preserve species typical behaviours (Priest, 2006; Renner, 2002) to enable us to teach conservation education more effectively (Forthman *et al.*, 1992; Mench *et al.*, 1996; Renner, 2002). Additionally, if we are to save many of our species from extinction appropriate sexual behaviour is necessary for successful reproduction (Forthman *et al.*, 1992) therefore enrichment, to encourage species appropriate behaviours and to inhibit the display of stereotypies (Carlstead, 1996; Hare *et al.*, 2003; Fischbacher *et al.*, 1999; McGivern, 2005; Mench, *et al.* 1996; Mellen *et al.*, 2003; Montaudouin *et al.*, 2005. and Renner, 2002.) will facilitate this aim.

Environmental enrichment can be defined loosely as an animal husbandry principle that seeks to enhance the quality of captive care by identifying and providing environmental stimuli necessary for optimal psychological well being. (Shepherdson, 1998; Swaisgood, *et al.*, 2005). It is also typically designed to permit or encourage animals to display their natural behavioural repertoire (Mellen and MacPhee, 2001) and to allow the animals own behaviour to have a direct effect on producing what it needs (Carlstead, 1996). Compared with the wild, captive environments lack novelty, are spatially limited, lack complexity

and generally provide the inhabitant with little control over its environment (Carlstead, 1996; Poole, 1998)

Stereotypic behaviours are often the result of the frustration caused by the animal's inability to carry out certain goal directed behaviours or they stem from the animal forced to live in a barren enclosure without stimulation or persistent unavoidable stress or fear (Shyne, 2006). A stereotypy is any repetitive, invariant behaviour without any apparent function or goal (Carlstead, 1996). Stereotypy as an indicator of animal welfare is complicated. Some older studies (Broom, 1983) suggest that stereotypic behaviour provides direct evidence for impoverished welfare and suffering and these suggestions are often used in more recent studies (Shyne, 2006). However, others strongly suggest that there is not a direct relationship and in fact Mason and Latham's (2004) survey showed that only 68% of environments that cause stereotypies are associated with diminished welfare. Additionally, Swaisgood and Shepherdson (2005) suggest that some stereotypies may be a scar from previous suboptimal environments or merely a healthy means of coping with an aversive environment (suggesting better welfare than animals not exhibiting the stereotypy). Stereotypies are however one indicator of diminished welfare and because of this there has been a general aim to provide opportunities for animals to have plenty to do and to provide a range of pleasurable activities, allowing behaviour goals to be achieved and choices made (Montaudouin and Pape, 2004). Animals should have an element of 'control' over their environment (Broom and Johnson, 1993) and enrichment ideas and programmes aim to provide animals with this control.

Biologically appropriate complexity in enclosures can be increased in many ways. For example adding substrates, thereby increasing the information content of the environment; providing barriers and landscaping to provide privacy and improve social interactions; and providing toys and novel items to elicit exploration and creative play (Swaisgood, 2005) are all ways of increasing complexity and providing the animals with some control over their environment. Shyne's (2006) Meta-analytic review suggests that regardless of the type of enrichment, the species of animal, or even the form of stereotypic behaviour, environmental enrichment reduces stereotypes and thereby improves captive zoo animal welfare. This reduction in negative behaviour may be a function of the novelty of the enrichment rather than its intrinsic qualities (Shyne, 2006) however this may not be a problem as enrichment items should be rotated so that the novelty of any one item remains interesting long term.

Even though there is now a definite and positive move towards improving an animal's welfare, enrichment decisions often focus less on animal needs and more on visitor needs (Carlstead, 1996; Davey, 2006; MacPhee *et al.*, 1998; Mench *et al.*, 1996) as sometimes the needs of people and animals do not often seem to be complementary for example allowing animals to hide away from the paying public (Davey, 2006). However, Davey (2006) proved that exhibit naturalism does have a positive influence on the human experience of zoos. Visitors showed greater interest as the enclosures tend to be more aesthetically pleasing, and non-visible animals motivate people to look for them. The enclosures also provide opportunities for conservation education among other things

(Davey, 2006). MacPhee *et al.* (1998) also found that the presence of enrichment, regardless of the type (natural or non-natural) did not influence visitor perceptions; non-natural objects were in fact associated more with activity than natural objects (MacPhee *et al.*, 1998).

Finally, keepers and handlers of captive animals are beginning to recognize and are willing to address the need to encourage all the animals in their care to display species-normal behaviour patterns. A practical enrichment programme to facilitate the reduction of stereotypic behaviour patterns in the Syrian Brown Bears housed in this small institution was produced (Appendix 1). Thus the aim is to assess the effectiveness of the programme and to address the logistical and practical limitations that the construction, implementation and assessment of the programme revealed in relation to this small institution.

Methods

Subjects

The two Syrian Brown Bears housed in this institution are siblings and are the last two Brown Bears to be bred in Australasia. The bears' current enclosure is neighboured by: the Sumatran Tiger exhibit on one side; a small nature strip and road on the other side; and the maintenance and meat preparation shed behind. Public viewing is from a raised platform looking down into the exhibit. See Appendix 1 for the enclosure furniture and inclusions.

Programme Construction

Firstly research was carried out into methods of constructing and implementing enrichment programmes. Additionally enrichment methods and items for Bears housed in other institutions in Australia were researched. An individual rather than a team due to time and human resource restraints constructed the programme. The steps used to construct the programme were a combination of the 'SPIDER' method pioneered and developed by Mellen and MacPhee at Disney's Animal Kingdom on which they wrote a commentary (2001) and course notes (2003) and the guidelines used by Hare *et al.* (2003) at San Diego Zoo to construct an enrichment programme for Giant Pandas. Outlined below are the guidelines used to construct this programme.

Research the Species' Natural History and Behavioural Ecology (Hare *et al.*,2003).

A good enrichment plan should both target behaviours that a species has a natural tendency to exhibit and take advantage of species' natural sensory abilities (Hare *et al.*, 2003; Chamove, 1996.). Additionally, the application of behavioural principles requires consideration of each species unique communication, social structure and feeding strategies (Forthman *et al.*, 1992). Therefore, research into the available literature was conducted on the Syrian Brown Bear's natural history (McGivern, 2005; Stirling, 1993; Ward, 1999.) and Huggie and Pooh's individual histories (daily reports kept by keeping staff).

Set Goals (Mellen *et al.*, 2003)
The goal for this programme was simply to establish a way of reducing stereotypic behaviours that the bears were exhibiting and to create a practical programme to aid in the achievement of this goal. Considering Shyne's (2006) meta-analytic review specific goals were not set as it was predicted that any enrichment event would reduce the stereotypic behaviours displayed by the bears.

Plan (Mellen et al., 2003)**/ Brainstorm and Establish Criteria for enrichment items** (Hare et al., 2003)
The considerations and criteria (in order of importance) used to plan and establish this programme were:

- Safety first (Hare *et al.*, 2003; Mellen *et al.*, 2003) – can the bears fall, drown, choke, be entangled, have an allergic reaction or is it toxic?
- Diet (Hare *et al.*, 2003.)– Will it cause obesity or have an effect on nutrition.
- Expense (Hare *et al.*, 2003.)– Is it inexpensive and replaceable or durable?
- Visitor perception (Hare *et al.*, 2003.)- Is it perceived positively by the public?

Implement programme (Mellen *et al.*, 2003)
A monthly enrichment calendar (Mellen *et al.*, 2003) was used for the dietary and novel enrichment parts of the programme

Evaluate (Hare et al., 2003; Mellen et al., 2003)**/ Systematic assessment observations**
It is important to evaluate the efficacy of any enrichment programme so that appropriate changes are made to avoid dilemmas for the animals or the staff involved. The use of a rigorous systematic approach to applied behaviour analysis in zoos has the power to bring us a step closer to solving some of the problems of conservation education and captive propagation (Forthman *et al.*, 1992) and quantitative data collection provides researchers with a relatively unbiased evaluation of the effectiveness of the enrichment manipulation (Shyne, 2006). The methods used for data collection in this study were both quantitative and systematic.

Programme Implementation
An element of keeper training had to be carried out so that everyone involved understood the programme and the aims of the research that was to be carried out by the research volunteers. This was done informally, allowing the keepers to read over the programme in their own time and talking it over with them individually.

Allocating keeper time to implement the programme was necessary as all keepers had very little time free to spend with the bears. In some instances keepers of other species were used to implement enrichment events. In all circumstances time and keepers were allocated at the beginning of the day to carry out the bears' enrichment. Keepers were asked to suggest a time to add the first additional event. The time agreed on was 3pm because this was the time the keepers had made opportunistic observations of the bears displaying stereotypies i.e. pacing.

Using a monthly calendar to implement the programme was found in the literature (Mellen and MacPhee, 2001 & 2003) to be a successful way to direct the enrichment and create responsibility within the keepers for the implementation of the programme. This was therefore the method, which was used to implement this programme.

Data collection

The main aim of collecting data in this study was to determine whether any change in the bears' routine would decrease the display of what we classed as negative behaviours of which most are stereotypies namely pacing. The aim was not to assess the effectiveness of individual enrichment items.

The time period of the study was 20 days. Each 10-day period was classified as one week.

For the first week the bears' routine remained unchanged (control week).

Activity/feed times remained at 7:30am, 11am, 2pm, and 4:15pm.

At the beginning of the second week the additional event was added at 3pm.

Observations were collected every day for the full two weeks between the hours of 8am and 4pm. Observations of the bears' behaviour was recorded for one minute at half hour intervals (behaviours were chosen from Table 1). At the time of each observation the weather and the number of zoo visitors near the bear enclosure were recorded so that these variables could be considered. (See Appendix 2 for the data collection sheet).

Various research volunteers collected data over the two-week period. Training was necessary for each volunteer on how to correctly observe the bear's behaviour. In depth descriptions of the bears' behaviour repertoire (Table 1) based on opportunistic observations by keepers was explained and given to each volunteer. Additional information on bears was given to each volunteer to read to extend their background knowledge on the species.

A problem found in many previous studies in the field of captive animal enrichment is the lack of specific, detailed definitions of stereotypic behaviour (Swaisgood *et al.*, 2005) and enrichment items (Mench, 1998; Sambrook, 1997). Therefore, we have been careful in our descriptions of both behaviour (see Table 1) and enrichment (see Table 1 in Appendix 1).

The method of data collection had to consider the volunteers' need i.e. time between observations was needed so that they could move around, eat and visit the bathroom. Data was collected on the bears individually as individual needs, likes and dislikes may be different and rely on many different internal and external factors. (Swaisgood, 2005; Hare *et al.,* 2003; Fischbacher *et al.*, 1999).

Table 1: List of behaviour descriptions used by the research volunteers.

Behaviour	Description
Sleep/Rest	Any time that the bear sat down or lay down in one position for longer than 30 seconds
Foraging	Actively looking for food in the enclosure. Sniffing, digging or moving substrate, eating
Pool	Any time spent in the pool
Play	Playing with anything in the enclosure that remains in the enclosure all the time eg. Excluding extra items given at enrichment times
Pos Int	Positive interaction with each other eg. Grooming, cuddling, playing, mating
X	Interaction with novel enrichment given at enrichment times
Int K	Interaction with keepers eg. Moving in or out of den on demand, eating from keepers hand, listening to and acquiring keepers attention
S Pace T	Short pace next to Tiger fence. Short pace is defined as walking back and forth over the same area for a distance of no more than 3 metres
L Pace T	Long Pace next to Tiger fence. Long pace is defined as walking back and forth over the same area for a distance greater than 3 metres
Pace D	Pacing at the den door
Pace	Pacing anywhere else in the enclosure other than those mentioned above
Neg Int	Negative interaction with each other eg. Fighting, dominating

For easier analysis, behaviour was grouped into categories:

Neutral - could be classed as either positive or negative or neither
- Sleep/rest was classed as neutral

Positive - behaviours we would like to encourage, more natural behaviours
- Foraging, Pool, Play, Pos Int, X, Int K, were all classed as positive

Negative - behaviours we would like to eradicate i.e. stereotypical behaviours
- S Pace T, L Pace T, Pace D, Pace, Neg Int, were classed as negative.

Data Analysis

Considering the small size of the data set, complex statistical analysis could not be successfully performed. However, pie and line graphs were created to show the trends found in the behaviour over the course of the two weeks.

Programme and Research Assessment

A process of assessment was carried out for both the programme and research processfinding out how its implementation affected both the bears and keepers. This wasachieved by getting all members of the keeping staff and volunteer research team tocomment on both the programme and research.

Questions for keepers:

1. Was the programme practical considering time restraints, facilities and the bears abilities i.e. were the bears easy to move at additional time through the day?

2. Did the calendar aid in motivating keepers and creating direction and responsibility for the novel and dietary enrichment?

Questions for Research volunteers:

1. Was it easy to understand and follow the training in data collection?
2. Did you feel you needed more background knowledge of the species or the bears themselves?
3. Did the observation seem sensible and achieve the predicted outcome?

Results

Programme Construction

See Appendix 1 for completed programme

Programme Implementation

The monthly enrichment calendar (see appendix 1) for novel and dietary enrichment was initially very successful, receiving positive feedback from all keeping staff. One additional enrichment event was successfully added to the bears' day. As the event was added data was collected on the effect this addition had on the bears' behaviour. Unfortunately, after the first 3-4 months of using the programme the initial success seemed to be short lived and the additional enrichment event at 3pm stopped occurring every single day, 6-7 months after the implementation of the programme the 3pm enrichment event very rarely occurred (Figure 1).

The environmental enrichment or enclosure changes and behavioural enrichment have not yet been implemented.

Graph to be inserted

Figure 1. Average no of times per week enrichment programme was followed

Data Analysis

Figures 2-5 describe how the bears spent their time in both weeks one and two. Week one was a control week, leaving the bear's routine as normal i.e. four activity/feeding times. During week two the additional enrichment event was added at 3pm. Figure 6 shows the trends for both bears towards a decrease in negative behaviours over the course of the study time. Sleep was omitted from figure 5 as this behaviour could be classed as either a negative or positive behaviour. Careful consideration of the figures shows that while both bears exhibited less negative behaviour during the second week of observation Pooh's behaviour trend towards less negative behaviour was more significant than Huggie's.

Graph to be inserted

Figure 2. Pooh-Week 1; Relative time spent on behaviours

Graph to be inserted

Figure 3. Pooh-Week 2; Relative time spent on behaviours

Graph to be inserted
Figure 4. Huggie-Week 1; Relative time spent on behaviours

Graph to be inserted
Figure 5. Huggie-Week 2; Relative time spent on behaviours

Graph to be inserted
Figure 6. Trends over time towards less negative behaviour for Huggie and Pooh (Excluding Sleep). Adding one extra enrichment event for week 2

Programme and Research Assessment
Table 2 shows the feedback from the assessment questions posed to the seven keepers

Table 3 shows the feedback from the assessment questions posed to the eight volunteer researchers

Table 2. Feedback from questions asked of the keepers

Question	**Feedback**
Was the programme practical due to Time Restraints?	All 7 keepers said that they did not have enough time during the day to add enrichment even if time was supposedly allocated in the morning
Was the programme practical in relation to facilities?	All keepers said that enclosure facilities allowed for the implementation of the programme
Was the programme practical in relation to bear's abilities?	5 out of 7 keepers said the bears easily moved around and did what they were asked during the additional enrichment event
Did the calendar aid in motivating keepers?	All 7 replied yes
Did the calendar aid in creating direction for the enrichment?	All 7 replied yes
Did the calendar aid in creating responsibility within the keepers?	All 7 replied yes and 4 added that they didn't need to waste time asking if the job had already been done. 2 added that it made them feel as if they had an important job to do.

Table 3. Feedback from questions asked of the research volunteers

Questions	Feedback
Was it easy to understand and follow the training in data collection?	All 8 reported that they initially thought they understood but while observing realised they needed more direction. 5 added that they would have benefited from a practise day all together.
Did you feel you needed more background knowledge of the species or the bears themselves?	All 8 believed they were provided with sufficient information but 4 added that they would have like to know more about normal wild behaviour
Did the observation method seem sensible and achieve the predicted outcome?	All 8 wanted to make more frequent observations but still found that the predicted outcome of seeing trends towards the reduction of negative behaviour was achieved.

Discussion

Discussion of results, effects and limitations relating to the bears

From the results of the data analysis we can see that there is a definite trend for both bears towards a reduction in negative behaviours during the second week (Figure 6). This seems to be a direct result of adding the extra enrichment event at 3pm every day during the second week. There is no effect due to a change in temperature or number of visitors to the zoo as there was no radical fluctuation in either of these variables over the two weeks. The only other event that may have had an effect on the bears' behaviour was the fact that Huggie was just beginning her oestrus cycle at the end of the second week. Because of this, the study needs to be repeated during the end of summer while the bears are still active so as to eliminate this variable also.

Additionally, because the initial ethogram for the bears was created using opportunistic observations of the bears by keeping staff, some behaviour was not observed and therefore not included and it was later realised that this was a very limited set of behaviours that the bears exhibited. Because of this, some behaviours that should have been recorded were either omitted or grouped with other documented ones for ease for the research volunteers. This may have caused the data to be unnaturally skewed. Furthermore, it was often hard to distinguish whether the bears were resting or exhibiting stereotypies when they were motionless for any length of time; again these behaviours were all grouped into sleep/rest and possibly caused an unnatural skew. Hopefully by omitting sleep/rest from Figure 5 completely we may have removed this distortion of the data. Because of the poor scientific rigour of the data collection process, the short length of the study and the very small data set it is only possible to present trends and not significant results.

According to this study, the small amount of the programme that was implemented had a very positive effect on the bears. Most of the keeping staff (71.5%) also faced no limitations in relation to the bears, although it was later noted that Huggie could be particularly stubborn if she decided she didn't want to take part in the event. This may in the future pose some limitations for implementing the full enrichment programme all the time.

Limitations and recommendations for the implementation of enrichment.

The process of constructing, implementing and assessing the enrichment programme for the Syrian Brown Bears was not without problems and limitations. Below is an outline of each limitation or effect on keeping staff and how these directly affected the programme and suggestions of ways to fix them.

Motivation and Responsibility

From the results we can see that the keepers were initially motivated to provide the additional enrichment for the bears every day but by the sixth month the 3pm enrichment event was hardly being provided at all. The literature suggested creating responsibility and motivation by producing a monthly calendar (Mellen and MacPhee, 2003). However, during the course of this study it has become apparent that this is notthe only way to motivate keepers although according to the results in Table 1 it does help and provide a positive aid. It has become obvious that by involving people in the construction and creation of programmes they feel more responsible for the success of the implementing stages. Therefore, all keepers who work directly with the animal providing day to day husbandry, or that want to be involved, should be involved in as many areas of the construction of the programme as possible, especially in setting goals and brainstorming (similar to what Hare *et al.* (2003) suggested).

The bears did become less active over the winter months so this may have also caused the keepers to be less impelled to provide the enrichment event and they may supply the event again as summer approaches.

Keeper time

While it was demonstrated that the programme could be implemented successfully, it is evident from the results (Table 3) that keepers found that the biggest limitation in implementing the programme was finding enough time to do so. This unfortunately is a huge limitation not only for this particular institution but also for other small institutions with limited resources to employ more keepers to provide such programmes. This may also extend across into some large institutions where it is still only the more dedicated keepers that supply the animals with enrichment and therefore their individual time becomes very limited and would consequently limit the amount of enrichment supplied. To counteract this problem there needs to be increased importance placed on the provision of enrichment. Enriching an animal's life should be made as important as supplying food, water and veterinary care (Mellen and MacPhee, 2001 & 2003)**.** When job descriptions and routines are written and employment positions created, enrichment must be considered as an integral part of any keeping job and therefore time should be allocated for this similar to how feeding, cleaning and staff meetings is allocated.

Resources

Lack of resources in small institutions pose a large problem for keepers and managers when attempting to supply additional enrichment. Unfortunately paying for the actual items is not the only financial outlay for enrichment activities. There is also extra keeper time or even extra keepers needed to carry out enrichment events, as a staff member implementing enrichment is not executing other duties, which need to be done by another staff member. Therefore, human resources can cause any institution a considerable cost, however, if this cost is considered when employing keepers human resources should not end up being a problem in the future. To reduce the cost of the individual items supplied to the animals, some of the main questions asked about any enrichment item supplied to an animal in this institution is whether it is inexpensive, replaceable or if not is it durable (See methods). As we have shown in this study, it is possible to reduce stereotypies by supplying any type of enrichment event as long as something different is done each day. Therefore, something as simple as a cardboard box or a Hessian sack, which require very little, if any, financial resources, can still be effective enrichment items.

Education

Lack of education and understanding of enrichment is a limitation when attempting to implement an enrichment programme. Both keepers and management must understand the importance of enriching the animals' lives in their care; otherwise the programme will not continue to be implemented. By giving all the keepers, managers and volunteer observers the opportunity to read through the programme and by giving them background readings to browse in their own time allowed some informal education to be carried out before the programme was implemented at this institution however this was still not enough. Formal training programmes should be carried out in all institutions so that all members of the zoo industry understand the importance of enrichment, its background and the practicalities of implementing enrichment programmes. This could be an important step towards better holistic care for captive animals. Lack of knowledge about carrying out scientific research was also a problem as it was important for the observations that experimental methods were accurate and it was important for the data analysis that the observations were also accurate. To gain this accuracy some training, although informal, was supplied to the keeping staff providing the enrichment event and the research volunteers that were recording the observations. A formal training and practise day would have also been beneficial to the research volunteers. This would not only have possibly increased the reliability of the data but would have provided the volunteers with more confidence with recording observations.

Research

Many limitations became evident whilst performing the research part of this study most of these are outlined in the other discussion sections. Additionally, successful research is dependant on the keepers and research volunteers' accuracy. Using inexperienced research volunteers to record observations is in many instances a requirement considering there is no financial assistance to employ experienced researchers. Education plays a large role in providing the volunteers with the knowledge to record successful and reliable observations. Alternatively there is definitely room within most Australian

institutions to become closely affiliated with animal behaviour courses within science faculties in universities and to supply these faculties with a variety of possible undergraduate or postgraduate projects to carry out. This will not only benefit the zoos but also the students who are supplied with ideas, motivation and scientific subjects.

Managerial Support and placing a value on enrichment

Successful enrichment programmes must be fully integrated into the management programme and supported at all levels of the institution; it must be part of the institutions common goals. (Mellen and MacPhee, 2003). Without the support of management in any institution, enrichment will remain in the middle or at the bottom of the priority list. Psychological well-being of the animal's in zoos should be of paramount importance even if the only reason is to create an interesting exhibit for the paying visitors to which they will be happy to return. Without managerial support, keeper's time will not be sufficiently allocated, enough keepers will not be employed to carry out the enrichment as well as all the other tasks a keeper has to carry out and keepers will not be sufficiently educated about the need for the provision of enrichment for the animals in their care. Leadership is an essential ingredient of any successful enrichment programme. (Mellen and MacPhee, 2003)

Suggestions and Conclusions

- The results suggest that any additional enrichment event in Huggie and Pooh's day can be successful in reducing negative behaviour of which most were stereotypies.
- Include as many members of the keeping staff as possible with the construction of an enrichment programme to create more responsibility and motivation in keepers.
- Managers need to allocate keepers time for them to provide enrichment. This should be a main part of written job descriptions and an integral element of daily routines and not just an event to fill in spare time.
- Managers need to plan for additional human resources needed to supply enrichment when employing keepers.
- Education needs to be carried out in all institutions for keepers, managers and volunteers into the importance of enrichment and scientific research
- Scientific research in animal behaviour needs to be carried out in zoos more often. To do this either research volunteers need to be trained to take accurate observations or links with universities need to be established to allow more students the opportunity to carry out research in zoos.
- Managerial and institutional support is the key to the successful implementation of an enrichment programme and research into the effectiveness of these programmes.

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Appendix 1. Syrian Brown Bear Enrichment Programme

The *Ursidae*, or bear family is made up of eight different species that are found throughout North and South America, Europe, Asia and North-Western Africa. *Ursidae arctus* or the Brown Bear has the widest distribution of any bear species; its habitat includes North America, Eurasia and North-western Africa. The brown bears are comprised of animals that normally inhabit large home ranges and have great strength proportionate to body size. . (McGivern. 2005) Species with wide geographical ranges have resulted in several subspecies, many based on size and pelage differences. (McGivern. 2005) The Syrian Brown Bear is just one of the Brown Bear sub species and is now endangered in its natural habitat.

The bear enrichment programme is divided into four main areas: Environmental, dietary, behavioural and novel enrichment.

Environmental enrichment will consist of ongoing improvements to the bear enclosure over time, which will create a more complex and naturalised environment for the bears.

Ideas from the dietary, behavioural and novel enrichment programme areas will be used every day to encourage the animals to display their natural behaviour repertoire and decrease stereotypical behaviours.

Environmental Enrichment

Currently this institution does not have the resources to increase the size of the Syrian Brown Bear enclosure therefore changes and additions will be made to the current enclosure to increase the complexity of the space. These changes will be made over time and observations will be recorded on the bear's behaviour.

Currently Mogo supplies the following permanent fixtures in the bear enclosure:

- A waterfall and pool
- Soil and mulch substrates for digging
- Rocks for climbing and some visual barrier from each other
- The enclosure is in a position that provides sunny spots and wind breaks in all conditions
- Safe shift area to allow keeper access for daytime enrichment additions or feeding and lock away den area at night
- Vehicle access for large exhibit renovations or furniture replacement

In addition to the fixtures that Mogo supplies, the Enrichment Guidelines from the American Association of Zoo Keepers National Enrichment Committee (McGivern, 2005) suggests the following should be supplied for all bear species.

1) Climbing structures: trees, telephones poles, rope, logs, rocks, fire hose hammocks
2) Weather considerations: shade structure,
3) Substrate for lying, sleeping, or nest building: grass, moss, hay, straw, leaves, Christmas trees
4) Substrate for digging: grass, sand, rotting logs
5) Visual barriers from other bears and from the public: brush or log piles, trees, rocks, caves, hills
6) Variety of feeding sites for main feeds

7) Mechanical devices to deliver random food items
8) Options for hanging items

Considering wild and captive Ursidae behaviour from the literature these suggestions outlined by the AAZK are necessary for enriching the lives of captive bears.
All bear species do some climbing during their everyday lives and Brown Bears are no exception often climbing trees to forage for food. Therefore climbing structures are important and this institution will construct a structure using poles, ropes and fire hose hammocks in the bear enclosure.

Weather considerations and places to nest and rest are important for all animal species. It has long since been recognised that zoos are no longer a provision for humans to watch animals in constant animation as in a circus. Nesting and resting are behaviours necessary for all animal life to survive and therefore all animals including bears should be provided with the tools and space to go about these behaviours. In addition to this, visual barriers that may impede the public's view of the animals may be favourable for the animals themselves and according to Davey, (2005) may also be enjoyable for the public, making them spend more time looking for the animal and admiring the enclosure, as it will resemble a more naturalistic space. Therefore new vegetation will be planted in the protected areas of the enclosure, a small bed/den area will be considered for the enclosure and the new climbing structure will create more visual barriers. Furthermore the bears will be supplied with a variety of substrates to nest in including those suggested above.
As bears forage for food in a multidimensional environment in the wild it is important to simulate this in captivity. Options for hanging items will increase the dimensions in the enclosure.

Providing a variety of main feed sites for the bears or mechanical devices to deliver food may be more difficult to facilitate at this institution considering the facilities,
resources and the need to lock the bears up at night. These ideas are important considerations and may decrease pacing behaviour. It has been found that captive bears that are thrown food by keepers or that are fed at the same time and the same way pace significantly more than those fed differently each day. (Montaudouin, S.2005) These points will therefore be an ongoing consideration for the bears and will be worked into the programme.

Dietary and Novel Enrichment
Bears, being omnivorous eat a wide variety of food in the wild. Therefore it is extremely important to supply them with a similar variety in captivity. It is also important to offer different food each day to increase interest and stimulation. Currently the bears at Mogo are fed:
<u>4:15pm Main evening feed consisting of (per bear):</u>
Winter - up to 1kg of meat five nights per week -
- 2 apples, 2 pears, endive, lettuce seven nights per week

Summer - 4kg of meat five nights per week
- 4 apples, 4 pears, 6 carrots, lettuce, endive seven nights per week
- 1 sweet potato, 1 corn, twice per week

- 1 coconut once per week

7:30am Morning Activity:

• Large dog kibble, 4x2 dog biscuits, sunflower seeds, sultanas, small dog kibble

11am and 2pm Day activities (per bear):

• 1 apple, 1 pear, 1 4x2 dog biscuit sandwich, 2 bread sandwiches. (Spreads include vegemite, peanut butter, honey, and jam).

• Mixture of dried fruit, nuts, dog kibble, seed, cereals

In addition to these set feed times the bears are sometimes given different browse at night or in the morning, whole pumpkins or other whole fruit and chicken necks during the course of the day.

After considering the enrichment programme from Taronga Zoo, this institution will increase the number of bear feeding times to five times in the Winter season and seven times in the Summer. Extra feeds will be small and will also be coupled with some novel enrichment. The evening feed will also be divided up more evenly throughout the day so that the bears may be more content and will possibly not pace in anticipation of the arrival of keeping staff and therefore their food. Novel enrichment includes auditory and olfactory activities and different items that may keep the bears attention for a period of time without necessarily using food. Currently keepers have supplied the bears with items like cardboard boxes, herbs and flavoured condiments to smell and taste, therapeutic herbs and plants for aromatherapy eg. Lavender, Catnip, Rosemary, tyres in which to hide food and plastic balls and containers to play with in the pool. These items are usually supplied in the morning in the enclosure or at night in the night den. These forms of enrichment will continue to be used and new ideas will be added. Novel enrichment will then be used in the one month programme in conjunction with the additional feed times.

Behavioural Enrichment

The bear enrichment programme at this institution will also include a training programme, which will allow keepers to observe the animals more closely. Through operant conditioning and target training the bears will learn to go to their mark, and show teeth and paws for close observation. These behaviours come naturally to the bears and keepers have already worked on this training to some extent informally. This training will therefore become more formal with the keepers setting aside a small amount of time each day to work with the bears with formal cues. This time will be both stimulating and enriching for the bears and as they become older this training will be invaluable for observing their health and well-being.

Table 1.

Dietary Enrichment	
Abbreviation	Description
BK	Big dog kibble
sK	Small dog kibble
Bix	2x4 dog biscuit
P	Peanuts
Sult	Sultanas
SS	Sunflower Seed
Sand	Sandwiches
Fig	Figs
Ap	Apricots
Dat	Date
A	Apples
P	Pears
O	Oranges
SP	Sweet Potato
W	Watermelon
Pum	Pumpkin
Co	Coconuts
Ce	Cereal/popcorn
Ch	Cheese
Yog	Yoghurt
M	No lactose frozen milk or milk paste
B	Frozen or fresh blood
OJ	Frozen juice or pulp
Cr	Crickets
MW	Meal Worms
Bam	Bamboo or other edible browse
Ins	Insectivore mix
Fi	Fish

Novel Enrichment	
Abbreviation	Description
Box	Cardboard Boxes
PB	Plastic Ball
Br	Browse to nest/play
Ty	Tyres
PVC	Plastic pipes drilled & filled with food
PTF	Plastic Tub drilled & filled with food
Fur	Other animals fur/feathers
Fe	Other animals faeces
ML	Muslie filled log or bamboo
HL	Honey log
IL	Insect log
Sp	Spices
Sa	Sauces/condiments
H	Herbs
Pe	Perfumes/aromatherapy
Pl	Smelly plant matter
Br	Brush heads to rub on
Aud	Music, nature sounds, recorded vocalizations of other animals

Appendix 2

Date: _____ Times of Feeds/Activities: _____

Week: _____ Day : _____ Comments: _____

Animal: _____

	8.30am	9am	9.30am	10am	10.30am	11am	11.30am	12pm	12.30pm	1pm	1.30pm	2.pm	2.30pm	3pm	3.30pm	4pm
Behaviour																
Weather																
Busy/ Not busy																

Key:

F – Foraging

Pool – Playing/sitting/foraging in pool

Play – Playing with items in enclosure

Pos Int – positive interaction with each other

Neg Int – negative interaction with each other

Int K – Interaction with keeper

L Pace T – pacing at tiger fence & front of pool

Pace D – Pacing at den

Pace – pacing anywhere else in enclosure

Sleep – Sleeping

X – Playing with novel enrichment given at feed times

S Pace T- pacing at tiger fence

Framing enrichment

Valerie Hare
Shape of Enrichment

Abstract

While enrichment programs and plans are unique to each institution, its staff, and its animals, the framework for planning enrichment is universally applicable. Since 2000, The Shape of Enrichment has conducted numerous Enrichment Workshops in several countries, including Brazil, South Africa, and the Philippines. Although each several-day workshop is custom tailored, the framing steps outlined in this paper are the core of the curriculum for all. Our instructors can attest, first hand, that this planning system works, regardless of the country, available resources, and taxa involved. An effective enrichment plan can be successfully achieved by systematically setting enrichment goals and exploring strategies to meet those goals. This paper will review the framing steps and their purpose, with special emphasis on the three key points of the enrichment definition: changing the environment; behavioural opportunities; and animal welfare. The importance of goal-setting and assessment will also be addressed. In conjunction with this paper, the delegates are invited to accompany the author on a "Zoo Walk" for a discussion on how these steps could be used to plan enrichment at one or more of Melbourne Zoo's enclosures.

What makes enrichment effective?

Dr Vicky Melfi
Paignton Zoo Environmental Park

Abstract

Sometimes enrichments don't appear to work, they're not successful when repeated, they are inappropriate for mixed species exhibits or are easily monopolised. So is there a special formula you can follow to ensure that enrichment will be effective? Yes and no! One of the biggest hurdles to providing effective enrichment is people, or more diplomatically the different needs and priorities of people within an organisation! I will suggest a set of rules, which applied methodically, which will increase the likelihood that enrichment will be successful. This will be demonstrated by reviewing the relative successes of different types of enrichments, with a variety of species.

Naturalistic bedding material

Genevieve Brayley

Abstract

For years we have had a battle with our animals not getting enough browse. Trying to get more branches for nesting material was taboo. With the new Orangutan exhibit been built it will now be a great opportunity to get the local primary and secondary schools, involved with the needs of the animals. We are now in the process of organising schools to start growing trees for us. It will be educational for the students to learn about the environment, plant cultivation, bringing their branches into the Zoo and watch the orangs and gorillas make the nest or just play with it. After eight months of planning with our education department I didn't think we would get such a magnificent result. One school alone offered to grow two hundred trees of our chose. This is a long term commitment which will benefit all.

The pressures of a city zoo incaged by a heritage wall have always made the Horticulture department very protective over the trees. They were continually watching animal staff, making sure we didn't over prune the flora for the animals. The keepers would continually get frustrated and sneak around cutting branches to give to the animals. This I'm sure is not the only institution that has these little battles. To help the animals get enough browse the horticulture department decided to start planting trees at our sister zoo, Werribee, a food source only. Could you imagine their faces when I would ask for branches for nesting material or enrichment?

Management like a clean looking exhibit. A forest is messy with lots of place to explore. Just like kids apes love to drag their bedding with them all over their exhibits. The bedding material we use to supply for the apes was paper (very dusty and it dried out their skin), plus management didn't want it out on display (totally understood). Straw is great with the gorillas but for some of our orangs the straw mites were a problem. Some would loose their hair and were very itchy. Certain gorillas would eat the paper. Wood wool is now the preferred bedding material. Its great to make nest with and some of the gorillas use it as toilet paper. If it's too dusty you can wet it a bit. It's also good in the exhibit. A lot of the apes mix it with other materials such as paper; material; branches and plant material. Management do not mind it on display.

With the new orangutan exhibits management would like natural products in the open exhibit. In the day room the visitor can see the orangutans building their nest up close behind glass. This is one of the most natural behaviours of the orangutans. The first step was to approach the curator for the ok and then the horticulture department for a plant list of fast growing plants that enjoy being pruned. It then went full steam ahead to the education department. They have all the contacts and curriculum. All I wanted was 12 schools (primary/secondary) involved growing one or two trees. We would only visit that school once in that year. This is what would normally happen in the wild with gorilla groups, trash one area move on to the next. By the time they get back to that habitat the plants have re-grown.

The education department project coordinator Shelley Waldon, Education Officer (discovery & learning) was put on the job to contact nearby schools. The aim she is trying to enforce for this project is that schools have an understanding that it's a long term commitment. The aim is to develop a sustainable partnership with the schools and Melbourne zoo orangutan group. This leaning experience address biodiversity issues in local and global environments.

I was hoping if every year 7 or grade prep planted a tree and looked after it they could watch it grow though their school life. I was also hoping that this would get local visitors involved in their local zoo. Bring in their branches and watch what the animals do with it, whether the orangutans play with it, break it, or make a nest, at least it's an enrichment that we weren't able to provide previously.

We have had enormous interest from schools. One school alone offered to grow two hundred trees of our choice. We also have looked at growing trees for our koalas; red pandas; elephants and gorillas. These schools have been told that if they needed help in how to set it up or if they need help in raising money to grow the trees they will get the support. If certain councils don't allow the schools to grow non-native trees then the schools can look at native trees for our native birds or mammals.

Awakening to the importance of environmental enrichment.

Greg McDougall
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Abstract

This paper follows my personal learning about the importance of environmental enrichment in the welfare of captive animals and how I applied this knowledge to improve the welfare of exhibited animals in Queensland. Achieving this outcome required cooperation between Government and the exhibited animal industry. This cooperation has resulted in the in the inclusion of a specific section on environmental enrichment in Queensland's code of practice for exhibited animals.

My first steps in a journey of discovery

Coming from a strong background in extensive animal production systems, I did not have an understanding of the importance of environmental enrichment in maintaining good welfare of captive animals. I had seen stereotyped behaviours in some animals including:

- Dogs that had been kept on a chain continually for extended periods going *chain mad.* The behaviours included excessive aggression, aimless barking, aimless pacing/trotting in circles, etc.; and
- Stabled horses such as thoroughbreds and other sporting horses *weaving* or *wind sucking*.

These animals were generally well cared for on a physical level and were in good body condition and health. I had little, if any; understanding of the importance of the animal's psychological needs in maintaining good welfare. It was generally understood that these abnormal behaviours were a consequence of being kept in an unstimulating environment. The solutions to these behaviours tended to address the symptom rather than the cause. An example of this is collars placed around the neck of horses that prevent the horse from wind sucking. Whilst this is effective at stopping the wind sucking, it not does not address the cause of the behaviour and so the real problem persists. Once established, the performance of stereotypies is often very difficult to prevent; the true solution is in prevention of the development of stereotypies, by providing a stimulating environment.

When studying at Queensland Agricultural College in the mid 80's I received my first experience with intensive animal production systems. In piggeries I saw plastic bottles and chains hanging in pens as a toy in an attempt to provide a more stimulating environment. I was told this prevented the development of undesirable behaviours such as tail biting. This form of environmental enrichment was primarily given to minimise production loss due to tail biting. I learned that, without variation, this form of environmental enrichment provided little psychological benefit, as the pigs soon lost interest in the toy.

I studied animal welfare through Adelaide University in the early 90s. This is when I became aware of the importance of psychological wellbeing to the overall welfare of animals. It was not until 2001, when I began animal welfare investigations and writing policies regarding the Zoo and Wildlife Park industry, that I was able to actively explore

environmental enrichment for captive animals. Discovering the complexities and challenges of providing and maintaining a stimulating environment for captive animals was (and still is) a steep learning curve for me.

Getting my feet wet

My first practical experience in relation to appropriate environmental stimulation was when a colleague and I investigated a welfare report regarding two chimpanzees in a enclosure that appeared barren and to provide little in the way of mental challenges or stimulation for the animals. The majority of furnishings in the enclosure were not suitable for the chimpanzees to use and the feeding regime was predictable and mundane. The RSPCA and Department of Primary Industries and Fisheries (DPI&F) were receiving frequent complaints from the public and national animal welfare organisations regarding the welfare of the chimpanzees. When I observed the chimpanzees their behaviours indicated listlessness, lethargy, disinterest and aggression towards the public and each other. I was surprised that, for a social species, aggression appeared to be the only interaction between the two animals.

When we approached the service area of the enclosure for closer inspection, the chimpanzees threw objects and spat at us. I should also point out that the public I observed that day appeared disinterested in viewing the animals and some smaller children appeared frightened by the chimpanzees' behaviour.

The chimpanzees

The chimpanzees are brothers and had been born at another zoo. There they had been raised and maintained in an environment that provided little stimulation, although were regularly dressed in baby cloths for the viewing public. When the zoo eventually closed there were difficulties finding another facility to re-home the chimpanzees. I was told that during this time they were maintained in a tiny enclosure with their mother. This enclosure had a bare cement floor with no furnishings and interaction with humans was minimal. By the time they arrived at the new zoo the mother had been euthanased due to disease concerns and the brothers had developed the behaviours I have mentioned above. Their new enclosure, whilst providing adequate space, contained poorly designed furnishings and did not provide adequate stimulation. My colleague, an ethologist, identified the chimpanzees' behavioural problems as a symptom of the animals being raised and maintained in an insufficiently stimulating environment. However, primates were not her speciality, so we began researching suitable environmental enrichment programs for the zoo management to implement.

Around this time an animal welfare organisation sent a primate expert to assess the conditions and behaviour of the chimpanzees. A report was submitted to the zoo management with key recommendations to renovate the enclosure furnishings and implement a wide range of environmental enrichment techniques, such as toys and complex feeding devices. With the help of psychology students from the University of Queensland, the enclosure furnishings were renovated and an effective environmental enrichment program was implemented and maintained.

The changes in the chimpanzees were astounding; within a month the brothers were more animated, began mutual grooming and had ceased most of the aggressive behaviour towards each other. These changes suggested a vast improvement in their psychological wellbeing and hence their overall welfare. In the 5 years since the changes were implemented, no complaints regarding the welfare of the chimpanzees have been received.

During the last 5 years I have visited the zoo to monitor the condition of the chimpanzees on the numerous occasions. Their behaviours indicate a continued improvement in their psychological wellbeing; now when going to the service area at the back of the enclosure, the chimpanzees are calm and seek interaction with me. It is hard to believe these are the same animals I had inspected 5 years previously.

On the visits I've made I have seen people of all ages enjoying the chimpanzee exhibit, which demonstrates that providing animals with environmental enrichment not only benefits the animals' welfare, but can also enhance the public experience.

Queensland's animal welfare law

The *Animal Care and Protection Act 2001* (ACPA) is Queensland's animal welfare legislation. The ACPA defines **"Pain"** to include *distress and mental or physical suffering.* This reinforces the importance of psychological wellbeing in animal welfare. To fulfil the intent of the ACPA, environmental enrichment is a vital tool in relieving pain in captive animals.

I reported my observations and findings with the chimpanzees to the General Manager of DPI&F's Animal Welfare Unit, which is responsible for administering the ACPA. It was agreed that creating an awareness of the value of environmental enrichment was a priority to address in the exhibited animal industry.

The exhibited animal industry

Responsible zoos and wildlife parks have an ethos of assisting with conservation, and providing entertainment and education to the community, as well as being profitable. I believe environmental enrichment provides these establishments with a vital tool in maintaining the welfare of the animals on exhibit, and, as a bonus, maintaining their economic viability.

I enquired within the industry and found a trend for conditioning or training animals to adapt to an exhibit rather than putting animals in an exhibit that provided a stimulating environment. Reports from the industry indicated that environmental enrichment was not fully considered and that it was believed that adequate mental stimulation was provided by the conditioning. I do not question that the conditioning of animals is of value, but believe it does not replace environmental enrichment as a tool for ensuring the psychological wellbeing of the animal.

The challenge for me at this stage was to create an understanding of the importance of environmental enrichment in the industry.

Creating the awareness
In comparison to some states, Queensland's exhibited animal industry is relativelynew and, until the last two or three decades, had few exotic animal species. This has meant that the industry is restricted in access to staff experienced with the behavioural needs of exotic species. A search for a person experienced in environmental enrichment led us to Margaret Hawkins, a behavioural biologist at Taronga Zoo, Sydney. Margaret agreed to give a presentation on environmental enrichment to the Queensland exhibited animal industry.

The Australasian Regional Association for Zoological Parks and Aquaria, Queensland (ARAZPAQ) is the umbrella organisation representing the exhibited animal industry in Queensland. I approached ARAZPAQ to include the topic of Environmental Enrichment in their annual conference. The effects on the chimpanzees and the public's experience were discussed with the conference steering committee. As a result, ARAZPAQ invited Margaret Hawkins to deliver a presentation on environmental enrichment at the 2004 annual conference in Cairns.

Margaret was well-received at the conference and participants were very interested and asked a lot of questions. I also judged Margaret's success in conveying her message by the positive feedback I received from ARAZPAQ members; they have reported on the effectiveness of the environmental enrichment programs they have implemented and there is a continuing trend for further implementation of environmental enrichment programs.

A change in regulation
The Department of Natural Resources and Water (NRW) is the Government agency that regulates the majority of exotic animal species in Queensland. NRW staff attended the ARAZPAQ 2004 conference and took note of the importance of environmental enrichment.

Recently NRW called a meeting to progress the development of minimum acceptable standards for exhibited exotic species in Queensland. The meeting was attended by representatives from NRW, ARAZPAQ, DPI&F and the Environmental Protection Agency. DPI&F recommended the inclusion of a specific environmental enrichment section in the standards. ARAZPAQ provided full support, the recommendation was carried and an environmental enrichment standard is currently in draft form.

These standards are anticipated to be published as a code of practice for exhibited animals in 2007. Once published, compliance with this code of practice in the exhibited animal industry will be mandatory.

Summary
Through the proactive actions of Government Departments and industry (ARAZPAQ), environmental enrichment programs are increasingly being adopted in the exhibited animal industry. This adoption has, and will improve the welfare of Queensland's

exhibited animals. As an understanding of the behavioural and psychological needs of individual species increases, the standards in which exhibited animals are kept will continue to improve.

Environmental Enrichment at Paignton Zoo in the UK.

Julian Chapman
Paignton Zoo Environmental Park

Abstract

This talk will cover three main issues regarding the development of Environmental Enrichment at Paignton Zoo and the creation and development of the Regional Environmental Enrichment Conferences (REEC). Firstly I will provide an overview about what we think makes our Enrichment Group at Paignton Zoo successful. I will describe our attitudes towards Enrichment, as well as how we have managed to make the group all inclusive; involving almost all departments within the zoo, including many of the managers. Secondly, I will suggest methods you can use to make the implementation of Enrichment easier. At Paignton Zoo we have developed Enrichment Timetables to make life easier for the keepers, also I will review some of the methods we use to get raw materials to make the Enrichments, essentially how our group networks with our local community and utilises the skills of the other departments! Thirdly there will be a brief report from the First UK and Ireland REEC that we hosted in May. Through REEC we have been able to improve communication and, more importantly, promote enrichment. So why was REEC started in the first place? What is REEC currently doing? More importantly, what are the plans for its future?

Paignton Zoo Environmental Park started taking Environmental Enrichment (EE) more seriously in 1999 when several members of staff attended the 7th International Conference on Environmental Enrichment (ICEE) hosted by Edinburgh Zoo, Scotland. Following this meeting the inclusion of EE into our animal management progressed rapidly, culminating in a very successful EE group. We kept the aims of the EE group simple they were: to integrate EE into the keepers' daily routine; to co-ordinate the efforts of the science and animal departments to carry out and investigate EE; and to ensure all departments in the zoo were aware of the EE undertaken at the zoo and how they could assist.

When we started holding regular meetings, every six weeks, it was decided that we would need to encourage good attendance. We prefer to keep training and enrichment separate at Paignton, but in this case we found that offering staff a food reward for turning up to the meeting successfully trained them. Fairly quickly we found that the frequency of the reward could be reduced, once everyone realised the meetings were good fun!

One other thing that we were keen to do was make sure everyone enjoyed EE; both the animals and the keepers. It is likely that everybody originally provides animals' with EE out of curiosity, to see what the animals' will do with it; that's what keeps us all interested. It is important that we don't lose this fascination and enjoy providing EE, that way it will done far more, whereas when it becomes a chore it will get pushed to the back of the schedule rather than the front where it should be. It is particularly important for managers to realise this and support their staff and praise their initiative when they

provide EE. It also helps to have someone who is responsible for checking that EE is safe for the animals, but this shouldn't stop imaginative ideas and trying new things!

To facilitate EE it is also important that an EE group involves as many different departments and individuals from your collection as possible. Don't be precious and think that EE only needs the animals departments and no one else; that is a classic case of cutting off your nose to spite your face. Different departments can help an enrichment group in many ways.

Firstly the keepers are the guys who will probably be actually implementing the enrichment. They have the opportunity of checking EE before it is used and hopefully assist in both its construction and study of its effectiveness. Researchers are also key to any group; keepers often do not have the time available to really do a long term study on how effective any particular enrichment is, however researchers have the training, the time and will be able disseminate the information in publications and talks. If your zoo has a Science department, they will have access to researchers who are highly motivated to collect data and willing to assist with all stages of the implementation of EE. To fully integrate the science department with the EE group at Paignton we always ensure that 1 of the 2 co-chairs of the group is a member of the science department.

Stores and maintenance departments are both important as well. It if sensible to make both departments aware that you can use a lot of the 'stuff' they consider rubbish, from scraps of mesh, to make feeder cubes, to cable reels, for in-line feeders. The store man also has a wealth of contacts in companies that can prove invaluable to the EE group. We have found that companies are frequently more than willing to make donations if, they think that it may improve their sales to the zoo, gain them publicity, or even get free zoo tickets; one favour deserves another!

Managers may well be too busy to attend EE meetings, but it is essential that they are kept informed of what is going on. So try to ensure that at least a deputy can attend the EE group; that way when you ask for time or equipment for EE they will at least be aware of what you are talking about. To this end it is sensible to get the mangers involved too, even if all they do is provide shredded paper to fill up a puzzle feeder, it makes them feel good!

Education and graphics departments are combined at Paignton and have worked together to produce a wonderful display about EE at one of our new exhibits, Monkey Heights. The display has several enrichment items for the children and adults to play with, as well as a DVD playing an excerpt from a TV show showing how we constructed some tiger enrichment. We also give talks to schools and other interested parties, followed by a practical session on how to make piñatas. Schools are also invited to make piñatas, following a detailed protocol, and bring them into the zoo when they visit.

One of the most important departments involved in any EE group is the press office, they can be of tremendous help and support. Many more companies will be willing to donate 'stuff' to your EE group if they think there is the chance of some publicity. At Paignton

we always involve our Press Officer, Phil Knowling, and frequently he is able to get publicise our EE activities, which has proven to be very profitable. Some of the best successes we have had include: end of roll unprinted paper from our local newspaper, we got hundreds of metres of paper to make piñatas as well as publicity from the newspaper who ran an article on us recycling their waste paper; our local fire brigade donated old hoses and after the press release we have had more donations from all over the country; following the rugby world cup we gave our gorillas some rugby balls, the resulting photographs made it into several national papers and many more rugby balls were donated.

The volunteers (docents) are a wonderful source of enrichment items and manpower. We give each new intake of volunteers an induction talk about EE, including its history and also how to create and evaluate its effectiveness. Then we encourage them to make any type of enrichment (which we has been previously approved) that they chose from piñatas, to hammocks to termite mound feeders. They grow herbs at home which are brought into the zoo and are planted up for the animals. The great thing about volunteers is that they often have 'real' jobs as well. Get them on your side and the companies they work for are yours for the picking; volunteers are wonderful ambassadors for EE. If you get a volunteer that works for the military you have found the golden goose, the amount of stuff that gets thrown out is amazing and they also have a lot of spare manpower too!!

We produce minutes from all our meetings and distribute them to all the relevant departments (which is most of them in the zoo). The minutes provide a method of communication to sure that everybody knows what they are expected to do before the next meeting. Information is sorted under the following headings: Jobs Done, In Progress, Jobs Not Started, Need To Be Sourced, Wish List, and AOB. We are fortunate that our EE group also includes 2 other zoos', Newquay and Shaldon. The larger group means that we have a bigger pool of information and knowledge to draw on and enables us to share EE with each other; if there is an excess of one type of enrichment.

The EE group actively seeks cheap and free sources of EE. For example, sunflower heads, the volunteers sell packets of 10 seeds to children who grow them through the summer and then bring them back to the zoo to be measured, the biggest wins a prize. The zoo benefits from the funds raised by the sales of the sunflower seeds and the animals benefit from the sunflower heads that are brought back into the zoo. For those who haven't moved into digital photography, old film cases are great for EE. We've managed to obtain these from photographers and photography shops and they can be used for any number of things, have a look at 'Shape of Enrichment' Vol. 14 No 3 (2006).

A few other things that we have 'scrounged 'include old CD's, from newsagents after a promotion. These can be suspended from string to make reflectors; alternatively they can be fixed to two hanging baskets to make an outside glitter ball. The fire hoses donated by the fire brigade are great for hammocks and browse feeders. Similarly, we have used donated tyres from local garages, barrels from a company that glazes pots and carpet tubes from shops in town to name but a few.

To manage the daily provision of EE we have created EE rotas for several of the animals at Paignton Zoo. These rotas have made life easier for the keepers and ensured that the animals get a greater variety of EE. Each EE is placed into one or other of the following groups, Food, Manipulative or Sensory. When this group is next on the list an enrichment item from the list is chosen, this is either repeated or refreshed on the second day of use and the type of EE rotated. This results in a gap of six days before an animal will be provided with the same 'type' of EE again. Each time an EE is used, it is crossed of 'the list' and won't be used again until all other EE's have been used. The more EE items available, the longer the gap until it is repeated.

Another major step forward, is that we now have an area dedicated to the making of EE. This area enables us to store both the raw materials and the finished EE products in the same place and we have a warm dry area to work in with all the necessary equipment close to hand. This area provides keepers with an easy and accessible source of EEs; they know they can get EE from this area and can keep a close eye on supplies, so EEs don't run out. All of this helps the whole process run more smoothly.

We are very aware that facilities and personnel at Paignton Zoo enable us to implement EE in an integrated way that may not be currently possible at all institutions. However, it is likely that a greater exchange of ideas between institutions would help us all and this in part led to the formation and development of the Regional Environmental Enrichment Conferences (REEC). The idea came about after discussions at the 2005 ICEE (International Conference on Environmental Enrichment) hosted by the Wildlife Conservation Society, New York. There were not many 'overseas' (non-American) delegates which attended the meeting, and this represented a pattern which had occurred at the last few conferences; the majority of delegates came from the country hosting the meeting. It was felt that this was largely due to the cost of overseas travel, Europe was represented by fewer than 20 delegates almost half of which came from Paignton Zoo and there were probably no more than 6 from Australia. So it was suggested that regional meetings should be organised, and held during the 18 month gap between the ICEE meetings. This would allow more people to attend an enrichment conference and would also fill the gap between conferences and hopefully maintain everyone's enthusiasm and motivation for EE. REEC meetings could also function as a stepping stone for people wanting to present a paper at the next ICEE, and build up confidence and experience, but also enable information to be disseminated to another audience.

With the establishment of REEC, additional meetings have now changed the entire enrichment calendar from New York 2005 and Vienna 2007, to New York 2005, Paignton 2006, Melbourne 2006, Vienna 2007, Bristol 2008 and hopefully another venue in Australia in 2008.

Another key aim of REEC is to encourage people to write articles for 'Shape Of Enrichment', to once again ensure that information is getting out to a wider audience. It is essential that 'Shape' have a good and varied selection of articles to ensure that the field of EE continues to grow.

As a result of the REEC hosted at Paignton there is now an e-mail group that anyone can join. To do so you need a Yahoo! ID which can be set up on https://login.yahoo.com/config/mail once you have this ID go to http://groups.yahoo.com/group/environmentalenrichment , this is the e-group homepage. You can either read the messages posted by other members or if you wish to post your own then click on 'Join this group' and fill in your Yahoo! ID. We would like as many members as possible to contribute to this group in the hope that it can be used as a tool to both disseminate information and ask for advice on any problems people may be facing with their enrichment.

Another development is the current construction of a website for REEC, www.reec.info. The website has been set up to serve in several ways: to provide a continual source of information from the regional groups; to promote forthcoming meetings, both REEC and ICEE; to make proceedings from any of REEC meeting freely available; and to provide links to other relevant websites.

Within each region, fundraising is important to reduce the cost of future meetings which will in turn make them more accessible, especially to some of the smaller institutions. The UK and Ireland REEC fundraising efforts currently include: a proposed 2 day EE workshop at Dublin Zoo and selling a range of greeting cards through the website.

In the future it is hoped that REEC meetings will be held in many more regions around the world. Ties with zoo professionals in South Africa and China are currently being discussed.